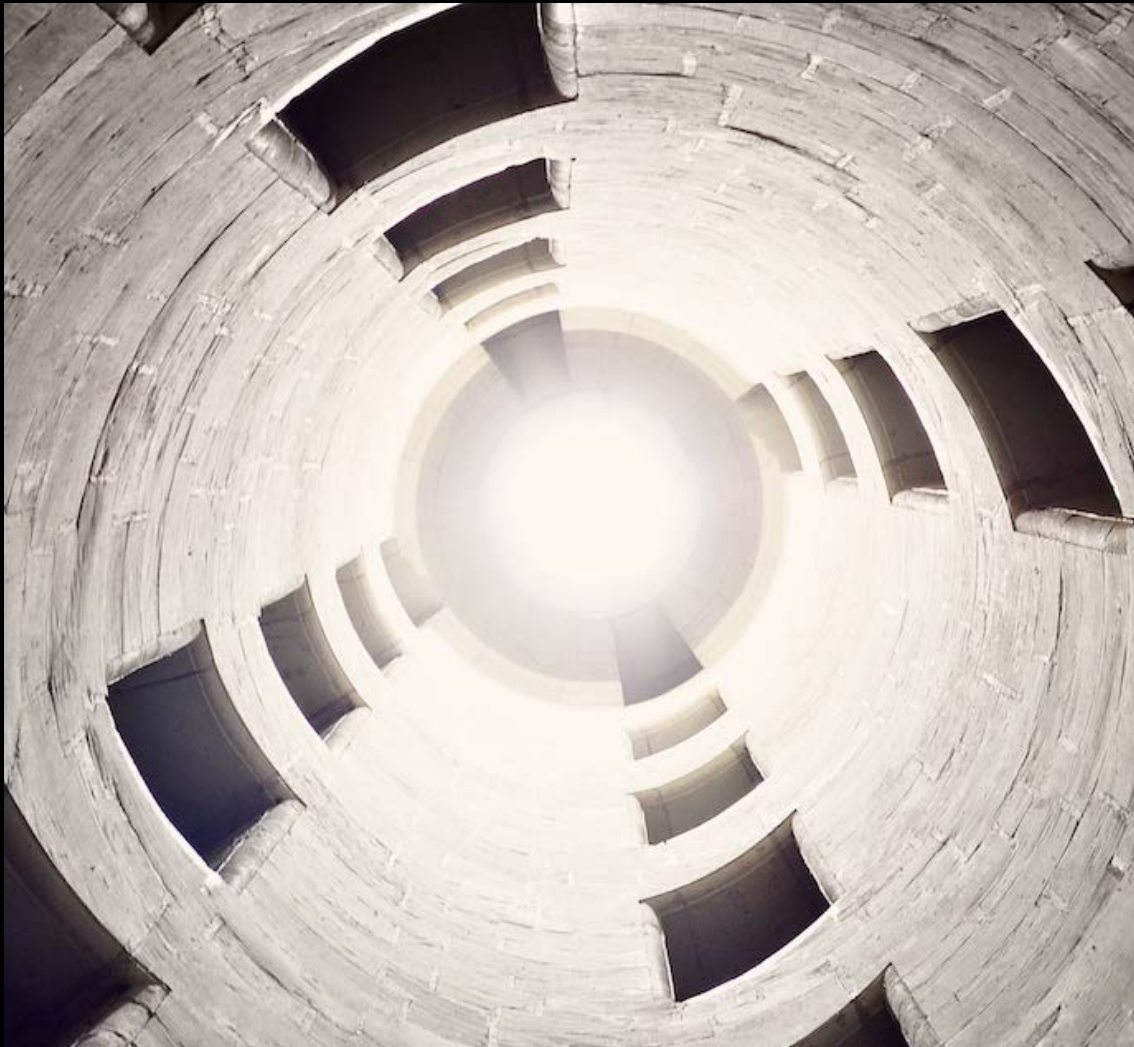


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Editors' Note

The editors are pleased to present this special issue, *Materialism and the Critique of Energy*. Each of the essays here appears in an edited volume by the same name forthcoming from MCM'. As Brent Ryan Bellamy and Jeff Diamanti put it in their introduction: though the "environmental problem of energy" is often "framed as a consequence of bad consumer habits," it is in fact "deeply bound to the material origins of the commodity form." And because the current ecological crisis is so deeply bound to the production and consumption of the commodity, it cannot be solved with the "techno-future vision" of energy-transition experts who imagine a future rescued through engineering. "The core contradiction of today's economic system," they write, "is and always has been tied to its facility with energy." Thus, "a critical standpoint on the conditions of political, economic, and ecological possibility requires a new account of energy's historical function" — of its relation to production and consumption of commodities, to the accumulation of value. The key insight of this collection of essays, and of the larger volume, is that our relation to fossil fuels — and all forms of energy — is its relation to the production and extraction of value.

Collected selection from the book are several approaches to the problem of energy and its relation to history and art. Andreas Malm, for example, lays out a long history of the relation between capitalist expansion and energy consumption, while Amanda Boetzkes tracks the ways energy consumption circulates in some contemporary art. Turning to the novel, Amy Riddle too looks at the relation between aesthetic forms and the political economy of energy. Katherine Lawless explores the "materiality of an energy unconscious" through a history of nuclear power. And David Thomas explores the relation between energy systems and energy cultures through the lens of Raymond Williams. Finally, Alberto Toscano turns to the concept of "exhaustion" and what the tragedy of materiality to "connect contemporary debates on the consequences of climate change to theorizations of the multiple crises of social reproduction." Taken together, these essays offer a snapshot of the intervention that dialectical materialism might make in contemporary debates of the Anthropocene, and why theorizing energy is indispensable to understanding our current regime of accumulation and the existential threat it poses

Davis Smith-Brecheisen, for the *Mediations* editors

Phantasmagorias of Energy: Toward a Critical Theory of Energy and Economy

Brent Ryan Bellamy and Jeff Diamanti

The critique of energy sits between two fields that condition the present — environmental catastrophe and capitalist crisis. Marx wrote that the past “weighs like a nightmare” on the living.¹ With global warming and the interminable crisis of capital, it is not just the past but the future, too, which strikes fear into the human mind. During the ongoing industrialization of the planet under capitalism, fossil fuels have been the dominant source of energy to power economic expansion and political domination.² The very fabric of today’s climate crisis is knit from the exhaust of intensive and extensive waves of capital accumulation. Typically framed as a consequence of bad consumer habits, the environmental problem of energy is and always has been deeply bound to the material origins of the commodity form — what it takes to make a thing and what it takes to move it. Today, the lion’s share of emissions come from transportation and production sectors of the industrial economy. By almost every projection, the simple reproduction of existing systems of production and distribution, to say nothing of their growth, will doom the planet to a host of ecocidal developments — from rising sea levels and ocean acidification to desertification in some places and more intensely concentrated rainfall in others. Against the weaving of such catastrophic tapestries, pundits of the coming energy transition spread solace with the techno-future vision of a world that could be different than the one currently soaked in hydrocarbons. Yet these proponents of technologically smoothed energy transition miss the forest for the trees: the question is not simply one of engineering, but instead how to overcome the deep roots of capitalism’s ever-growing energy dependence.

Whether for the requirement of aggregate economic growth or the expansion of new horizons of value, capitalism has been historically and logically bound to ever-increasing quantities of energy. The core contradiction of today’s economic system is and always has been tied to its facility with energy. A critical standpoint on the conditions of political, economic, and ecological possibility requires a new

account of energy's historical function, which is to say, a new account of energy's relationship to the production, distribution, and accumulation of value. This issue of *Mediations*, draws its articles from the edited collection *Materialism and the Critique of Energy* (MCM Press, 2018). Both develop a critical standpoint, first, by revisiting the entangled conceptual and material history of capital and energy at the foundations of materialism and, second, by clarifying the stakes of a critique of energy for contemporary critical theory and politics.³ While the condition of climate change today has occasioned a groundswell of interest in energy regimes and environmental systems, only the materialist critique of energy found at the heart of Marxism can explain why capitalism is an energy system and hence offer a clearer sense of a way out of its fossil-fueled inertia.⁴ This collection distills a form of energy critique both sensitive and hostile to the many forms of inequality, injustice, and exhaustion that populate the contemporary political landscape.

Materialism has a long history. Though materialism's roots as a philosophical project stretch further back than the nineteenth century, we are concerned with its turn toward the material structures that began shaping social life in a quickly industrializing Europe. Current understandings of both energy and materialism were forged in the furnace of coal-powered innovation. The coeval emergence of industrial capitalism and self-consciously materialist thought is not mere coincidence; nor can their historical emergence be explained as simple causal determination. Rather, we argue, their emergence must be understood dialectically, beginning with a critical recognition: the materialist tradition that emerges out of this moment is already terminologically and epistemologically connected to the industrial flares of a fossil-fueled world. From Ludwig Feuerbach, Marx, and Friedrich Nietzsche to twentieth-century critical theory, Marxist-feminism, and the multiple post-humanisms and new materialisms emerging today, streams of different materialisms flow: each is historically shaped by the industrialization and globalization of fossil fuels.⁵ This is particularly urgent given that this materialist tradition, after Marx, remains the basis for the most viable critique of the political-economic system, capitalism, whose rolling crises appear increasingly indistinguishable from the looming problems of energy and climate.

Materialism has developed two modes of tracking energy that demystify the force unleashed by fossil fuels: on the one hand, through the critique of political economy; and on the other, through a theory of materiality contoured by the access to deep history and cosmic space made available first by coal and eventually by oil and natural gas. There is a historical dimension to these trajectories. The methodological and theoretical development of Marxism, the tradition most strongly associated with the first of these two modes, begins in the 1840s within the contemporaneous surfacing of the theory of energy across Britain, Prussia, and France. What this means for materialism as it evolves from Feuerbach's treatment of Christian reason to Marx's critique of capital is that energy is dialectically bound to economic history

— not a concept or variable independent of it, but a structuring force without which capital could not operate. Following this originary recognition, energy slipped away from materialist understanding until Walter Benjamin intervened to articulate a materialist revision of cosmic time. His dialectical apprehension would identify the *stylistic force* of energy over and above its positivistic or physicalist concept. Energy, through Benjamin's gaze, becomes a materialist concept once more. The following three sections introduce these developments in turn.

Marxism and the Origins of Energy Critique

Marxism could be said to have two births. In the first, the fires of the Industrial Revolution breathe forth a concatenation of social conflict from which the labor movement and international communist movement emerge. But a different kind of Marxism is also nascent in the mature phases of the second scientific revolution. In the late-eighteenth century, from the principles of motion, Newtonian mechanics, and models designed to exhibit scientific discoveries came political economy, industry, and the tools of the industrialist's trade. Sadi Carnot (1796–1832) famously drew up a theory of the caloric from simple observations of the steam engine, and Hermann von Helmholtz (1821–1894) refined his ideas about the conservation of energy in observations of muscle metabolism.⁶ The work of the body and the work of the machine, once ignited by the roaring furnace of fossil fuels, allowed for the redefinition of the conceptual constellations of science. In the collision of the industrial and scientific revolutions a new set of variables emerged: energy and work; wealth and value; labor and capital.

At the dawn of the nineteenth century, developments in production and economy — mixed with increasingly sophisticated accounts of what in the eighteenth century was still called *vis viva* or living force — occasioned the simultaneous discovery of energy. By mid-century, Lord Kelvin (1824–1907), Julius von Mayer (1814–1878), Rudolf Clausius (1822–1888), and Hermann von Helmholtz arrived at more or less the same law of the conservation of energy. Thermodynamics emerged from this cauldron of scientific and industrial exchange as a key field of knowledge. Its theories stated that the total energy of an isolated system is constant and that energy can be transformed from one form to another but can be neither created nor destroyed.

The theory of energy as it unfolded in this crucial decade did not descend from the heavens but bubbled up from the hidden abode of industrial production. This is the remarkable insight offered by the twentieth-century historian of science, Thomas Kuhn, whose analysis of the “simultaneous discovery” of energy conservation frames the paradigm through which energy would emerge — as much the effect of economic history as it is an outcome of scientific discovery. He opens his 1956 essay with a query: “Why, in the years 1830–1850, did so many of the experiments and concepts required for a full statement of energy conservation lie so close to the surface of scientific consciousness?”⁷ Kuhn approaches an answer to his question in the form

of a threefold hypothesis. First, the scientific and industrial instruments of the 1830s made available multiple instances of the conversion process from water, wind, wood, and coal into motion or thrust.⁸ Second, the dominant investment driving scientific discovery was the economic “concern with engines.” And third, the “philosophy of nature” running through Gottfried Wilhelm Leibniz, Immanuel Kant, Friedrich Wilhelm Joseph Schelling, Johann Gottlieb Fichte, and their shared *Naturphilosophie* made German thinkers, but British and French scientists as well, “deeply predisposed to see a single indestructible force at the root of all natural phenomena.”⁹ When Kuhn makes reference to something like “scientific consciousness,” he means it as both a cause and an effect of — at least in the case of the doctrine of energy — an emergent mode of understanding the economic, technical, and philosophical coherence of force. Put differently, the “scientific consciousness” responsible for the doctrine of energy helps generate, and in Kuhn’s account is symptomatic of, the emergence of a new mode of production: industrial capitalism.¹⁰

The emergence of the doctrine of energy and Marx’s materialism in the mid-nineteenth century is not sheer happenstance. Rather, their emergence is mutually implicated in industrial phenomena. The decisive shift from the problem of alienation in Marx’s early writings to the more technical language of labor power of *Capital* signals a growing awareness of the historical and social specificity of energy flows bound to the worker’s exploitation. Terminologically, labor power is identical to Helmholtz’s word for the work of energy (*Arbeitskraft*), which, as Anson Rabinbach reminds us, had been rapidly popularized across public science circles since late 1840s in Western Europe.¹¹ As a technical term for the value form of human work in the factory too, labor power simultaneously names the objective consistency between the worker’s caloric output, the coal power expressed in machinery, and the abstraction of both forms of *Arbeitskraft* by the value form of capital at a more general level. *Arbeitskraft* is the concept Helmholtz had been using in the 1840s to distinguish energetics from *vis viva* or living force still resonant with the scientific epistemology of the previous century. Between the 1840s and the 1850s, Marx had changed his thinking on the core concepts that would animate his critique by the time of *Capital* in 1867. Rabinbach argues that by positing *Arbeitskraft* Marx finally had access to the concept necessary to conceive of capitalism as a totality. This means that Marx’s more developed critique of political economy, sensitive as it is to the energetic content and calibration of *Arbeitskraft*, already contains a critique of energy.

By naming the commodification of human work *labor power*, Marx alerted his readership to the twofold abstraction taking place in the production process: human exertion becomes a flow of energy in the concrete, while at the same time being modulated by the value form of capital in the abstract.¹² The calorie burners of a human body offer a relatively inefficient source of physical energy compared to even the heat and light released from burning a piece of coal. Yet no lump of coal ever got up and threw itself into the furnace of the steam engine. Capital thrusts human and fossil

energy together to extract surplus value from the former but at a greater and greater magnitude due to the energetic efficiency of the latter. Once the conditions for industrial capital are in place, neither coal power nor labor power can produce surplus value independent of the other because each form of energy congeals unevenly into, and is in turn socially regulated by, what Marx calls the “organic composition of capital.”¹³

Marxism offers a developed concept of energy by taking note of just how entangled the capitalist compulsion to increase productivity and the generalization of coal power were. If capitalists could keep the factories open around the clock, then they might also seek to implement the ever-profitable “curtailment of the necessary labour-time” by implementing labor saving techniques and machines.¹⁴ Later, Marx adds that “[t]he same causes which develop the expansive power of capital, develop also the labour power at its disposal. The relative mass of the industrial reserve army thus increases with the potential energy of wealth.”¹⁵ In this sense, Marx’s notion of labor power and its social regulation are inextricably connected, via the dialectic of forces and social relations of production, to the energetic capacity of a given place and time.

Marx’s concept of labor as it evolves over the course of his writing registers, among other things, the radically disruptive and uneven process of fossil energy’s integration into the social relations of production. Both a familiar and a novel relation to energy is at work across industrial capital at this time — from muscle-bound forms of human and animal labor to productivity-lending machines in the factories. The energy innovations of water- and steam-powered production reduce the amount of labor time required to produce a given commodity by a worker of average skill and productivity. The influx of water- and coal-powered machines into the site of production shift the balance not only in labor’s intensity, but also in its worth. The environment through which labor was organized and sustained was submitted to constant revision as capitalists dug deeper into the dirt to build waterways for mills and unearth new sources of coal. In essence, the new regime of energy generates a radical transformation in the character of the labor-capital relation. Counter to orthodox histories of the industrial revolution that posit coal power as a cheaper and thus natural replacement to wind, water, and wood, Andreas Malm offers a unique account of this historical transformation into a fossil-fueled industrial economy. Malm outlines the ways in which coal-powered steam engines offered a solution to a labor problem plaguing British capitalists: namely, how to bring the site of production into the urban spaces where the newly dispossessed were gathering.¹⁶ Coal power, according to Malm, did not rise because of its relative cheapness, but because of the ease of transporting coal as compared to transporting water power, which had to remain proximate to the waterways. At its origin then, fossil capital increased the productivity of a newly minted proletariat in the same moment that it generated their class relation to the new mode of production. Put concisely, the proletariat became materially bound to the industrialization of fossil fuels; one becomes unthinkable without the other.

Why Energy Needs Dialectics and Why Materialism Needs Energy

Marx reconciles the critique of political economy with the otherwise positivistic concept of energy dominating scientific inquiry, yet he does so with a dialectical twist — showing energy and labor as immanent to one another — that turns energy into a moving target. Marx's treatment of energy occurs shortly after Feuerbach inspired a new direction in materialism. Energy became a core component of historical materialism when Marx connected the surge of physical force in the production process to a twofold abstraction of human labor — on the one hand by coal-powered industrialization and on the other by the value form of capital. Yet the concept of energy developed along alternative genealogies in nineteenth- and twentieth-century materialism, becoming an index of how materialist thinkers imagine their relationship to the physical and the metaphysical. Briefly tracking one such genealogy, we offer an account of how the historical particularities of energy's systematic usage inform its concept and figure. These particularities include the social, economic, ecological, and political environments in which energy is put to work.

In the history of materialism in the twentieth century there are a number of vital encounters with energy, staged at different levels of abstraction. Consider for instance the figure of the eternal return so important to Nietzsche and troublesome to Benjamin: "What, if some day or night a demon were to steal after you into your loneliest loneliness and say to you... 'The eternal hourglass of existence is turned over again and again, and you with it, speck of dust!'"¹⁷ Here, Nietzsche personifies the eternal return popularized by thermodynamic theory. The idea being that a cosmic logic is independent of the ephemeral and self-involved history of human reason. In the person of the demon, the eternal return marks the irony of human finitude and the metaphysical tradition on which Nietzsche leans to make a point about cosmic infinitude. Turn to the famous section 1067 of Nietzsche's notebooks, *The Will to Power*, and both the paradigm and promise for thinking this eternal return become more explicit: "And do you know what 'the world' is to me? Shall I show it to you in my mirror? This world: a monster of energy, without beginning, without end; a firm, iron magnitude of force that does not grow bigger or smaller, that does not expend itself but only transforms itself."¹⁸ Nietzsche turns the law of the conservation of energy into a metaphysical conceit, a new concept of history divorced from the moral, ethical, and philosophical constructs he found so intolerable. Rather than as a flow made historically contingent, energy, for Nietzsche, is encountered as the world as such.

When Nietzsche drew the thought experiment of the eternal return out of the law of the conservation of energy, he may or may not have had Frederick Lange's monumental book *History of Materialism* (1866) in mind, but to Benjamin the connection to Lange verified a certain theoretical underdevelopment. Benjamin sees in Nietzsche's words the traces of a mode of thinking that is taken with its own image. By the early twentieth century, energy had begun to emit a philosophical tendency contemporaneous with its industrialization and figured as *ungraspable*

and *inexhaustible* growth.¹⁹ Both Nietzsche and Lange had certainly encountered the materialism of Louis Auguste Blanqui (1805–1881), even if their references to the communard were infrequent. Blanqui's appearance in the first volume of Lange's *History of Materialism* closes a poetic sequence opened by Lucretius in *De rerum natura*. Lange drew conclusions about the fate of materialism from Blanqui's cosmic concept of the eternal return:

It is interesting that recently a Frenchman (A. Blanqui...) has carried out again, quite seriously, the idea that everything possible is somewhere and at some time realized in the universe; and, in fact, has often been realized, and that too as an inevitable consequence, on the one hand, of the absolute infinity of the universe, but on the other of the finite and everywhere constant number of the elements whose possible combinations must also be finite.²⁰

When Lange tied the (in)finity of being to the fundamentals of materialism, he did so with what was only a faint expectation of its thermodynamic implications. Yet, Lange's reading of Blanqui supplies the metaphysical coordinates that appear in Nietzsche's eternal return. Moreover, this reading also defined the material elements in a way that would prove necessary for Benjamin's materialist conception of the cosmic.

As Benjamin conducted his research on Baudelaire, he uncovered a connection between Blanqui's cosmic criticism and Nietzsche's eternal return, and he did so, as we know, in the midst of the early rumblings of German fascism. Benjamin's insight into the sociopolitical appearances of energy's force comes first in the form of a preemptive critique of the fascistic cult of technology:

It is the dangerous error of modern men to regard [ecstatic contact with the cosmos] as unimportant and avoidable, and to consign it to the individual as the poetic rapture of starry nights. It is not; its hour strikes again and again, and then neither nations nor generations can escape it, as was made terribly clear by the last war, which was an attempt at new and unprecedented commingling with the cosmic powers. Human multitudes, gases, electrical forces were hurled into the open country, high-frequency currents coursed through the landscape, new constellations rose in the sky, aerial space and ocean depths thundered with propellers, and everywhere sacrificial shafts were dug in Mother Earth.²¹

The great surge in forces available to twentieth-century military and industry struck Benjamin as modern man's contact point with the flux of the cosmos — a new "*physis*" consisting of rhythms, temporalities, and spaces previously reserved for the gods.

In Benjamin's critique, the internalization of that force did not express an inversion whereby technology dominated man, as the techno-utopian mastery of nature had in World War I.²² The surge in energy expressed in the war was conditioned by capital. To imagine otherwise was either to be entranced by the mystique of the cosmos or by the mystification of industrial capital. In Benjamin's treatment, the way all three thinkers — Blanqui, Lange, and Nietzsche — were absorbed in the concept of eternal return was a feature of thinking about the world *industrially*. Benjamin, in other words, interpreted the conceptual apparatus of the eternal return as reified thinking — a failure to historicize that thus mistakes a perfectly consonant image of the present for being itself: a thought that bubbles up out of production so pure and unadulterated a product of its circumstances that its provenance (and thus historicity) becomes unrecognizable. It was as if they were looking at an autostereogram of factory smoke and seeing the birth of being.

If for Nietzsche "the world" is "a monster of energy, without beginning, without end" whose only will is "the will to power," then "the world," for Benjamin, is still tied to what he called, following Baudelaire, *the phantasmagoria of industry* — a world too tied up with industry to recognize the historical specificity of thought.²³ This realization defines the allure with which Benjamin archived Blanqui's anticipation of Nietzsche's eternal return and, in good Benjaminian fashion, tied it to the historical condition that binds both together. Cut from the same cloth, Benjamin says, the "cosmic speculation" that both men engage in signals a new stage of materialism — a critical state fully responsive to the energetic content of history.²⁴

Alas, both Blanqui and Nietzsche are, in Benjamin's words, from a "century... incapable of responding to the new technological possibilities with a new social order," which is to say a standpoint out of phase with the technological rush that rapidly overtakes political thought.²⁴ By the time Benjamin took his own life at Portbou, it looked like that incapacity had extended to the twentieth century as well.

Benjamin was overcome on more than one occasion by matter, but this is not the same as saying that Benjamin was a new materialist, much less a new (or old) matter-ist. For in his account the problem with the eternal return of energy is that it provoked an unmediated image of industrial progress, rather than a dialectical one. Here we see the aesthetic force of capital's facility with industrialized energy fully formed: the fossilized mode of production projects an image of itself as a world. In order to move from the phantasmagoric to the dialectical, we will always need one eye on value and one eye on the cultural modulation of nature, lest we turn to either a vitalist new materialism allergic to historical determinability or a thermodynamic desocialization of value immune to the political.

The theoretical appearance of the eternal return as cosmic speculation is qualified by the rupture of fossil fuels, even if Benjamin does not yet fully grasp the systemic capacity that capital has drawn from them. It is clear enough to Benjamin that the war machine facilitated by capital drew unconscionable power from the earth's depths,

and that this power was dislocating, violent, and significant at a cosmic level.²⁵ Neither Nietzsche nor Blanqui were *wrong* in their phantasmagoric image; rather, it is in their interpretation of the outcome that both skip over the historical conditions from which a reified concept of energy is made possible. Occasioned by the new concept of energy supplied by the industrial image of thermodynamics, these cosmic speculations verify the stylistic appearance of energy beyond any immediate experience of it and the incomplete project of critically grasping how it contours historical experience. That is, even if Benjamin is alert to the way in which fossilized energy itself leads to a materialist notion of cosmic time (or a geological time-scale, as we will later term it), his temptation by the cosmic is proximate to the deep time drawn up by fossil capital. This cosmological element in Benjamin's thinking is sometimes seen as the aberration in his claim to materialism, a similar kind of idealism to that which he takes issue with in the "eternal return" as it appears in Nietzsche. Benjamin's "cosmic time" itself functions as another example of a kind of energy unconscious (like Nietzsche's and Blanqui's failure to historicize the concept on Benjamin's account): Benjamin, in other words, does not fully grasp how the burning of crystallized cosmic-time in the form of coal undergirds industrialization; yet, as with Nietzsche before him, he somehow apprehends the consequences of energy's historically specific stylistic expression, without yet knowing precisely how energy figures in the project of critical materialism.

The burning of the fossilized carbon locked away in long-dead plant and animal matter generates a decidedly new, indeed unprecedented, historical situation. Yet this assertion does little to discredit Blanqui, Lange, Nietzsche, or Benjamin; instead, it simply situates the eternal return on a geologic time-scale. Ashes to ashes, dust to dust, yet energy passes on for all of time. The problem, for us, is that we live in a fragile habitat, and that fragility is relative to a human standpoint already conjoined to radical social inequality. As Malm writes in *Fossil Capital*, "the causal power of the past inexorably rises" once capital becomes fossil fueled.²⁶ One cannot separate the cosmic order made available as *image* to Blanqui and Nietzsche, and in Benjamin's critique of them, from the economic order of the industrialized energy system. Fossil capital's burning away of condensed energy from past eras, previously sequestered in the Earth, catches up with the present in the form of billowing emissions that wrap the planet in a warming blanket. The industrialization of energy also produces a vantage from which to assess the ontological status of energy and its residues.

Energy's economic elasticity and social plasticity in the form of fossil fuels, especially once oil becomes the dominant source of global energy in the 1950s is one kind of theoretical problem; its consistency — its unique immunity to creation and destruction — is yet another. Historical materialism was built for addressing this kind of challenge. Whence, then, a critical theory of energy? Where is energy in the critique of capital: an input on the side of labor; a force of production on the side of capital; or, is it somewhere else? Like most good questions, this one also has two

sides. On one hand, if what interests us is the political economy of energy, we can turn to Marx's own embedded critique of energy. Historical materialism is born in the same breath as the doctrine of energy conservation, not as a version of it, but as a rejection of its uncanny claim on value, history, and labor. For a political economic framing of energy and capital, one might search out the technical location and impact of energy in general on the composition and scientific critique of capital. One might look, for instance, to the human and animal calories per kilojoules of fuel extracted, to the length of the workday, to the organic composition of capital, and to the level of capital's reliance on energy from fossil fuels to maintain intensive gains year after year. On the other hand, if what interests us is a critical theory of energy, we can follow the conviction that Marxism works best when it conducts immanent critique rather than an intransitive orthodoxy, and ask: how are the core concepts that Marxism takes as its own transformed by the late twentieth- and early twenty-first-century experiences of energy substitution at the site of production and mounting impact of climate change everywhere else? This approach relies less on process and outcome. Turning to an ontology of energy, it points to a different order of question, and it has as much to do with the influence of Lucretius on Marx's materialism as it does with Blanqui's impact on the landscape of critical thinking in the twentieth and twenty-first centuries.

Materialism and the Critique of Energy

Patricia Yaeger has asked how humanists and social scientists might reconceive cultural history in light of the energy regimes that underwrite it. This same question might be asked of the history of theory: what is critical theory in the age of wood, wind, coal, and oil? Answering the question means clarifying the social structure of energy regimes offered across various traditions. Teresa Brennan, for instance, brings the work of Marx much closer to the economic and environmental impasse named by late fossil capital in her book, *Exhausted Modernity* (2000). Labor, Brennan insists, is an all too human category for Marxism's critique of the labor theory of value. She argues that it moves too far in the direction of objectified nature to allow us to return to an ecological standpoint. To think the critique of the Gotha Programme while reading *Capital* provides one solution: against the orthodox position that only labor provides value — and the cult of the (masculine) body that flows from this position — the rejoinder that nature provides it too must be read back into the critique of the mode of production that depends upon labor power as well as labor's minimization. For Brennan, arriving at this point entails adding the "law of substitution" to the Marxist critique of capital.

The "law of substitution" follows from a critique of political economy without a subject, where labor power is an *embodied* force, but one that is nevertheless consistent with the other forms of energy: mechanical, chemical, electrical, atomic. Thinking about energy and labor in these terms achieves a kind of total mapping of what might be

called the labor-energy relation. Brennan writes, “time is out of joint.... We smell this around us and know it in our bodies. We console ourselves with the myths of hybrids... while living the divide between a speedy fantasy that overlays us and a natural time that knows it is running out.”²⁷ The rising organic composition of capital squeezes tiny quotients of labor from ever more immiserated and precarious bodies. The concrete and electrical world of fixed capital weighs heavy on the critical and ecological will of the *polis*. At the same time, for Brennan, labor becomes at once calories, carbohydrates, lipids, protein, and depletion as well as consciousness, language, and international and gendered division. Brennan figures labor as at once matter *and* materiality — its relation to the environments in which it finds itself embedded is exogenously and endogenously regulated by flows of energy. As such, value begins to disappear as it bleeds in the background of the various flows of the “law of substitution.”

In this way, Brennan’s work risks folding labor power back into the world of nature. It stops short by tying capital’s use of energy to socially necessary labor time, threatened ever increasingly by the “violent conversions” of capital’s energetic disposition. As Elmar Altvater reminds us, nature is “not *value*-productive, because it produces no commodities to be sold on the market.... [I]t is labor which turns nature into commodities.”²⁸ Moreover Anna Tsing argues that nature is instrumentalized all the time as use value necessary for exchange value — as resource and as standing reserve — though, at any one time, the vast majority of it never enters this relationship quantitatively.²⁹ Instead, the standing reserve of nature gets reconfigured as either carbon sink or fuel in the age of fossil capital. Yet just as true for materialism and the critique of energy is the corollary claim implied by Brennan: namely, that labor power is itself a social relation produced out of capital’s economization of energy’s physical force, a relation that is suffused as much with electrical currents and data flows as it is with blackened carbon-full skies and bleached oceans. The question for today’s materialism would thus seem to pivot back and forth between the question of where value comes from, and how to locate energy in the production and destruction of economic, social, and natural environments.

However detached, Marxism’s theoretical inversion of energy into the dynamic of capital’s reinvention of labor is not purely conceptual, and coming to terms with the entanglements of capital and energy regimes from the vantage of Marxism necessarily engages in a dialectic of historicity — a coming to terms with the present as a historical moment, rather than as an empty totality, a plurality of pluralities, or an eternal return. It is to historicize, as Benjamin did for Blanqui, the temptation to think the eternal return of energy — the seduction of metaphysical immunity from economic and ecological catastrophe. If Marxism is to stay true to one of its guiding insights — that “[humans] make their own history, but they do not make it as they please” — it must renew its habit of attending to the pivot located in the critique of energy.³⁰

The central insight that historical materialism brings to a theorization of energy

is that the relation we have to fossil fuels, and indeed to all forms of generating, capturing, and storing or distributing energy, is *form determined by value*. Edison's major innovation was not the filament that would illuminate a glass bulb, but the grid that would distribute electricity from the point of its generation to the point of its consumption. He created the mechanism whereby energy could be brought to market. In this way, market relations, and the capital-labor relation underlying them, came to effectively mediate not only the price and draw of energy, but also which energy source would dominate economic capacity, turnover time, and the technical composition of consumption.³¹ While renewable technologies are gradually displacing fossil fuels from electricity generation — though the jury is out on whether renewables could ever make up for future demand in a growth curve — the grid itself as social *form* is wired for the accumulation of *value* (i.e. the former is determined by the latter). The grid's relation to the energy market, for instance, conceals the origin and source of the electricity, allowing for mixed modes of generation.³²

Etienne Balibar claims that “Marx's materialism has nothing to do with a reference to *matter*.”³³ Following this line, one might say that *Marx's materialism has nothing to do with a reference to energy either*, not because the concept and history of energy is not important to Marxism, but because it is essential to separate the sense of energy as eternal return from a dialectical sense of energy as social relation. In Malm's words:

No piece of coal or drop of oil has yet turned itself into fuel, and no humans have yet engaged in systematic large-scale extraction of either to satisfy subsistence needs: fossil fuels necessitate waged or forced labor — the power of some to direct the labor of others — as conditions of their very existence.³⁴

You cannot *see* energy in the way that you can see a barrel of oil, because energy in the concrete is still abstract, and an energy system fueled by fossil fuels is more abstract still, even though it is determinate of virtually all economic and political capacities today.³⁵ Energy has come to determine the future of capital development in a profound way. This is not to say that, therefore, energy is capital and capital is energy: ubiquitous and allusive, forever leaving its mark but hiding under the cloak of appearances.³⁶ Instead they bear a family resemblance, and not accidentally since capitalism's global spread since the industrial turn — its very systematicity — has been an effect of its facility with fossil fuels. Energy thus does not merely name the capacity for doing work, as in physics, with a focus on potential, kinetic, thermal, electrical, chemical, nuclear, or other forms of energy, but instead makes vivid the ways any future beyond capital must reconceive both the capacity for work and the flows of value. The critique of energy is the critique of our structural dependence on an environmental relation inherited from the industrial revolution; it is a critique of the facile faith in a technological fix to climate change; it is a critique of the many

barbarisms that flow from the contradictions of late fossil capital; and it is a critique of a fossil-fueled hostility to the very notion of social revolution — and hence of the very notion of structural dependence too.³⁷

These essays present no single answer to the twin fields of social anguish that characterize the present: environmental catastrophe and capitalist crisis. Yet, they recognize that these fields cannot be eliminated, reconciled, or transformed without thinking them together. They present starting points for carrying out the work of making energy into a conceptual category for the critique of capital and for figuring the dynamics of historical change crucial to understanding the role of energy in human development. Today, as the annual consumption of fossil fuels lurches upward, emerging economies industrialize and postindustrial economies automate. The vague promise of a clean transition to a renewable economy rings out as capital's own false consciousness of its material structure. With a projected increase of 45 percent global energy consumption by mid-century in order to maintain current growth rates, we are no doubt on the brink of a major transition.³⁸ Without a materialist critique of energy, the transition will almost certainly exacerbate, rather than alleviate, environmental and economic anguish.

Notes

The authors are enormously grateful for sustained, challenging, and exacting feedback from Justin Sully, Imre Szeman, Nicholas Brown, and Marija Cetinić on this essay.

1. Karl Marx, *The Eighteenth Brumaire of Louis Bonaparte*, Karl Marx (New York: International Publishers 2008 [1869]) 15.
2. Energy names both the strength and vitality required for sustained physical or mental activity and the power derived from the utilization of physical or chemical resources. It is also true that fossil fuels have been the dominant source to power revolutions, the overthrow of colonial rule, and many of the imaginings of alternative social orders, which is not to mention the USSR, PRC, Yugoslavia, or other communist nations (each of which relied heavily on fossil fuels).
3. This collection responds to a set of challenges and questions posed by the emergent field of study called the energy humanities. For an introduction to the field, see Imre Szeman and Dominic Boyer's "Introduction: On the Energy Humanities in *Energy Humanities: An Anthology* (Baltimore: Johns Hopkins University Press, 2017); Bellamy and Diamanti's special issue of *Reviews in Cultural Theory* titled *Energy Humanities* (2016); the short treatise *After Oil* (2016; available in full at afteroil.ca); and the website of the Petrocultures Research Cluster (www.petrocultures.com).
4. See Brent Ryan Bellamy, "The Inertia of Energy: Pipelines and Temporal Politics," *Time, Globalization, and Human Experience*, eds. Paul Huebener, Susie O'Brien, Tony Porter, Liam Stockdale, and Rachel Zhou (New York: Routledge, 2016) 145–159.
5. For an account of how Marxism anticipates, and is in the unique position to critique, the proliferation of materialisms today see Kimberly DeFazio, "The Spectral Ontology and Miraculous Materialism," *Red Critique* 15 (Spring 2014) <http://redcritique.org/WinterSpring2014/spectralontologyandmiraculousmaterialism.htm>
6. Howard Caygill, "Life and Energy," *Theory, Culture & Society* 24.6 (2007) 21; Russell Kahl, Introduction to *Selected Writings of Hermann von Helmholtz* (Middletown, Connecticut: Wesleyan UP, 1971) xvi.
7. Thomas Kuhn, "Energy Conservation as an Example of Simultaneous Discovery," *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: U of Chicago P, 1977 [1956]) 72. Kuhn observes that without naming energy as such, William Grove (1811–1896) and Michael Faraday (1791–1867) in England, as well as C.F. Mohr (1806–1879?) and Justus von Liebig (1803–1873) in Germany, simultaneously observed both the convertibility of force across electrical, thermal, and kinetic forms, and more importantly that this force could neither be created nor destroyed.
8. Here we are referring to scientific instruments such as James Prescott Joule's (1818–1889) apparatus for measuring the mechanical equivalent of heat and industrial mechanisms for converting energy such as the wind mill, water wheel, and steam engine.
9. Kuhn, "Energy Conservation" 73, 96.
10. By the mid-nineteenth century, the manufactory system had taken hold of Britain. Though the timing of this development is a hotly contested historical debate, the long transition from feudalism was now nearing its completion. T.H. Aston and C.H.E. Philpin, eds, *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-Industrial Europe* (Cambridge: Cambridge UP, 1987) and Ellen Meiksins Wood, *The Origins of Capitalism: A Long View* (London: Verso, 2002).

11. Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Los Angeles: U of California P, 1990) 55.
12. For a compelling political argument modeled on the poetics of entropy see Karyn Ball, "Losing Steam After Marx and Freud: On Entropy as the Horizon of the Community to Come," *Angelaki: Journal of the Theoretical Humanities* 20.3 (September 2015) 55–78.
13. Though Marx rarely speaks of "energy," he does when discussing the industrial reserve army in Chapter 25 of *Capital*: "It is capitalist accumulation itself that constantly produces, and produces indeed in direct relations with its own energy and extent, a relatively redundant working population..." Karl Marx, *Capital: A Critique of Political Economy Volume I*, trans. Ben Fowkes (London: Penguin Books, 1976 [1867]) 782, 798.
14. Marx, *Capital Vol. I* 432.
15. *Capital Vol. I* 798.
16. Andreas Malm, "The Origins of Fossil Capital," *Historical Materialism* 21.1 (2013) 32.
17. Friedrich Nietzsche, "§341: The Heaviest Weight," *The Gay Science*, trans. Josefine Nauckhoff (Cambridge: Cambridge UP, 2008) 194–195.
18. Friedrich Nietzsche, *The Will to Power* (New York: Random House Books, 1967) 549–550.
19. We're grateful for Tyrus Miller's treatment of the concept of the eternal return and Benjamin's fascination with it in "Eternity No More: Walter Benjamin on the Eternal Return," *Given World and Time*, ed. Tyrus Miller (Budapest: CEU Press, 2008).
20. Frederick Lange, *History of Materialism Volume 1* (London: Trübner & Co., Ludgate Hall 1877) 151. The Blanqui Lange writes of is indeed the Blanqui after whom Blanquisme, a particular revolutionary attitude, gets its name. As Friedrich Engels wrote in *Der Volksstaat*: "Blanqui is essentially a political revolutionist. He is a socialist only through sentiment, through his sympathy with the sufferings of the people, but he has neither a socialist theory nor any definite practical suggestions for social remedies. In his political activity he was mainly a 'man of action,' believing that a small and well organized minority, who would attempt a political stroke of force at the opportune moment, could carry the mass of the people with them by a few successes at the start and thus make a victorious revolution." Friedrich Engels, "The Program of the Blanquist Fugitives from the Paris Commune," Marxists.org, trans. Ernest Untermann 1908, <https://www.marxists.org/archive/marx/works/1874/06/26.htm>
21. Walter Benjamin, "To the Planetarium," *The Work of Art in the Age of Its Technological Reproducibility, and Other Writings on Media*, eds. Michael W. Jennings, Brigid Doherty, and Thomas Y. Levin (Harvard: Harvard UP, 2008) 58.
22. Benjamin, "To the Planetarium" 59.
23. Nietzsche, *Will to Power* 550.
24. Walter Benjamin, *The Arcades Project* (Cambridge, Mass.: Harvard UP, 1999) 15.
25. Tyrus Miller contends that Benjamin understands eternal return socially and meta-historically as a critique of progress. Benjamin finds a fellow traveler in Blanqui on this investment. "Blanqui conjoins a temporality of crisis with a temporality of repetition," Benjamin claims, but he goes one step further and gives the shared time of crisis and repetition historical weight by situating what Miller calls the "privileged crisis point" in history—the very moment when this "cosmic order"

- becomes intelligible to Blanqui ("Eternity No More" 288).
26. Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (New York: Verso, 2015) 9.
 27. Teresa Brennan, "Why the Time is Out of Joint: Marx's Political Economy Without the Subject," *South Atlantic Quarterly* 97.2 (1998) 278.
 28. Elmar Altvater, "The Social and Natural Environment of Fossil Capitalism," *Socialist Register* 43 (2007) 41.
 29. Anna Tsing, "Sorting out Commodities: How Capitalist Value is Made through Gifts," *Journal of Ethnographic Theory* 3.1 (2013) 21.
 30. "...they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past." Marx, *The Eighteenth Brumaire*.
 31. For a discussion of grids, futurity, ruin, and politics see Karen Pinkus, "Intermittent Grids," *South Atlantic Quarterly* 116.2 (April 2017) 327–343.
 32. These components shift, behaving differently in varied historical contexts as well. The energy of the center is not the energy of the periphery. Moreover, the varied historical contents also have to be taken into account in different national contexts.
 33. Quoted in Alberto Toscano, "Materialism without Matter: Abstraction, Absence and Social Form," *Textual Practice* 28.7 (2014) 1222.
 34. Malm, *Fossil Capital* 19.
 35. In tracking the lineaments of capital as a real abstraction, Benjamin Noys suggests there is "no image of capital, capital itself is a kind of pure relationality, a pure abstract relation of value, labour and accumulation, which can only be 'seen' in negative." Benjamin Noys, *The Persistence of the Negative* (Edinburgh: Edinburgh UP, 2008) units/cppe/seminar-pdfs/2005/toscano.pdf.
 36. See also, "[m]oney is both abstract and real; it is a real abstraction that, even if it does not really exist, produces effects in reality." Oxana Timofeeva, "Ultra-Black: Towards a Materialist Theory of Oil," *e-flux* 84 (September 2017) <http://www.e-flux.com/journal/84/149335/ultra-black-towards-a-materialist-theory-of-oil/>
 37. Timothy Morton, like other object-oriented-ontology enthusiasts, takes global warming as the final nail in the coffin for anything resembling revolutionary will: "We were perhaps expecting an eschatological solution from the sky, or a revolution in consciousness — or, indeed, a people's army seizing control of the state. What we got instead came too soon for us to anticipate it. Hyperobjects have dispensed with two hundred years of careful correlationist calibration. The panic and denial and right-wing absurdity about global warming are understandable. Hyperobjects pose numerous threats to individualism, nationalism, anti-intellectualism, racism, speciesism, anthropocentrism, you name it. Possibly even capitalism itself." Timothy Morton, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: U of Minnesota Press, 2013) 76.
 38. International Energy Agency, *World Energy Outlook* (Paris: OECD, 2008).

Long Waves of Fossil Development: Periodizing Energy and Capital

Andreas Malm

Only those who most stubbornly hold fast to their ideological blinders would today deny that there is a link between capitalism and emissions of carbon dioxide. The latter have grown in tandem with the former, not coincidentally but constitutively. But it was not always like that. Originally — and this holds however one wishes to date the birth of this mode of production: to the fourteenth, sixteenth, or late eighteenth century — capitalism relied on what would today be called renewable energies: wood, muscle, wind, and water. It then adopted fossil fuels, coal first of all. By this step — surely one of the most fateful in its history — capitalism sired a peculiar formation I describe as the fossil economy, most simply defined as an economy of self-sustaining growth predicated on the consumption of fossil fuels, and therefore generating a sustained growth in CO₂ emissions.¹ Picture a pair of bellows. If one of the handles is the ceaseless growth that defines capitalism, the other is made up of coal and oil and gas; out of the nozzle comes a blast of CO₂ that fans the flames of the fire of global warming. The more growth you have, the more forceful the push will be, and the stronger the blast.

This observation, however, does not solve the question of how exactly capitalist growth has been linked to fossil fuel consumption over the course of its history; it merely poses it. The easiest way to describe the correlation of the two would be to conceive of capitalism as a smooth, linear curve of perpetual expansion, emitting a stream of CO₂ just as steadily enlarged. But this would be inaccurate. Capitalist growth is a singularly turbulent process. It moves in spurts and slowdowns, creates and destroys, accelerates and decelerates, clears the ground of established structures for the building of higher stages and tumbles, without fail, into depressions.² To be sure, growth as such rarely ceases; rather it sticks to a secular trend, the many deviations and fluctuations moving around an upward curve.³ But the process of growth proceeds through upsetting contradictions rather than an even, incremental addition of output, which impel the expansion and renew the momentum again and

again, and it might be these contradictions and the convulsions they generate that do most to produce and reproduce the fossil economy on ever greater scales. The dents in the curve may hold the secrets to its direction.

The Energy in the Waves

One way of conceptualizing this history of dynamic non-equilibrium, which seems to have a promising but surprisingly overlooked potential for our purposes, is the theory of long waves of capitalist development. Commonly traced to the foundational contribution of Russian economist Nikolai Kondratieff in the early 1920s, the theory proposes that capitalism moves in waves of forty to sixty years' duration.⁴ Each wave has two phases: an “upswing” characterized by boom conditions, succeeded by a “downswing” of persistent stagnation. The exact periodization has been a matter of endless controversy, but a standard chronology would look something like this:

	Upswing	Downswing
First long wave	c. 1780–1825	c. 1825–1848
Second long wave	c. 1848–1873	c. 1873–1896
Third long wave	c. 1896–1914	c. 1914–1945
Fourth long wave	c. 1945–1973	c. 1973–1992
Fifth long wave	c. 1992–2008(?)	c. 2008– (?)

Figure 1. Waves of Capitalist Development

When Kondratieff first proposed the wave movement, he claimed to have discovered it through sheer observation: no economic theory predicted such a rhythm to growth.⁶ Ever since, the most compelling argument for the existence of long waves has been empirical.⁷ Few economic historians would dispute that growth in the advanced capitalist countries has generally been faster in the periods designated as upswings and slower in the downswings: some sort of alternation appears undeniable.⁸ But why would capitalist economies develop in this jerky fashion? One part of the answer, on which most theories of long waves build, is the rhythm of technology diffusion. Truly revolutionary technologies, with the power to electrify economies both literally and figuratively, change the way goods are produced and open up fresh venues for general expansion, do not come online gradually. They come in bundles and bursts and thrive on dislocation; only if a crisis has weakened previous technological systems can they break through and advance.⁹ Each wave is consequently associated with a certain set of technologies, and the consensus as to their identities is wide and well-supported.¹⁰ A typical list would look like this:¹¹

	Constellation of technologies	Leading branches and core inputs
First wave	Water-powered mechanization of industry	Cotton and iron
Second wave	Steam-powered mechanization of industry and transport	Railways, machine-tools, cotton, iron, and coal
Third wave	Electrification of industry, transport, and households	Electrical equipment, engineering, chemicals, and steel
Fourth wave	Motorization of transport and other parts of the economy	Automobiles, aircraft, refineries, petrochemicals, oil, and gas
Fifth wave	Computerization of the economy	Computers, software, telecom equipment, and microprocessors

Figure 2. Associated Technologies

Two things strike the eye here. First, the emergence of the fossil economy appears to have occurred in the shift from the first to the second long wave: from one based on water to one picking up steam. This is the conjuncture where it all began.¹² Second, each subsequent wave — with the curious exception of the fifth — seems to have surged forward on the basis of technologies producing or transmitting fossil energy in novel ways. Students of long waves have not failed to notice this pattern. “In each wave dominant technologies can be identified that are associated with primary energy sources such as coal, oil, and natural gas,” states one; Kondratieff himself saw one of the clearest signs of an upswing in “the rapidity in the increase of coal production and coal consumption”; in a short paper inspired by the oil crisis of the early 1980s, George F. Ray argued that major innovations sparking off long waves were “either directly originating in, or closely connected with, the production of energy, such as steam engines or the railways,” always boosting the demand for energy, always dependent on “the abundant supply and almost unlimited availability of fuel.”¹³ The implication of this statement is significant: capitalism has moved out of its recurring downswings and revived growth on a higher level, first by starting, then by stoking and augmenting the fire. Picture the pair of bellows being blown every fifty years or so, each time with greater force, each time generating a new pulse of CO₂ that rises towards the sky for the full duration of capitalism and, most likely, beyond.

At first sight, the fifth wave is anomalous. Computers are one step removed from fossil energy, at least when compared to steam engines or automobiles, and yet the

wave which their generalization appears to drive has generated the most extreme explosion in global CO₂ emissions ever recorded. I will return to this apparent paradox below. It seems, however, that, following the original switch, every downswing has been overcome through a deepening of what is often called “carbon lock-in.” The alloy of fossil fuels and self-sustaining growth has been consolidated in three consecutive revivals (late nineteenth century, mid-twentieth century, late twentieth century), which reconfirm combustion as the venue for expansion and suffuse the economy with coal, oil and natural gas on a progressively larger scale. In the process, each wave has also produced its own “technomass,” to speak with Alf Hornborg: an infrastructure of the (for the moment) most advanced technologies, as in railroads, electrical grids, highways, oil platforms, tankers, airports, data centers... the ever-growing bag between the handles, as it were.¹⁴

Some fossil technomass is flushed away by subsequent waves — Joseph Schumpeter’s famous “creative destruction” — and deposited in the earth’s crust. Some is incorporated by the new eras. Old railroads, electrical grids, highways, and other infrastructures still in use can be seen as material legacies from previous long waves, the body of the fossil economy swelling and solidifying throughout its history; they represent technologies bequeathed to the present.¹⁵ No wave has, as yet, displaced any fossil fuel; coal has been a mainstay since the second.¹⁶ Urban sprawl is an inheritance from the end of the third and onset of the fourth.¹⁷ Coal mines and airports currently under construction to connect the nodes of globalized production will weigh down on future generations: and so on. The history of the fossil economy takes the concrete form of a sedimentation of layers upon layers — not through gradual accretion, but through successive alluvial deposits from discontinuous, often violent long waves.

Carlota Perez, the most influential wave theorist of the early twenty-first century, who stands on the shoulders of Schumpeter, writes:

So each great surge [her preferred term for waves] represents another stage in the deepening of capitalism in people’s lives and in its expansion across the globe. Each revolution incorporates new aspects of life and of production activities into the market mechanism; each surge widens the group of countries that conforms [sic] the advanced core of the system and each stretches the penetration of capitalism to further corners of the world, inside and across countries.¹⁸

Exactly the same thing could be said about the fossil economy, because it has been at one with capitalism. The long waves have been capitalist and fossil bound, diffusing new combusive technologies without which business-as-usual would still be stuck in the steam age. Each upswing has been punctured by a signal crisis, marking the arrival of a structural crisis of the capitalist economy, resolved — so it seems — by

the adoption of innovative fossil fuel-based technologies across the board, until the globe as whole resembles a bag in the bellows. Why? By what fossil mechanism has capitalism leapt from wave to higher wave? To be able to search for answers to these questions, I need to engage more closely with some theory of long waves. Among the very many proposed since the days of Kondratieff, I select one, nowadays virtually forgotten, that of Ernest Mandel.

A Dialectic of Profits and Prime Movers

A revolutionary Marxist and leader of the Fourth International, Ernest Mandel pioneered the resurgence of scientific interest in long waves from the 1970s onwards. His own idiosyncratic theory was first outlined in *Late Capitalism* (1972) and then elaborated in *Long Waves of Capitalist Development: A Marxist Interpretation* (1995).¹⁹ Long waves, in Mandel's definition, are a cycle of "successive acceleration and deceleration" of capital accumulation.²⁰ Given that such accumulation originates in the production and realization of commodities, upswings will manifest themselves in high rates of growth in industrial output and world trade and downswings in a slackening of both, a rhythm Mandel claimed to be able to demonstrate with statistics.²¹ Contractions do not vanish in the upswing, but are relatively short and mild, while years of feverish prosperity predominate; conversely, fleeting booms are interspersed between the long and severe recessions characteristic of the downswing.²²

For Mandel, however, long waves are not only or even primarily statistical phenomena. They are real segments of capitalist history. On this point, he took a leaf from his maestro Leon Trotsky, who censured Kondratieff in the early 1920s for imputing a law-like regularity to the waves, modeled on the shorter business cycle. No ticking clocks automatically set off upswings and downswings, Trotsky argued; instead, the turning points between the phases are determined by such unforeseeable events as wars and revolutions, the colonization of new countries, or the discovery of new resources — "those external conditions through whose channel capitalist development flows."²³ Moreover, the two phases correspond to "entire epochs," in economics but just as much "in politics, in law, in philosophy, in poetry [!]" : "in all spheres of social life."²⁴ They are qualitative totalities, not quantitative artifacts, to be studied in all their complexity and, as one would say today, contingency.²⁵

Writing on the other side of one full wave, Mandel could add new material to Trotsky's picture. The first upswing coincided with the French Revolution and the Napoleonic Wars; the second with the heydays of free competition and Victorian progress; the third with classic imperialism and finance capital; the fourth with the golden era of mass production, Keynesianism, consumerism, the welfare state; to which one can now easily append neoliberalism, globalization, bourgeois triumphalism, "end of history," network society, digitalization, and all the other trappings of the fifth.²⁶ In between lay no less distinctive periods of social upheaval and strife. Others have made similar observations, among them Eric Hobsbawm:

Each of the “Kondratievs” [sic] of the past not only formed a period in strictly economic terms, but also — not unnaturally — had political characteristics which distinguished it fairly clearly from its predecessor and its successor, in terms both of international politics and of the domestic politics of various countries and regions of the globe. That is also likely to continue.²⁷

It follows that the waves cannot be perfectly symmetrical oscillations of the same length.²⁸ Since they move “in zigzags, looping up and down,” with Trotsky; shaped not by any single factor but “by a series of social changes,” with Mandel; playing out on “the social, political and cultural scenes,” with Hobsbawm, there is no reason to expect any fixed periodicity.²⁹ To this argument, however, Kondratieff presented a powerful rejoinder. If the waves are conditioned by random shocks — wars, revolutions, conquests, discoveries — why would there be any discernible sequence to capitalist development? Why would such events cluster around the turning-points — think of the revolutions of 1848, the outbreak of World War I in 1914, the oil crisis in 1973, the final collapse of the Soviet Union in 1991 — if not because they are symptoms of the waves, rather than their causes?³⁰ Accidents make for bad pacemakers. Trotsky never offered a reply, leaving it to Mandel to try to fuse the two views: long waves are indeed epochs bound by political struggles (Trotsky), but they are also the products of endogenous tendencies in capital accumulation (Kondratieff).³¹ How could that possibly be true?

To solve this theoretical conundrum, Mandel introduced the concept of “partially independent variables” acting upon the capitalist laws of motion.³² Put in the simplest possible terms: suppose inventors have developed a major new technology, lying in wait in workshops until massive investment will diffuse it. Suppose capitalists remain hesitant, because the expected profits are too low to merit the outlays — then all of this falls within the *modus operandi* internal to the mode of production itself. Now suppose that the main trade unions suddenly fall apart. A piece of anti-union legislation may have been rammed through; ideological infighting, choked funding, or military occupation might have caused the unions — hitherto mighty enough to block all wage cuts — to crumble. None of these factors can be derived from any intrinsic logic of capital. As a result, the profit expectations receive a shot in the arm, capitalists rush to invest in the new technology, and soon a full upswing is underway. In Mandel’s theory, this would be a perfect case of how “partially independent variables” — here, the change in union power — interact with the systemic laws of motion, first holding accumulation back and then letting it loose as the historical stage is rearranged. In itself, such an event cannot open up a new epoch, but if it is combined with trends growing out of the system itself — and this is what happens at the turning points — all the components might fall into place for a step change.³³

The accumulation of capital has certain inbuilt tendencies — to maximize

profits, to ratchet up the rate of exploitation of labor, to raise the productivity in the struggle against competitors, as well as to search for improved technologies, larger markets, cheaper raw materials, and so on — that give the capitalist mode of production its general “push.”³⁴ But these tendencies never operate alone in the world. Capital confronts an environment where foreign and often volatile influences are at work: classes with varying degrees of capacity to advance their interests, states with shifting alliances and geopolitical ambitions, ideological traditions with long lifetimes and irregular breaks, remains of feudalism or actually existing socialism or the welfare state, all with their own forces of gravity.³⁵ Such variables, and the list could be extended endlessly, are partially independent or autonomous, in the sense that they have roots in historical soils not endemic to capital itself, yet cannot fail to be entangled with capital in a world dominated by it.³⁶ These variables are not fully inside capital, but not fully outside it either. Capitalist laws of motion therefore assert themselves through an interaction between intra-economic and extra-economic forces, and it is here, in the “concrete dialectic of the subjective and objective factors,” that the long waves arise, their epochal essences being, so to speak, amalgamations of innumerable variables with a certain temporal solidity, eventually cracked by new contradictions.³⁷

There is reason to ask if this amounts to a theoretical solution. Is it anything more than a blank check for analytical eclecticism? What else does it achieve than reformulating the Trotsky/Kondratieff antinomy on a higher level?³⁸ A Mandelian response might be that no formulation, however subtle and intricate, can reflect the real jumble of causal pathways between the mechanisms of capital accumulation and their “external conditions”: only historical inquiry can disentangle it.³⁹ For such an endeavor, Mandel put up certain signposts. First of all, he urged close attentiveness to ups and downs in the rate of profit, the safest indicator of how well the accumulation of capital fares. Since the production of commodities is motivated by the quest for profit, it will grow fast and slow as profits rise and fall; in times of declining profitability, capitalists will be less inclined to invest, and vice versa.⁴⁰ As new technologies are introduced in an early upswing, avant-garde investors who avail themselves of the higher productivity will reap super-profits exceeding the average and pulling it up in the process.⁴¹ Further into the upswing, however, clouds will sooner or later gather on the horizon, in the shape of any number of contradictions: too much installed machinery might turn into a burden; too many factories might have been built for the market to absorb the output; full employment might inflate the power of the unions; high demand might drive up raw materials prices — with any amount of input from the partially independent variables.⁴²

Whatever the exact nature of these contradictions, they will feed into the rate of profit and lower it. Be it expensive machines, dried-up markets, militant labor, expensive fuels, or any other affliction, the capitalists will experience it as a downward pressure on the rate of profit. Here is the “synthetic index of the system’s overall

performance,” the “seismograph of history” recording and expressing “all the changes to which capital is permanently subject”: the single point in which endogenous and exogenous factors converge.⁴³ It is also the most important measure for practicing capitalists — that which “makes the system tick.”⁴⁴ Consequently, a declining rate of profit will announce the approaching terminus of the upswing; the signal crisis might see it in free fall; throughout the early downswing, it will stay flat or even fall further. “Only when specific conditions permit a steep rise in the average rate of profit” will capitalists regain their appetite for investment and, if all goes well, launch a new upswing.⁴⁵ The moment of steep rise registers the (if only temporary) resolution of the contradictions: afflictions eliminated, profits spike. In other words, movements in the rate of profit set the rhythm of deceleration and acceleration by summing up the general conditions and regulating the motivations for capital accumulation.⁴⁶

No upswing can transpire, however, Mandel argues, unless any working-class resistance threatening to smother profits is defeated. The eruption of a structural crisis is usually attended by high unemployment, deflation or inflation, deteriorating working conditions, aggressive wage-cuts as capital seeks to dump the costs on labor and widen profit margins — all conducive to intensified class struggle. Integral to the brew of the downswing, the contest between the classes is an inherently unpredictable component. Here, more than anywhere else, “subjective factors” come into play: the organizational strength of the working class, the degree of its self-confidence and autonomy, its militancy or propensity to compromise and the equivalent factors in the camp of the bourgeoisie determine the outcome.⁴⁷ Capital can lay the foundations for a new epoch of expansion only if it prevails against all enemies and social impediments, including, but not limited to, organized labor.⁴⁸ How does such a victory materialize? What does capital do when it triumphs? It starts a technological revolution, concentrated to one particular sphere. Mandel explains it this way in *Late Capitalism*:

In order completely to reorganize the technical process new machines are needed, which must previously have been designed.... [Q]ualitative leaps forward are necessary in the organization of labor and forms of energy.... The fundamental revolutions in power technology — the technology of the production of motive machines by machines — thus appears as the determinant moment in revolutions of technology as a whole. Machine production of steam-driven motors since 1848; machine production of electric and combustion motors since the 90s of the 19th century; machine production of electronic and nuclear-powered apparatuses since the 40s of the 20th century — these are the three general revolutions in technology engendered by the capitalist mode of production since the “original” industrial revolution of the later 18th century.⁴⁹

If each wave marks a new phase in capital's capacity to recover profits after crisis, the magnitude and structure of "forms of energy" relative to forms of labor are here isolated as the sine qua non of the long waves. Power technology, in other words, is the key to the upswing. "Once a revolution in the technology of productive motive machines" — or prime movers, in common parlance — "has occurred, the whole system of machines is progressively transformed." Each of the three historical revolutions, between the first wave and the fifth, has remolded "the entire economy, including the technology of the communications and transport systems. Think, for example, of the ocean steamers."⁵⁰ If new life is to be breathed into sagging capitalism, it must come in the most basic, most universal guise: energy.⁵¹ Only power technology pervades every nook and cranny of the mode of production, impelling, conveying, lifting, hauling, heating, pumping, communicating, fetching goods of all conceivable kinds. If a rise in profits is the economic precondition for the upswing, a new generation of prime movers is its material embodiment.

But the links between profit and prime mover are more complex than that. As an economic fact if not an ideal invention, the new set of motive machines has its immediate origins in the "attempts by capital to break down growing obstacles" to a rise in the rate of profit: on the shop floor, first and foremost.⁵² When capital desperately seeks to restructure the labor process and put it on a more profitable footing, nothing can be more useful than a truly revolutionary power technology. It is the battering ram, the generalizable device with which capital destroys resistance and swings into renewed expansion. Victory over labor, then, does not so much precede as come about through the energy revolution, the two working hand-in-glove as the downswing nears its end.

In a two-way process so typical for Mandel's thinking, however, the prime mover not only assists in raising profits but also spreads throughout the economy as a result of those same raised profits: a positive feedback loop, one might say, propelling capital out of its long crisis. Moreover, the new technology can sustain the momentum of the upturn only if it is powerful and pervasive enough to maintain high profits, neutralizing any threats in the short term — which, in turn, induces capital to invest deeper in it.⁵³ In sum, the prime mover is: (1) adopted to remove barriers to higher profits, primarily those erected by labor; (2) widely diffused when and as profits increase, partly as a result of its own exploits; and (3) used for as long as possible to ride the upswing phase of the wave, stimulating accumulation on a grander scale. In all three moments, energy constitutes the material solution to the contradictions of the structural crisis. Working its first wonders in the downswing, it comes into full bloom after a positive turning point, usually precipitated by some concatenation of victories — not only on the shop floor, but on the world arena as a whole.

Any regularity of the long waves, pace Trotsky, is laid down by the constellation of prime movers and their auxiliary machines.⁵⁴ Even if the activity of inventors and engineers followed a linear, continuous rhythm, capitalism would still move in jolts

and jerks, because the rise of a new constellation could only be coterminous with a sharp rise in profits — always a singular event, determined by the collision of all sorts of variables, in the class struggle above all — and only permeate the economy in heavy chunks, the shift from one power technology to another an exceedingly massive undertaking.⁵⁵ But the effects of the energy injection are not everlasting, of course. They seem to last somewhat longer than five years, but never as long as half a century, the span of the upswing approximating — but no more — that of a human generation. Then contradictions resurface again.

Power technology thereby forms the materialist endpoint for Mandel's attempted fusion of endogenous laws and exogenous shocks, Kondratieff and Trotsky, accumulation and politics: a highly original sketch of a theory, identified by the author of *Late Capitalism* as his own special contribution to the field.⁵⁶ In *Long Waves*, however, the theme of energy disappears from sight.⁵⁷ Other wave scholars pass over it in silence. No one seems to have picked up this particular thread from *Late Capitalism* and followed it backwards and forwards through history; Mandel himself let it fall from his hands.⁵⁸ Left to gather dust, its potentials are quite unlike those of any other long-wave theory, as will be clearer upon a brief comparison with the foremost neo-Schumpeterian version: that of Carlota Perez.

Driving the Bulldozer

"Technology is the fuel of the capitalist engine," writes Carlota Perez.⁵⁹ Mandel would have had it the other way around. True to her master Schumpeter, Perez regards technological development as a virtually unmoved mover, advancing in the workshops and laboratories of innovators, always working to improve efficiency; "once a truly superior technology is available," its breakthrough is "practically inevitable."⁶⁰ But it demands adjustment from its surroundings. A groundbreaking innovation craves new financial systems, new governmental policies, new forms of education, habits, behaviors, "mental maps of all the social actors" matching its own logic: the computer cannot stand the rigidities of the conveyor belt or the nation state.⁶¹ It compels society to reorganize into networks. Society, however, is slow in adapting, for unlike technology, social relations are characterized by inertia, resistance, vested interests pulling the brakes, always lagging behind the latest machines.⁶² When new technologies appear on the scene — "received as a shock" — society is tied to the old ways.⁶³ These must be pulverized. The period of installation

is the time when the new technologies irrupt in a maturing economy and advance like a bulldozer disrupting the established framework and articulating new industrial networks, setting up infrastructures and spreading new and superior ways of doing things.⁶⁴

Like a bulldozer without a driver, technology uproots all the inadequate institutions and cart away the hurdles for its own self-realization.⁶⁵ “Each technological revolution inevitably induces a paradigm shift” in society at large, forcing through rejuvenation in every sphere — from economy to mentality — in a process both necessary and painful.⁶⁶ At the moment of the bulldozer’s first appearance, society is rooted in the manners of obsolete technologies: a crisis of “mismatch” ensues. The whole fabric is ripped apart, until, after two or three decades, society has learned to behave as technology expects: an upswing follows.⁶⁷

Since Perez’s waves — or “great surges of development,” as she likes to call them — start with the “big bang” of a revolutionary innovation, she has to turn the established chronology on its head: first comes the crisis of mismatch, then the “full expansion.”⁶⁸ Normally, a Kondratieff wave is understood to begin with an upswing (that is, starting in 1945) and end with a downswing (that is, until 1992), but Perez pairs the halves in the opposite order and, for instance, identifies the early 1970s as the onset of the crisis-ridden first stage of a surge induced by the coming of the computer.⁶⁹ Unsurprisingly, she singles out the usual five protagonists — water-powered mechanization, steam, electricity, motorization, information and communications technologies (ICT) — but considers each the instigator of crisis, while Mandel, again, would have it the other way around: each as the creation of crisis.

In the slightly esoteric debate over how to date and define waves or surges, profoundly different views of causality are thus on display. For Perez, technology drives capitalist development; for Mandel, the reverse. Perez’s theory has its counterpart in the productive force determinism of old-school Marxists, in which social relations are motionless fetters on technology, to be burst apart by a relentless progress; for Mandel, the most mercurial substance of history is the class struggle. Social relations of power, in Mandel’s view, act as “the ultimate determination of the process of undulatory development”: the driver steers the bulldozer so that it levels his obstacles, not the other way around.⁷⁰ In passing, Perez notices that a technological revolution tends to center on “a source of energy,” calling forth a novel “techno-economic paradigm” encompassing all of society — whereas in Mandel, tensions between multiple social variables usher in new energy technologies.⁷¹ While Perez essentially proposes an extension of technological determinism to the history of industrial capitalism in toto, Mandel can inspire a radically different agenda for research on the history of the fossil economy, guided by two overarching questions in necessary dialogue with each other:

- (1) Have the contradictions of the downswings generated and fashioned new fossil fuel-based technologies, and if so, how? And,
- (2) Have those technologies served to resolve the contradictions and fuelled the upswings, and if so, how?

In wave theory *à la* Mandel, that which takes place in one phase is always linked to that which happened in the former. The neoliberalism of the fifth wave can only be understood as a way out of the impasses of the fourth, the Keynesianism of the fourth as a response to the imbalances and catastrophes of the third, and so on — and the same would go for the defining constellations of technology. This appears to be a singularly promising approach to the study of long waves of fossil development, particularly since it allows for free and full reciprocal action between capitalist laws of motion and all manner of partially independent variables: “Interplay: that was what it was about for Mandel.”⁷² His theory, as I have rendered it here, gives ample room for the struggle between capital and labor, but this is only one battle among many to be brought into the picture; indeed, the theory is open for almost anything: “Averse to determinism, Mandel advocated an integrated analysis of the entire societal reality.”⁷³ That was both his greatest strength and greatest weakness. As a recent critic points out, Mandel ended up adding variable to variable to variable to variable... until the analytical synthesis threatened to spill out into chaos.⁷⁴

On the other hand, “the great advantage of his method consists, above all, in its openness to historical contingency.”⁷⁵ The explanation of one wave must be unlike that of any other, since each wave — as a bounded historical period, not an interval in a predetermined rhythm — is peculiar to itself.⁷⁶ But it is also an instantiation of a recurrent phenomenon. Mandel’s theory is messy and labyrinthine and intended to be so, because it is, first and foremost, a guide to the study of “actual historical dynamics.”⁷⁷ What, then, can it tell us, more concretely, about the past, present and future of the capital-energy nexus? This is a question for any number of other studies, but at least a couple of signposts for further research are in order here. I offer some brief reflections on the turns from the first to the second, from the fourth to the fifth and from the fifth to a possible sixth wave yet to come.

To make a long story told elsewhere very short, British industrial capitalism surged forth on a first wave of water-power.⁷⁸ But in 1825, a signal crisis erupted in the form of a financial crash, followed by a succession of painful, protracted depressions. Extraordinary profits had attracted too much capital to the cotton industry in particular, causing an over-establishment of factories and, consequently, a massive overproduction of commodities, under whose weight the rate of profit now plunged. At the very same time as the banks collapsed — setting the typical pattern of interplay with partially independent variables — the British working-class rose, relieved from the criminalization of all trade union activity when the Combination Laws were repealed, and for the next two decades, the manufacturing districts were shaken by one near-revolutionary uprising after another. It was then that the shift to steam occurred.

The combativeness of key segments of the British working-class — cotton-spinners, handloom-weavers, machine-makers, wool-combers — blocked the path to resuscitated profits. Fortunately for the capitalists, however, they possessed a weapon

to do away with them all: automatic machinery. Rolled out in the two decades after 1825, an army of self-acting mules, power looms, machine tools, and other machines effectively wiped out the insurgent collectives, cleared the way for wage reductions and speed-ups and brought the class to the subdued, domesticated state of the high Victorian era. That mechanical army was powered by steam. Fully developed and familiar to manufacturers since the mid-1780s, the new power technology, and I mean *power* in the dual sense of the term (as in energy *and* dominance), overtook cheap water only after 1825, when the pressure of the contradictions of the first downswing made the transition imperative.

Steam alone could impel the offensive against labor. Water was embedded in the landscape and integrated in the weather, virtually free to use but located outside of towns, subject to fluctuations in river levels, incapable of running a concentrated mass of accelerating machines. Steam engines, on the other hand, could be put up anywhere and used at anytime: for their fuel was severed from the landscape, detached from weather cycles, brought up from underground as a dead still relic of ancient photosynthesis. Setting it on fire, capital released a completely new source of energy to destroy the resistance of labor. A steep rise in the rate of profit followed, allowing for an upswing in which steam-power opened all sorts of venues for fresh accumulation and remolded the economy in toto: a huge blast from the bellows.

Needless to say, the shop floors of Britain constituted but one, albeit crucial, frontier in this turn from the first to the second long wave. The full role of steam remains to be specified in detail. To follow the guidelines of Mandel, one would need to take into account all the buttons that must be pushed for capital accumulation to exit a structural crisis and revive on a higher level — not only a rise in the rate of surplus value, but also a broadening of markets, a reduction in turnover time, a cheapening of raw materials, and other elements of constant capital, to name some. How did steam power contribute to the mid-nineteenth century victories along these frontiers? A study of the origins of the fossil economy in this first full wave movement would need to delve deeply into the empirical data of the period and subject it to that type of open, pluralist, exuberantly complex analysis Mandel pioneered.⁷⁹ Yet the outline of the core elements underwriting each successive wave may nevertheless be established as early as the first.

Now jump straight to the apparent paradox of the fifth wave. Unlike steam engines, electricity, automobiles, or petroleum, computers are neither prime movers or transmitters nor sources of energy in themselves, and yet the upswing they carried caused the most extreme CO₂ blast in the history of industrialized capital. How can one shed light on that link? Perhaps by accepting Mandel's view that a major contradiction of the fourth wave was a perilously strong labor movement in the core. As the reserve armies of labor were depleted over the course of the 1960s and the self-confidence of the working class soared towards the wild heights of 1968–73, the high rate of surplus value of the previous two decades could no longer be maintained, and a

“fall in the rate of profit became unavoidable.”⁸⁰ To resolve that crisis, some profound restructuring was exigent. Among the many preconditions for a fifth long wave, Mandel proposed the following: “In order to drive up the rate of profit to the extent necessary to change the whole economic climate, under the conditions of capitalism, the capitalists must first decisively break the organizational strength and militancy of the working class in the key industrialized countries.”⁸¹ Did computer technology assist them in that battle? If so, how was it connected to the increased combustion of fossil fuels? An exhaustive inquiry is far beyond the scope of this essay: here I offer a crude hypothesis. It runs something like this:

(1) The globalization of production broke the strength of labor in the advanced capitalist countries. By pitting workers there against workers in Mexico, Brazil, the post-Stalinist Eastern European economies, but primarily in China, they all became mutually substitutable to an extent never seen before. Armed with the capacity to shift commodity production to distant countries and export from there, within the framework of integrated cross-border supply chains, employers could push unions to the wall, by threatening that “unless you accept our demands, we will relocate.” Beginning in the late 1970s, culminating with the admission of China into the WTO in 2001, the globalization of production removed one of the main hurdles to a capitalist renaissance. It gave a critical contribution to the relative rebound of the profit rate after the dismal lows of the 1970s.

(2) The very same process caused an unprecedented explosion in CO₂ emissions. In China, the quest for cheap and disciplined workers, with whom all other workers of the world had to compete, set off the largest spree in fossil fuel consumption in history: cross-border chains extending into the People’s Republic and, indeed, the four corners of the world demanded fresh infrastructure for the supply of energy, which, incidentally, mostly came from coal. They were held together by the transportation of goods, components, raw materials and personnel in vehicles fuelled by petroleum.⁸² Overall, the globalization of production extended the logic of the fossil economy to new territories, giving the main impetus for the epochal boom in combustion outside the traditional core.

(3) Information and communications technology, or ICT, made the globalization of production possible. One of the most revolutionary services of this technological paradigm consisted in linking, coordinating, lubricating world-encompassing production chains: without ICT, globalization as we know it would have been unthinkable. As one geographer notes, the opening of the gates to China from the late 1970s

onwards coincided with the rise of virtual bridges: “In the West, the combination of two industries, computers and communications, began providing the *enabling technology for industrial capital to seek out and manage cheap labor on a global scale.*”⁸³ By allowing it to create transnational circuits, ICT turned into a battering ram against the defenses of labor, realizing the substitutability of industrial workers and unleashing the full force of existing power technologies across borders.

Finally yet importantly, humanity is now faced with the imminent prospect of catastrophic global warming, the sum of all the CO₂ blasted into the air since the Industrial Revolution. At the same time, since the financial crash of 2008, central components of the capitalist world economy — the European Union, the United States, the People’s Republic of China — appear mired in relative stagnation of various degrees of depth and volatility, with some attendant symptoms of political crisis: a pretty good match for a fifth downswing. That conjunction gives rise to an intriguing possibility. Could capitalism swing itself into a sixth long wave by casting off fossil fuels and switching to renewables — just what humanity needs to stave off the most intolerable scenarios of climate change? Every nook and cranny of the world economy urgently needs to be disconnected from coal and oil and gas and filled with substitutes that come close to zero emissions: a grand transition to impelling, conveying, lifting, hauling, heating, pumping, communicating, doing everything with the power of sun, wind, water. Might such a universal rollout of new power technology breathe fresh air into languishing capitalism *and* ensure that we collectively back off from the cliff in time?

Probably the most elaborate case for such a future has been made by John A. Mathews, who builds directly on the work of Perez. He believes that the crash of 2008 signaled the descent into the crisis-ridden stage of yet another “surge,” which will usher in a sweeping adoption of the renewable energy technologies (abbreviated RE) already in store and under development, leading, via a bumpy ride over the next couple of decades, into a rich green Kondratieff. These beneficent technologies perfectly fit the profile of a wave-carrying paradigm: they enable, first of all, “costs and prices to be drastically reduced.” They are of virtually unlimited supply. They have “massive potential for applications and so for becoming pervasive,” causing productivity to spike, spurring other novel technologies — electric vehicle charging systems, smart grids managed online, cities filled with intelligent green buildings — opening up unimagined channels for the accumulation of capital. The bottom-line is never in doubt. “The point is,” Mathews writes, “to demonstrate that the new technology provides superior performance and profits”: only by dint of this quality can it be expected to trigger a proper surge.⁸⁴

Hence the agent of the transition in this new wave of capital shed of carbon will be capital itself. “It is capitalist emulation and drive for profits that will accelerate

the uptake of renewable energy sources,” the spirit of creative destruction harnessed for the most virtuous goal, firms scrambling to satisfy consumer demand with the lowest possible emissions and enriching themselves fabulously in the process.⁸⁵ More precisely, it is the financial sector that will drive the switch. Applying another model from Perez — the arrival of new technologies are accompanied by financial bubbles (think of the British railway mania in the 1830s and 1840s or the more recent dotcom boom) — Mathews predicts that the profit potentials of RE will attract frenzied investment from venture capitalists, the whole pack of adventurous speculators following the scent of super-profits. “If the last decade has seen REs emerging from out of their long (prolonged) gestation phase and into the installation phase, then we can anticipate a ‘Renewable Energy bubble’ some time perhaps around 2015–2020” — this was written in 2013 — “reflecting the surge of financing and credit creation into the field of REs and green technologies.”⁸⁶ In this prognosis, the future is bright green like a budding leaf. “Through direct market connections, and through the aggregating effects of financial instruments, the entire economy will be brought within the ambit of new capitalist eco-calculations that bring ecological limits to the center of concern.”⁸⁷

Now what would happen were one to choose Mandel instead of Perez as a source for speculation? The first lesson of his theory is clear: never underestimate the ability of capitalism to reinvent itself.⁸⁸ Never stick to orthodox formulas that always proclaim the end of the road. Prepare to be taken aback by capital, whose flexibility and resourcefulness have confuted so many prophecies of breakdown so many times before. That said, there are a number of question marks to be jotted down alongside Mathews’s storyline. First of all, it might be a category mistake to conceive of a conversion to renewable energy as analogous to any of the technological leaps experienced since the mid-nineteenth century.⁸⁹ Going from fossil fuels to renewables — completely, no delay — is quite unlike adding automobiles, airplanes, and petrochemicals to the arsenal of capitalist productive forces. Since the original switch between the first and the second waves, when the fossil economy emerged in full, the upswings have been predicated on technologies for more extensive consumption of fossil fuels: but this time, we are talking about a reversion to qualitatively different type of energy. If, since the high Victorian era, every “great surge of development,” to use the sanguine neo-Schumpeterian terminology, has materialized through fossil energy, this one would have to break out of that mould and re-embed itself in the kind of energy the very first structural crisis jettisoned. The adequate analogy would rather seem be that singular transition — now in reverse, and on an unfathomably larger scale.

The question to ask, then, is if capital accumulation in general and a phase of renewed expansion in particular are compatible with an exclusive use of sun, wind and water. Or is there something in fossil fuels that make their energy indispensable for capital? As much as ever, the currents that make up “RE” remain integrated in

landscapes and subject to fluctuations in weather. Can capital survive if fettered to the places and hours where the sun happens to shine and the wind to blow? More to the point: can it thrive within such fetters? They would seem to contravene the logic of globalized and lean production — a problem Mathews conveniently ignores, when he posits the sixth surge as essentially a renewable continuation of the fifth (whereas it has to remove carbon lock-in inherited from the fourth wave, in the form of *inter alia* the oil industry).⁹⁰ But perhaps some sort of reconciliation can come about. Perhaps several different renewables from many topographic regions can be connected in overarching mega-grids that elevate them above the concrete determinants of landscape and weather, making them available practically anywhere anytime. Now that obviously requires comprehensive planning, most probably by other agents than venture capitalists, quite likely by states interfering deeply into the flow of energy. Can capital reconcile itself to such meddling — let alone gain from it?

I have offered some more detailed, though rather skeptical reflections on these issues elsewhere.⁹¹ Here I note one further complication: all upswings so far have rested on the freedom to consume vastly greater quantities of energy than the previous wave. There has never been any other way to feed growth in commodity production. If this history is anything to go by, a sixth upswing would not only have to replace the current total consumption of fossil fuels by an equal amount of renewable energy: it would have to add a significant margin for growth — not 100 percent of oil and coal and gas, but 120 or 150 or even more would need to be extracted from unfossilized energy within the course of a few decades. It seems a tall order. The alternative, of course, would be to reduce energy consumption, beginning with its wastage: something no previous upswing has ever had to worry about. Growing by slimming seems alien to the workings of capital. But, again, one should not discount its capacity for miraculous reinvention.

Then there are some straightforward empirical problems in Mathews's assessment. The evidence for the emergence of an RE bubble is, to put it mildly, mixed. Total capital invested worldwide in renewables fell by 23 percent between 2011 and 2013. It rebounded in 2014, by some 17 percent over the previous year.⁹² Total investment in fossil energy was some four times larger, meaning — it bears repeating — that for every dollar used to build up RE capacity, four other dollars were ploughed into oil, coal, gas. The International Energy Agency predicts a similar distribution until 2035 — no world-saving speculative binge in sight — and notes matter-of-factly: "Getting the world on a 2°C emissions path would mean a different investment landscape."⁹³ So far, the money does not quite seem to roll into the green Kondratieff corner. Mega-projects for concentrated solar power in deserts — notably Desertec — "promise as many associated investment opportunities as there are entrepreneurs to find them," Mathews has declared, but in reality the entrepreneurs have fled that ship like rats.⁹⁴ By the time of this writing, the Desertec project appears to have utterly failed. The eco-Schumpeterian storyline is built on the premise of secularly falling prices for

renewables — entirely realistic — and just as secularly rising prices for fossil fuels, which, however, are directly contradicted by the present collapse in the price of oil. And then it hasn't even considered the possibility that it might not be very lucrative to market a fuel that is practically gratis. Where will the profits to the energy supplier come from when the price of solar power approaches zero?⁹⁵

Finally, Mandel leads me to a rather different set of questions. How could investment in renewable energy not only deliver profits but underpin the *steep rise in the average rate of profit* required for capital to embark on a new upswing? In what sense could it constitute *the solution to the contradictions* of the fifth structural crisis? Could it serve capital as a bulldozer by which to break down the growing obstacles? It does not seem to be a self-driving bulldozer, not a force advancing on its own, spreading “new and superior ways of doing things” while society adapts more or less pliantly. Mathews seeks to distance himself from technological determinism, but he never poses the profoundly *social* question of a Marxist perspective on energy in the waves: what source could help capital to defeat its enemies, including itself?

The answer depends, of course, on the exact nature of the contradictions of the present conjuncture. Let us, for the sake of argument, accept the proposition that capital now, in a reversal of the situation in the 1970s, suffers from too weak labor, unable to purchase all the commodities churned out, so that over-production, over-capacity, over-accumulation have become near-chronic maladies of the world economy. Then perhaps giant public — note public — investment programs in renewables could provide just the injection of demand capital so desperately and impotently craves. But that remains pure speculation. So far, no capitalist class has taken any initiatives in the direction of climate Keynesianism on an epochal scale. Under the banners of free trade and austerity, that class rather continues to push states further away from influence over investment and squeeze out the last drops from public budgets and working-class earnings, and as Naomi Klein has eloquently argued, such strategies for renewed accumulation run exactly counter to the prerequisites for a switch.⁹⁶ To speak in the terms of Mandel, climate Keynesianism seems to necessitate a subjective factor, some sort of social force more external and hostile than internal and congenial to capital. It has yet to appear on the stage.

But then one should not forget the partially independent variables. This time, the climate system itself might prove one such externality. An extreme climate emergency could shove this mode of production in an unforeseen direction. Indeed, if any prophecy about the next phase of capitalist development can be made with anything like certainty, it is that global warming will be a determining external condition through whose channel it must flow. Once in there, all known wave patterns might eventually — this sort of breakdown cannot be excluded — come to an end along with everything else. However, before we reach that point, and to make it slightly less likely, a rediscovery of Mandel's method and painstaking application of it to the realities of our day, always with an eye on the subjective factor, might be of a little help.

Notes

1. Under this definition, non-capitalist fossil economies are perfectly possible and have indeed existed in the shape of Stalinist formations. For some reflections on them, see Andreas Malm, “Who Lit this Fire? Approaching the History of the Fossil Economy,” *Critical Historical Studies*, 3.2 (Fall 2016) 215–248.
2. As pointed out by, for example, Leon Trotsky, *The First Five Years of the Communist International* (London: Pathfinder, 1973) 226; Michael Storper and Richard Walker, *The Capitalist Imperative: Territory, Technology, and Industrial Growth* (Oxford: Basil Blackwell, 1989), 202; Ernest Mandel, *Long Waves of Capitalist Development: A Marxist Interpretation* (London: Verso, 1995) 120; Chris Freeman and Francisco Louçã, *As Time Goes By: From the Industrial Revolutions to the Information Revolution* (Oxford: Oxford UP, 2002) 43, 55; Carlota Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (Cheltenham: Edward Elgar, 2002) 162. “The stage on which capitalist history is played out is always on the move.” Anwar Shaikh, “The Falling Rate of Profit as the Cause of Long Waves: Theory and Empirical Evidence,” *New Findings in Long Wave Research*, eds. Alfred Kleinknecht, Ernest Mandel and Immanuel Wallerstein (London: Macmillan, 1992) 174.
3. As emphasized with particular clarity by Trotsky, *The First Five* 252; Leon Trotsky, “The Curve of Capitalist Development,” article originally appearing in Russian in *Vestnik Socialisticheskoi Akademii*, 1923, available at marxists.org.
4. N. D. Kondratieff, “The Long Waves in Economic Life,” *Review of Economic Statistics*, 17 (1935) 105–115. On Kondratieff, his theory, and the theories of his many predecessors, see Freeman and Louçã, *As Time* 66–92. Klas Eklund “Long Waves in the Development of Capitalism?” *Kyklos* 33 (1980) 383–419, remains an excellent survey of long wave theories.
5. Ernest Mandel, *Late Capitalism* (London: Verso, 1978) 122; Mandel, *Long Waves* 1; Freeman and Louçã, *As Time* 141; Phillip Anthony O’Hara, *Growth and Development in the Global Political Economy: Social Structures of Accumulation and Modes of Regulation* (London: Routledge, 2006) 6; Tessaleno Devezas, “Crises, Depressions, and Expansions: Global Analysis and Secular Trends,” *Technological Forecasting and Social Change* 77 (2010) 739–761; Chris Freeman, “Technology, Inequality, and Economic Growth,” *Innovation and Development* 1 (2011) 11–24; Andrey V. Korotayev & Leonid E. Grinin, “Kondratieff Waves in the World System Perspective,” *Kondratieff Waves: Dimensions and Prospects at the Dawn of the 21st Century*, eds. Leonid Grinin, Tessaleno Devezas & Andrey Korotayev (Volgograd: Uchitel, 2012) 48–51.
6. Kondratieff, “The Long Waves.” It speaks to his scientific vision that Kondratieff discerned the wave pattern only on the basis of the first two-and-a-half waves.
7. This is not to say that the existence of long waves is empirically uncontroversial — to the contrary — but overall, it has been easier to point to an actual rhythm of alternating upturns and downturns corresponding approximately to the chronology above than to theoretically *explain* it. See, for example, Eric Hobsbawm, *On History* (London: Abacus, 1998) 36–37, 66. For recent collections of an impressive array of data showing relatively high levels of growth of world GDP in the upswings and low ditto in the downswings, see Devezas, “Crisis, Depressions,” and Korotayev & Grinin, “Kondratieff Waves.”
8. Eklund, “Long Waves” 412–413. Even Angus Maddison, who sets out to refute the theory of long

waves, ends up endorsing a (somewhat diluted) version of it under the force of the data: “There have been five distinct phases of economic performance in the capitalist epoch, each with its own momentum.” Angus Maddison, “Fluctuations in the Momentum of Growth within the Capitalist Epoch,” *Cliometrica* 1 (2007) 171. (This is gleefully noticed and discussed by Devezas, “Crisis, Depressions” 752–753.)

9. Freeman & Louçã, *As Time*, 139–142. Long wave theory is thus based on the crucial distinction between invention and diffusion: “Scientific-technical inventions in themselves, however, are insufficient to bring about a real change in the technique of production. They can remain ineffective so long as economic conditions favorable to their application are absent.” “The Long Waves,” 112.
10. As noticed by Espen Moe, “Energy, Industry and Politics: Energy, Vested Interests, and Long-Term Economic Growth and Development,” *Energy* 35 (2010) 1732.
11. Based on Freeman & Louçã, *As Time* 141. Similar lists, with slight variations, can be found in, for example, Mandel *Late Capitalism* 120–121; Mandel *Long Waves* 33; Perez, *Technological Revolutions* 10–11, 14; George F. Ray “Energy and the Long Cycles,” *Energy Economics* 5 (1983) 5; Arnulf Grübler and Helga Nowotny, “Towards the Fifth Kondratiev Upswing: Elements of an Emerging New Growth Phase and Possible Development Trajectories,” *International Journal of Technology Management* 5 (1990): 437; Peter Dicken, *Global Shift: Transforming the World Economy. Third Edition* (London: Paul Chapman, 1998) 148; Bo Göransson and Johan Söderberg, “Long Waves and Information Technologies: On the Transition towards the Information Society,” *Technovation* 25 (2005) 205; Chris Papenhausen, “Causal Mechanisms of Long Waves,” *Futures* 40 (2008) 789; Carlota Perez, “Technological Revolutions and Techno-Economic Paradigms,” *Cambridge Journal of Economics* 34 (2010) 192, 195–197.
12. For an analysis of this conjuncture, and more precisely of the shift from water to steam in British industry, see Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016).
13. Craig S. Volland, “A Comprehensive Theory of Long Wave Cycles,” *Technological Forecasting and Social Change* 32 (1987) 127; “The Long Waves” 109; Ray, “Energy” 5. See further W. Seifritz and J. Hodgkin, “Nonlinear Dynamics of the Per Capita Energy Consumption,” *Energy* 16 (1991) 615–620; Patrick Criqui, “Energy Crises and Economic Crisis: A Long-Period Perspective,” *Energy Studies Review* 6 (1994) 34–46; Bruce Podobnik, “Toward a Sustainable Energy Regime: A Long-Wave Interpretation of Global Energy Shifts,” *Technological Forecasting and Social Change* 62 (1999) 155–172; Jonathan Koehler, “Long Run Technical Change in an Energy-Environment-Economy (E3) Model for an IA System: A Model of Kondratiev Waves,” Working Paper 15, Tyndall Centre for Climate Change Research, 2002; João Carlos de Oliveira Matias and Tessaleno Campos Devezas, “The Fifth Kondratieff Wave: The Fossil Fuel Apogee,” Workshop Presentation, IV International Workshop on Oil and Natural Gas, Lisbon, May 10–20, 2005; Göransson and Söderberg, “Long Waves” 207–208; Robert U. Ayres, “Turning Point: The End of Exponential Growth?,” *Technological Forecasting and Social Change* 73 (2006) 1196–1197; A. T. C. Jérôme Dangerman & Hans Joachim Schellnhuber, “Energy Systems Transformation,” *Proceedings of the National Academy of Science* (2013) E554–555.
14. For the concept of technomass, see Alf Hornborg, *The Power of the Machine: Global Inequalities of Economy, Technology, and Environment* (Walnut Creek: AltaMira, 2001) 11, 17, 85, 94. On the construction of energy infrastructures in the long waves, cf. Bruce Podobnik, *Global Energy Shifts*:

Fostering Sustainability in a Turbulent Age (Philadelphia: Temple UP, 2006) 61–62.

15. “Railway systems originating in the middle of the nineteenth century are still very important today. Electrical technology is the essential foundation for electronic systems and the automobile has certainly not disappeared.” *As Time* 145.
16. The relative shift from coal to oil after World War II coexisted with continued absolute increases of coal output, as pointed out, importantly, by Podobnik, “Toward a Sustainable” 157.
17. See George A. Gonzalez, *Urban Sprawl, Global Warming, and the Empire of Capital* (Albany: SUNY Press, 2009).
18. Perez, *Technological Revolutions* 20. Note that Perez is by no means an anti-capitalist: these insights do not depend upon opposition to the system.
19. Mandel, *Late Capitalism*; Mandel, *Long Waves*. A brilliant biography of Mandel is Jan Willem Stutje, *Ernest Mandel: A Rebel’s Dream Deferred* (London: Verso, 2009).
20. *Late Capitalism* 109. Emphasis in original. The waves are said to be most obvious in advanced capitalist countries, as opposed to the lagging peripheries of the system. *Long Waves* 2.
21. On the role of these two indicators, see, for example, *Late Capitalism* 141; *Long Waves* 6.
22. *Late Capitalism* 122; *Long Waves* 21. See also “The Long Waves” 111, and *The First Five* 253–254.
23. Trotsky, “The Curve.” An excellent rendering of the debate is Richard B. Day “The Theory of the Long Cycle: Kondratiev, Trotsky, Mandel,” *New Left Review* no. 99 (1976) 67–82.
24. “The Curve.”
25. See also, Eklund, “Long Waves” 389.
26. *Long Waves* 82. See further, for example, 76–81, 99, and *Late Capitalism* 128–9.
27. Hobsbawm, *On History* 37.
28. For example *Late Capitalism* 133, and *Long Waves* 76.
29. *The First Five* 252; *Late Capitalism* 129; *On History* 66.
30. “The Long Waves” 112–113.
31. See also Day, “The Theory” 81. The third main source of inspiration for Mandel’s theory of long waves was, of course, Joseph Schumpeter. See also Francisco Louçã, “Ernest Mandel and the Pulsation of History,” *The Legacy of Ernest Mandel*, ed. Gilbert Achcar (London: Verso, 1999) 104.
32. Ernest Mandel, “Partially Independent Variables and Internal Logic in Classical Marxist Economic Analysis,” *Social Science Information* 24 (1985) 485–505.
33. Ernest Mandel, “Explaining Long Waves of Capitalist Development,” *Futures* 13 (1981) 336.
34. Mandel, “Partially Independent” 489.
35. “Partially Independent” 490–495.
36. “Partially Independent” 492.
37. *Long Waves* 133. See also, Louçã, “Ernest Mandel” 107; William Hamilton Sewell Jr., *Logics of History: Social Theory and Social Transformation* (Chicago: Chicago University Press, 2005) 11. One could of course argue that these types of factors are so interwoven as to be virtually impossible to separate — as is so often the case with an analysis informed by the dialectical method.
38. As argued in “The Theory” 81–82.
39. See also Marcel van der Linden and Jan Willem Stutje, “Ernest Mandel and the Historical Theory of Global Capitalism,” *Historical Materialism* 15 (2007) 39–41.

40. For a powerful restatement of this classical view and demonstration of its validity, see Andrew Glyn, "Does Aggregate Profitability Really Matter?" *Cambridge Journal of Economics* 21 (1997) 593–619.
41. *Long Waves* 20, 110.
42. For a stylized scenario, see *Long Waves* 44–46.
43. Mandel, "Explaining" 335; Stutje, *Ernest Mandel* 190; *Late Capitalism* 133. Emphasis in original. See also, Minqi Li, Feng Xiao and Andong Zhu, "Long Waves, Institutional Changes, and Historical Trends: A Study of the Long-Term Movement of the Profit Rate in the Capitalist World-Economy," *Journal of World-Systems Research* 13 (2007) 33.
44. "Explaining" 335.
45. *Late Capitalism* 145. See also 108–9, 114, 120; *Long Waves* 7, 16.
46. *Late Capitalism* 110. In the rate of profit, then, Mandel fuses all the multiple endogenous and exogenous variables in a single factor so "close to the system's heart as to make one understand why changes in *that* factor can precipitate a change in the way in which the system as a whole grows or does not grow." "Explaining" 335.
47. *Long Waves* 33, 36–37, 118–19, 123, 128, 137.
48. In the midst of the fourth downswing — the first edition of *Long Waves* appeared in 1980 — Mandel listed the conditions for a new upswing, among them "a qualitative increase in the degree of integration of the USSR and China into the international capitalist market," a decisive break of "the organizational strength and militancy of the working class in the key industrialized countries," "radical rather than marginal changes in the transformation of some key areas in the so-called third world into large markets," "radical defeats of national liberation movements." *Long Waves* 87–90.
49. *Late Capitalism* 112, 118–119. See also 116–117. All emphases except the first added. Note that the selection of key technologies in this schema deviates from the modern consensus. See also Louçã, "Ernest Mandel" 117. The point here, however, is not the *identity* of the technologies singled out by Mandel, but the historical role he ascribes to them.
50. *Late Capitalism* 118–119.
51. *Late Capitalism* 112.
52. *Long Waves* 33.
53. *Late Capitalism* 115–116, 119.
54. *Late Capitalism* 137, 143–144; *Long Waves* 19.
55. *Late Capitalism* 145.
56. *Late Capitalism* 145.
57. With very rare exceptions, for example, the statement that each wave is associated with "new machine systems, based on different sources of energy" (*Long Waves* 112). In this book, however, the main theme and purported original contribution is the theory of *asymmetry* in the long waves: the turn into a downswing — the outbreak of depression — is exclusively caused by the laws of motion of capital itself, whereas the upturn is precipitated by a beneficial outcome of class and other political struggles. See for example 104. This theory is dubious: there appears to be no *a priori* reason to deny exogenous shocks a role in the outbreak of crises. Be that as it may, it is the power theory of *Late Capitalism*, not the asymmetry of *Long Waves*, that is of value to us.
58. The analytical poverty of energy theory in the Marxist school of long waves is on full display in

Matthew Edel, “Energy and the Long Swing,” *Review of Radical Political Economics* 15 (1983) 115–130, written at a time when Mandel’s influence was at its peak. It contains no discussion of the above passages from *Late Capitalism*.

59. Perez, *Technological Revolutions* 155.
60. *Technological Revolutions* 38. See also 15.
61. *Technological Revolutions* 20–32, 41–43. “Mental maps” 20.
62. *Technological Revolutions* 6, 26, 153, 155; See also Perez “Technological Revolutions” 198.
63. *Technological Revolutions* 23.
64. *Technological Revolutions* 36. Emphasis added. See also, for example, 145.
65. *Technological Revolutions* 41–43, and “Technological Revolutions” 188, 194–195.
66. *Technological Revolutions* 15. Emphasis added.
67. *Technological Revolutions* 26.
68. *Technological Revolutions* 29–30, 48. On the “big bangs” — unexplained events of an almost cosmological character — see 11–12, 29.
69. *Technological Revolutions* 11, 57.
70. Louçã, “Ernest Mandel” 113.
71. *Technological Revolutions* 8; “Technological Revolutions” 191.
72. Stutje, *Ernest Mandel* 191. Emphasis added. On the importance of the concept of partially independent variables for opening up long wave theory to history, see also Louçã, “Ernest Mandel” 111; As *Time* 58. John McNeill contends that long waves can shed no light on environmental history — the discipline whose doyen he is — since they are unrelated to the temporalities of nature. “How can one harmonize this outlook with the rhythms of climate change, which in any case are not uniform around the world, and are surely quite independent from any economic cycles that may derive from human affairs?” J. R. McNeill, “Observations on the Nature and Culture of Environmental History,” *History and Theory* 42 (2003) 38. But this is to conflate the issue of *how natural processes impact on society* with that of *how social processes impact on nature*: if the latter is in focus, long waves might very well be central to the explanation.
73. *Ernest Mandel* 187. Emphasis added.
74. Michael R. Krätke, “On the History and Logic of Modern Capitalism: The Legacy of Ernest Mandel,” *Historical Materialism* 15 (2007) 126–128.
75. van der Linden & Stutje, “Ernest Mandel” 41.
76. See also Freeman & Louçã, *As Time* 111, 131, 150; Rodney Edvinsson, *Growth, Accumulation, Crisis: With New Macroeconomic Data for Sweden 1800–2000* (Stockholm: Almqvist & Wiksell International, 2005) 31, 167–168, 285–286, 289–290; Rainer Metz, “Do Kondratieff Waves Exist? How Time Series Techniques Can Help Solve the Problem,” *Cliometrika* 5 (2011) 235–236. On Mandel’s different explanations for each wave, see *Late Capitalism* 130–132, 145.
77. Eklund, “Long Waves” 414. Emphasis in original. See also *Late Capitalism* 145; Stutje, *Ernest Mandel* 169, 194.
78. See Malm, “Who Lit?”
79. This task will be taken up in *Fossil Empire*, the sequel to Malm, *Fossil Capital*.
80. *Long Waves* 73.

81. *Long Waves* 88.
82. For a more detailed analysis of this dynamic, see *Fossil Capital* 327–366.
83. Peter J. Taylor, “Thesis on Labour Imperialism: How Communist China Used Capitalist Globalization to Create the Last Great Modern Imperialism,” *Political Geography*, 30 (2011) 175. Emphasis added.
84. John A. Mathews, “The Renewable Energies Technology Surge: A New Techno-Economic Paradigm in the Making?” *Futures* 46 (2013) 12–16. Emphasis added.
85. John A. Mathews, “Naturalizing Capitalism: The Next Great Transformation,” *Futures* 43 (2011) 872.
86. Mathews, “The Renewable Energies” 17.
87. Mathews, “Naturalizing Capitalism” 874. Emphasis added.
88. *Late Capitalism* 92–93.
89. This mistake is also made from a Marxist standpoint by Podobnik, *Global Energy Shifts*.
90. “The Renewable Energies.”
91. *Fossil Capital*.
92. Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014*; Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2015*, bnef.com.
93. Figure and quotation from International Energy Agency, *World Energy Investment Outlook 2014 Factsheet Overview*, www.iea.org, 1. Emphasis added.
94. “The Renewable Energies” 16.
95. See further *Fossil Capital*.
96. Naomi Klein, *This Changes Everything: Capitalism vs. the Climate* (London: Penguin, 2014).

Mapping the Atomic Unconscious: Postcolonial Capital in Nuclear Glow

Katherine Lawless

During his visit to Hiroshima on May 27, 2016, the first ever to be made by a sitting U.S. president, Barack Obama claimed that "the memory of the morning of August 6, 1945, must never fade."¹ Not only did he seek to preserve the memory of the dropping of the first atomic bomb beyond the last voices of the *hibakusha*, he framed this call for preservation in moral terms: "The scientific revolution that led to the splitting of an atom requires a moral revolution as well." If his explicit claim is that the role of science in human atrocity can be mitigated by a renewed moral framework, the implicit message is that the practice of commemoration provides a symbolic ground for this renewed morality. Accordingly, the president's discourse of moral revolution not only affirms the largely apolitical, ahistorical nature of global memory culture, which tends to translate historical forms of exploitation into universal narratives of suffering, but it also obscures the slow violence of nuclear energy regimes by reducing nuclearity to the moment of explosion. In seeking to preserve the memory of atrocity, the moral revolutionary, however unwittingly, preserves the colonial logic of nuclear energy regimes by transforming the material exploitations of energy production into the universal grammar of commemoration.

Against the idealism of the moral revolutionary, I want to recuperate the material dimensions of cultural memory and suggest that it might serve a different purpose in the context of postcolonial capital: to elucidate the materiality of an energy unconscious embedded in memory media.² Postcolonial capitalism here signifies the ways in which immaterial forms of accumulation and material forms of labour intersect in the colonial landscapes of global memory culture. My utilization of the term is meant to reflect the complex ways in which enclosures of knowledge and labor reinforce one another while contributing to new forms of accumulation through the aestheticization of colonial capital's material remains.³ In my elaboration of the atomic unconscious of postcolonial capital, I adapt Michael Niblett's question regarding the mapping of energy regimes in relation to cultural media. Suggesting that patterns

of capital accumulation might be embedded in cultural forms, Niblett asks: “What happens if we map the flow of energy regime transitions in relation to cultural manifestations?”⁴ In other words, what can specific cultural media (Niblett uses the example of Gothic narratives) tell us about the flow of energy during the transition between regimes (for example, from coal to oil)? Following Niblett’s lead regarding this link between material inputs and symbolic forms, I ask: What happens if we map the emergence of global memory cultures alongside the transition to nuclear energy? And, consequently, how does memory media register not only cultural anxieties about repeating the past but also the “energy invisibilities” that accompany the emergence of nuclearity as a “green alternative” to fossil fuels?⁵

I begin by tracing the entwined histories of memory studies and energy humanities and identify the vital role discourses of rupture have played in both the preservation of memory and conceptions of nuclearity. I follow this brief historicization by tracking the ways in which the energy unconscious works across different cultural mediums tasked with doing memory work, beginning with the example of the modern museum. Drawing on the concept of resource aesthetics, I argue that the atomic unconscious, closely associated with the history of photography, registers a new regime of dispossession in the uneven landscapes of postcolonial capitalism in which commemoration becomes not only an aesthetic practice but also a cultural resource. Finally, I assert that the materialities at work in nuclear photography — including its status as a physical object that circulates within and through various cultural institutions; its manifestation as the effect of light on a chemically specific surface; and its subjection to environmental impacts that result in fading, tearing, annotating, archiving, destruction — register contradictions between the brute materiality of nuclear inputs and cultural representations of nuclearity in the form of an atomic unconscious whose relationship to memory differs significantly from the carbon unconscious. I conclude by claiming that memory can serve as a critical methodology for the energy humanities.

Discourses of Rupture

As emergent disciplines of the atomic age, memory studies and energy humanities share a common genealogy: both arise from a series of ruptures — technological, historical, moral — accompanying the postwar condition. While the origin of global memory culture is varied, and contested, American historian Jay Winter argues that it proliferated after World War II due to shifting social and economic conditions that increased both leisure time and disposable income.⁶ Despite this socioeconomic basis, memory studies often uses the atrocities of the Holocaust as a touchstone, a tendency that has been harshly criticized by Kerwin Lee Klein, who sees the memorial turn in historical discourse as a form of cultural re-enchantment deriving from the intersection of the therapeutic and the avant-garde.⁷ As a result of this re-enchantment, memory is falsely lauded as a site of emancipation. Memory scholar Andreas Huyssen

proffers a similar critique. In addition to the criticism of Holocaust as touchstone, he claims that the conception of “history as trauma” that permeates memory studies does very little to elucidate the political and material dimensions of cultural memory.⁸ The effect is to reduce memory to yet another version of identity politics.⁹ Indeed, affirming memory as the organizing principle of twentieth-century historical study *par excellence*, Winter asserts that “the hyphen of identity is strengthened by commemoration.”¹⁰ However, the main difference between memory and other expressions of identity is that memory movements pose a temporal disruption rather than a simple re-signification. This concept of temporal rupture is central to literary theories of trauma and memory, which locate emancipatory potential in repressed counter-narratives that speak back to and against dominant historical narratives.¹¹ Here, traumatic memory signifies a disruption of the proper ordering of experience. Representations of historical trauma stand in for an original encounter, analogically signifying the return of the repressed, where repressed memory disrupts official historical narrative.¹² Postcolonial scholars, however, have criticized this version of trauma theory for its colonial constitution: “following feminist psychologist Laura Brown, they argue that the ‘event’ or ‘accident’-based model of trauma associated with [Cathy] Caruth assumes the circumstances of white, Western privilege and distracts from ‘insidious’ forms of trauma that involve everyday, repeated forms of traumatizing violence, such as sexism, racism and colonialism.”¹³ Put differently, Western trauma theory fails to address the slow violence of colonial logics, which include forms of sexual and racial exploitation.¹⁴

In nuclear discourse, the emancipatory potential of rupture is tied to postwar instantiations of the twin movements of human rights and decolonization. This relationship is best represented in the work of Gabrielle Hecht, who states: “In the beginning, there was The Bomb. It ended The War. Splitting the atom ruptured human history.”¹⁵ Connecting scientific discovery and morality (albeit very differently than Obama), she explains that the historical rupture taking place around the time of detonation was not only scientific but moral as well; alongside the power of nuclear technology, the Universal Declaration of Human Rights, in line with movements of decolonization, promised to emancipate those populations exploited under colonial rule.¹⁶ Mediated by discourses of historical rupture, however, decolonization did not lead to emancipation; rather, colonial power was simply reoriented along the lines of the nuclear (colonizer) and the non-nuclear (colonized).¹⁷ In a separate article, Hecht departs from the usual polarizing categories of nuclear scholarship to examine the ways in which the intertwining “rupture-talks” of nuclearity and decolonization play out in the lives of uranium miners in colonial Africa.¹⁸ By making the miners and not technoscientific innovation the focus, she exposes the “power effects” of nuclear ontologies. By mapping the reorientation of French colonial power onto the revolutionary imaginary of nuclear technology, she argues that discourses of rupture had material effects: “Nuclear and postcolonial rupture-talk combined in shaping

sociotechnical practices, but what mattered most to [the uranium miners] was how these practices conjugated colonial power relations into real and imagined futures.”¹⁹ What becomes evident in Hecht’s work on nuclear ontologies is the ways in which the discourses of moral and historical rupture that underwrite contemporary forms of commemoration eclipse the slow violence structuring the everyday labor of the uranium miner.

Elsewhere I have argued that memory is implicated in the forms of exploitation that accompany the new global enclosures; and that the dispossession of knowledge reinforces material dispossessions. Sites of memory, in other words, are also sites of enclosure, operating according to a logic that conceals cycles of accumulation and dispossession through the preservation of the material remains of previous stages of accumulation. In this way, enclosures of knowledge fortify the outward thrust of capitalist expansion. This relationship is exemplified in popular interpretations of the Harper government’s actions toward knowledge-producing institutions, such as the closure of seven of nine Fisheries and Oceans Libraries whose destruction has been referred to in popular media as both “libracide” and a “knowledge massacre.” These practices emerge alongside a cultural paradigm I have named the preservationist aesthetic, which frames the new global enclosures in moral terms as sites of historical and cultural preservation and emphasizes memory’s property form in the post-crisis cultures of late capitalism. It also places the drive for preservation in the form of collective memory at the heart of *both* new forms of enclosure *and* new practices of resistance. Mediated by this ideology, social, political, and economic exploitation are reframed as aesthetic problems in terms of loss, erasure, and ruin. Hence, alongside the proliferation of memory culture we see the corresponding proliferation of aesthetic trends such as ruin porn. In general, the preservationist aesthetic has a dual function: on one hand, it recovers and preserves those aspects of common history under the name of heritage that are threatened with erasure by the innovations of capitalist production, including nuclear technology; on the other hand, it produces new spheres of enclosure by colonizing those spheres previously excluded from the production process, transforming them into aesthetic experiences. In short, the preservationist aesthetic is an ideological mechanism for translating material exploitations into symbolic terms (that is, forms of extraction into forms of cultural representation). As a result, we are faced with a paradox: in defending against the threat of erasure, of “obsolescence and disappearance” that characterizes late capitalism, preservationist aesthetics contribute to the creation of new spheres of colonization and enclosure.²⁰ In this way, the forms of representation specific to this aesthetic regime facilitate neocolonial sensibilities by mediating capital’s social and material resources. Thus, despite the mandate to educate, the function of memory museums and similar memory media is to conciliate and disarm while at the same time commodifying and incorporating the social and material remains of previous stages of accumulation.²¹

Memory media, however, are not only sites of primitive accumulation but also resource aesthetics across which different materialities are at work. Outlined by Brent Ryan Bellamy, Michael O'Driscoll, and Mark Simpson in the introduction to a special issue of *Postmodern Culture*, the concept of resource aesthetics provides a framework for linking modes of exploitation (like uranium extraction) with modes of representation (Hecht's concept of rupture-talk, for example).²² Beginning with the "amnesiac history" of Fort McMurray as a storage site for radioactive waste, Bellamy et al. define the resource aesthetic as a site of contradiction between the figural and the material that requires a dialectical understanding of the relation between "the aesthetics of resources" and "the aesthetic as resource." Elaborating this constitution, Imre Szeman identifies the dual aspect of resources, their simultaneous materiality and unrepresentability, stating: "Resources are material in ways that, in part, evade aesthetics, evade representation. There's a double movement in thinking about aesthetics and resources that I want to keep alive: one in which we recognize their sheer necessity and blunt reality, and another in which we try to bring them into representation."²³ In these terms, the "blunt reality" of uranium extraction doesn't show up in popular discourses of nuclearity, which feature The Bomb or forgotten heroes like the nuclear operator. Hecht, among others, has even suggested that knowledge of the relationship between uranium extraction and nuclearity has, in fact, been withheld from uranium miners.²⁴ Resource aesthetics facilitate this dispossession of knowledge in support of accumulation practices like uranium extraction.

The Slow Violence of Nuclear Memory

Mediating contradictions between cultural narratives of atrocity (or accident-based trauma) and the slow violence of exploitation, memory media are therefore part of an apparatus of erasure that participates in material forms of dispossession. The modern museum is a prime example. While museums have long played an important role in the production of cultural value, contemporary museums take an active role in this process in the context of late capitalism, as Rosalind Krauss has shown.²⁵ According to Wolfgang Ernst, museums are "memory-producing machines" that, unlike their historical predecessor, are "transformers" rather than mere "receptacles."²⁶ No longer mere spaces for the sedimentation of historical memory, they are vehicles through which collective memory as a cultural resource is both produced and transmitted.²⁷ As cultural transformers, they are exemplars of a new mode of enclosure that converts the material remains of previous stages of accumulation into aesthetic objects under the auspices of cultural preservation. Take the United States Holocaust Memorial Museum, for example. As the inaugural memory museum, it not only helps to elucidate the conversion of mundane everyday objects into shrines of dispossession, it also serves as a microcosm of the new experience-based economy in which memory becomes a cultural resource. According to Alison Landsberg, one of the most striking

exhibits in this museum, which spans three floors and incorporates both historical artifacts and personal possessions, is the room on the second floor filled with “survivor shoes.”²⁸ Drawing on Fredric Jameson’s comparative analysis of Van Gogh’s peasant shoes and Warhol’s *Diamond Dust Shoes*, where the latter “embod[ies] the logic of the commodity” and the former retains a sense of “lived individuality,” each shoe “bears a trace of the absent body” and in doing so recreates a “whole missing object world.”²⁹ These “survivor objects,” in which religious and commodity fetishes seem to merge, resist the alienating logic of the commodity while contributing to a fantasy of immediacy in which the mediating object is rendered invisible.

Despite the resistance to erasure that underwrites memory’s preservation, the preservationist aesthetic nevertheless participates in the slow violence of nuclearity by reinforcing a series of elisions, beginning with the elision of Hiroshima as the origin of global memory culture.³⁰ Further elisions include: Hiroshima’s overshadowing of the long-term nuclear testing on the Marshall Islands, which saw sixty-seven tests over a period of twelve years (and whose explosive power and radioactive fallout far surpassed that of Hiroshima); the banalization of petro-crises, such as oil spills, against the atrocities of nuclear meltdown; an emphasis on atrocities (spills and meltdowns) that fail to acknowledge the everyday forms of exploitation that support these wide-scale atrocities. In the nuclear museum, these elisions take the shape of nuclear exceptionalism, which Hecht defines as “a technopolitical claim — emerging immediately after the end of World War II — that there was something radically unique about nuclear things. From 1945 onward, both cold warriors and their activist opponents cultivated this nuclear exceptionalism. Atomic weapons were portrayed as fundamentally different from any other human creation.”³¹ In “Nuclear Ontologies,” Hecht elucidates the stakes of such exceptionalism in the following way: “Asserting the ontological distinctiveness of ‘the nuclear’ carri[e]s political, cultural, and economic stakes amplified by morality-talk, which tend[s] to boil down to a simple duality: nuclear technology represent[s] either salvation or depravity.”³² The response to the radical uniqueness of the destructive capacity of atomic weapons is, of course, the radical uniqueness of the potential salvation offered by forms of nuclear energy. However, the other side of this exceptionalism, as she points out, is the rendering banal of nuclear power, where nuclear power is represented “not as a life-saving technology for the human race, but as simply another way to boil water. Radiation [is] just another industrial risk. Such representations seek to banalize nuclear things.”³³ Along with the sensational discourses of nuclear atrocity, the banalization of nuclear power serves to elide the slow violence of such energy regimes, in addition to the reality that other similar energy regimes (such as coal and oil) perform similar routine elisions through the polarization of the mundane and the spectacular.³⁴ Put differently, in the production of nuclear memory, the slow violence of global energy regimes (which includes both climate change and the new global enclosures) is eclipsed by the spectacle of nuclear atrocity and re-presented

as the preservation of nuclear memory.

The preservation of nuclear memory then is not a question of morality but a problem of representation. Linking the erasure of memory to processes of slow violence, Rob Nixon writes: “In the long arc between the emergence of slow violence and its delayed effects, both the causes and the memory of catastrophe readily fade from view as the causalities incurred typically pass untallied and unremembered.”³⁵ Slow violence — “a violence that occurs gradually and out of sight” as opposed to a violence that is “immediate in time” and “explosive and spectacular in space... erupting into instant sensational visibility” — is also, then, a form of forgetting.³⁶ For Nixon, the question becomes one of how to represent this slow violence of the everyday that is effaced by the spectacular violence of atrocity. Accordingly, he asks: “In an age when the media venerate the spectacular, when public policy is shaped primarily around perceived immediate need, a central question is strategic and representational: how can we convert into image and narrative the disasters that are slow moving and long in the making, disasters that are anonymous and that star nobody, disasters that are attritional and of indifferent interest to the sensation-driven technologies of our image-world?”³⁷ In other words, how can we represent the everyday forms of violence that fail to register as violence without reducing them to spectacle? In the context of nuclear memory, the question becomes: how can we represent the everyday violence of nuclearity characterized by uranium extraction and related forms of exploitation without reducing them to the spectacular violence of Hiroshima?

The answer lies (at least in part) in Patricia Yaeger’s concept of the energy unconscious, to which the concept of narrative erasure is central. Drawing on Jameson’s notion of the political unconscious, Yaeger defines the energy unconscious as not only a “cultural code or reality effect” but also a “field of force” whose causality lies elsewhere and shows up as an “energy invisibilit[y]” that constitutes a “particular kind of erasure.”³⁸ Building on Yaeger’s definition, Brent Ryan Bellamy describes it as a “structuring presence” that lies “outside the narrative” of energy; in Vivasvan Soni’s words, an “unsignifying opacity,” which Szeman describes further as an “incapacity to name the social, political and cultural significance of energy.”³⁹ As sites of accumulation, memory media are also registers of the energy unconscious, which take different forms in different media tasked with the work of remembering. Literary critic Stephanie LeMenager, for example, describes the energy unconscious of oil literature as a form of “embodied memory and habitus for modern humans, insofar as everyday events such as driving or feeling the summer heat of asphalt on the soles of one’s feet are incorporating practices, in Paul Connerton’s term for the repeated performances that become encoded in the body.”⁴⁰ Following Marshall McLuhan’s description of “infrastructure as media,” she argues further that infrastructure as embodied memory is also “a meeting point of ecology and history.”⁴¹ Bob Johnson makes a similar claim regarding petroculture’s embodied memory in his work on the role of fossil fuels in the production of American culture, arguing that forms of cultural

production featuring carbon derivatives not only structure both an experience and understanding of the world, but also the ways in which the suppression of carbon dependency drives its reappearance as embodied memory.⁴² In LeMenager's and Johnson's treatments, embodied memory signifies the return of a repressed energy infrastructure.

A Methodology of Exposure

The materialities at work in nuclear photography which register contradictions between the brute inputs of nuclear fallout and cultural representations of nuclearity — highlighted, for example, by the “atomic shadows” left by exposure to nuclear fallout — constitute an energy unconscious that looks quite different from that of carbon. The atomic unconscious that emerges in nuclear photography is less structural and more iconic, less embodied and more diffuse, relating to questions of visibility, invisibility, and exposure rather than habitus or embodiment.⁴³ Barbara Marcon, for example, talks about “atomic shadows” as a form of testimony; Ned O’Gorman and Kevin Hamilton refer to Atomic Age aesthetics as a “performance of collective memory” in which the forgotten origins of nuclear hegemony are buried within a cultural icon; and Lippit refers to the x-ray as “a kind of living remnant, a phantom subject” that “retains the dimension and shape of its object while rendering its inside.”⁴⁴ What each of these characterizations has in common is the “problem of exposure,” which elin o’Hara slavik argues is central to both photography and the history of the atomic age.⁴⁵ Nicole Shukin affirms this historical interdependency, stating that “in both their means and their ends photography and nuclear science share a history as well as material resources and techniques, particularly ‘exposure’ of bodies to light, either in the form of visible or invisible rays.”⁴⁶ Accordingly, as Thomas Pringle suggests, this allows photography to serve as a material index or “early variety of Geiger counter” that “repurpose[es] aesthetics into a functional diagnostic tool for *the general barometry of light*.”⁴⁷ slavik, and other theorist-practitioners of nuclear photography, utilize this methodology of exposure to “make visible the unseen, to reveal what is denied and hidden.”⁴⁸

What, exactly, does this methodology, which is so intimately connected to discourses of rupture, promise to reveal? In trauma theory, it promises, of course, to reveal repressed memories, which contribute to the broader cultural movement toward the re-valuing of forgotten histories. In the context of nuclearity, however, it promises to reveal the persistent materiality of nuclear exposure. Following the dialectic of the resource aesthetic, it takes two related forms: one material, the other figural. In the former constitution, the methodology of exposure reveals the material exposure of the photograph to the invisible rays of nuclear energy. In the latter, it emerges in conjunction with discourses of testimony and witnessing that render nuclear photographs, in Yaelle S. Amir’s words, “material witness[es] to the effects of nuclear energy.”⁴⁹ In her curatorial statement, Amir describes the material persistence

of nuclear traces in the following way: “The exhibition *Reactive Matters* explores the ways in which nuclear energy permeates our surroundings — its presence lingers in the soil we tread, the water we consume, and the roads we often travel.” While this statement sounds similar to LeMenager’s description of oil infrastructure as embodied memory, there is a clear distinction between the constitution of the carbon unconscious and that of the atomic. Instead of registering as a performance encoded in the body, atomic infrastructure registers as alienated memory through which the remains of nuclear disaster are animated as material witnesses. Fetishized, these material witnesses perform a double elision: first, they stand in as substitutes for the living witness, the *hibakusha*; second, as substitutes for the social relations of spectacular violence, they elide the social relations of slow violence underwrite the spectacle of atrocity.

This brief account of the relationship between nuclear memory and postcolonial capital demonstrates that memory is not just an object of analysis; it is also a methodology of exposure that promises to reveal the materiality of the energy unconscious at work within and across memory media. In elaborating its usefulness as a critical methodology for the energy humanities, I have demonstrated at least three things: (1) by placing the entwined histories of memory and energy alongside one another, with particular attention to the nuclear, I have demonstrated how each corresponds to colonial discourses of rupture; (2) by framing memory media (such as nuclear photography) as resource aesthetics, I have posited memory as both an aesthetic practice and a cultural resource that is embedded within cycles of accumulation, as well as a form of materiality and a mode of figuration where the former is eclipsed by the latter; and, finally, (3) by positing memory as a site of dispossession, I have suggested that the analysis of various memory media might help to track different expressions of the energy unconscious, which registers, in the case of the atomic unconscious, not only the energy invisibilities that accompany the transition to nuclearity but also the forgotten materiality of nuclear memory itself. Without such a materialist perspective, we are left with the false radiance of a moral revolution whose advocates sit on the winning side of nuclear history and whose discourses serve the interests of postcolonial capital.

Notes

1. The full transcript of Obama's tribute speech was reprinted by *The New York Times* the day of the commemoration. "Text of President Obama's Speech in Hiroshima, Japan," *The New York Times*, March 28, 2016, <http://www.nytimes.com/2016/05/28/world/asia/text-of-president-obamas-speech-in-hiroshima-japan.html>
2. Patricia Yaeger, "Editor's Column: Literature in the Ages of Wood, Tallow, Coal, Whale Oil, Gasoline, Atomic Power, and Other Energy Sources," *PMLA* 126.2 (2011) 305–326.
3. For a broader discussion of postcolonial capitalism and its relation to labor and knowledge, see Sandro Mezzadra's "How Many Histories of Labour? Towards a Theory of Postcolonial Capitalism," *Transversal: Unsettling Knowledges*, European Institute for Progressive Cultural Policies, 2012, <http://eipcp.net/transversal/0112/mezzadra/en>.
4. Michael Niblett, *Fueling Culture: 101 Words for Energy and Environment* (New York, NY: Fordham UP, 2017) 138.
5. The concept of "energy invisibilities" belongs to Patricia Yaeger. I am using it in relation to the atomic unconscious to suggest that the atomic unconscious is comprised of energy invisibilities that accompany the transition to nuclearity.
6. Jay Winter, "The Memory Boom in Contemporary Historical Studies," *Raritan* 21.1 (2001) 52–66.
7. Kerwin Lee Klein, "On the Emergence of *Memory* in Historical Discourse," *Representations* 69 (2000) 136.
8. Andreas Huyssen, *Present Pasts: Urban Palimpsests and the Politics of Memory* (Stanford UP, 2003)
9. Memory scholars such as Shoshana Felman discuss the relationship between Freud's work on trauma and the idea of "history as trauma" discussed by Huyssen. In her remarks on Cathy Caruth's analysis, Felman suggests that Freud was responsible for the transformation of all history into trauma: "In an exemplary analysis of Freud's as yet uncharted legacy of trauma in his last work *Moses and Monotheism*, Caruth remarkably, paradigmatically, shows how the book itself — Freud's testament on *history as trauma* — is the site of an inscription of a historical trauma: that of Freud's dramatic departure from Vienna, then invaded and annexed by Hitler's Germany." Shoshana Felman and Dori Laub, *Testimony: Crisis of Witnessing in Literature, Psychoanalysis, and History* (New York, NY: Routledge, 1992) 174. Indeed, though Caruth doesn't pen this phrase exactly (history as trauma), in her reading of Freud she asks: "What does it mean, precisely, for history to be the history of a trauma?" (15). Her answer to this question is: "For history to be a history of trauma means that it is referential precisely to the extent that it is not fully perceived as it occurs; or to put it somewhat differently, that a history can be grasped only in the very inaccessibility of its occurrence" (18). She concludes with the claim that "history, like trauma, is never simply one's own, that history is precisely the way we are implicated in each other's traumas" (24). History, in Caruth's analysis undergoes an essential transformation; the history of trauma in particular is transformed into history as trauma in general. Cathy Caruth, *Unclaimed Experience: Trauma, Narrative and History* (Baltimore: John's Hopkins P, 1996).
9. Both Winter and Huyssen have argued this perspective. Winter, in particular, claims that "[t]he creation and dissemination of narratives about the past arise out of and express identity politics" (Winter, "The Memory Boom" 54).

10. Jay Winter, *Remembering War: The Great War Between Memory and History in the Twentieth Century* (Yale UP, 2006) 36.
11. In *Unclaimed Experience*, Cathy Caruth emphasizes the logic of rupture not only in her references to trauma's belated representation but also to its appearance as a "break in the mind's experience of time" (61). Transferring the language of psychic experience (in which the symptom is inscribed on the body as text) to narrative representation, Caruth argues that the trauma text is "the story of a wound that cries out, that addresses us in the attempt to tell us of a reality or truth that is not otherwise available," a wound that "is experienced too soon, too unexpectedly, to be fully known" (4).
12. The problem with such a model is not only that it relies on the analogical importation of an individual model of psychic trauma into the order of cultural representation, but also that it is based on a fundamental assumption that history proceeds chronologically. Walter Benjamin and Guy Debord, as well as a number of contemporary theorists of primitive accumulation, including Tony C. Brown and Massimiliano Tomba, are critical of this abstract, linear historical time for its complicity with not only the accumulation of capital but, in Debord's words, "the victory of the bourgeoisie." Guy Debord, *Society of the Spectacle*, trans. Ken Knabb (New York: Zone Books, 2006) 51. See also Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," *Illuminations*, ed. Hannah Arendt, trans. Harry Zohn (New York: Schocken Books, 1968) 217-252; Tony C. Brown's "The Time of Globalization: Rethinking Primitive Accumulation," *Rethinking Marxism* 21.4 (2009) 571-584; and Massimiliano Tomba, "Historical Temporalities of Capitalism: An Anti-Historicist Perspective," *Historical Materialism* 17 (2009) 44-65.
13. Michael Rothberg, *Multidirectional Memory: Remembering the Holocaust in the Age of Decolonization* (Stanford UP, 2009) 89.
14. This postcolonial critique of trauma theory is echoed by Slavoj Žižek's materialist critique of trauma. Following Catherine Malabou in her elaboration of a "material unconscious," Žižek argues that the Freudian model of trauma is Western-centric and cannot account for experiences of trauma that do not take the form of a sudden, unexpected event (such as chronic civil war). Departing from Malabou, however, he maintains that even her critique focuses to specifically on content rather than form. Traumatic shock, he suggests, should not be understood as a repetition of substance, but of the very act of erasure. Such a position is useful in articulating the atomic unconscious. In this model, the methodology of exposure would reveal not the erased content, but this very act of erasure. Slavoj Žižek, "Descartes and the Post-Traumatic Subject," *Filozofski vesting* 29.2 (2008) 9-29.
15. Gabrielle Hecht, "Nuclear 2," *Fueling Culture: 101 Words for Energy and Environment*, eds. Imre Szeman, Jennifer Wenzel, and Patricia Yaeger (New York: Fordham UP, 2017) 246.
16. Gabrielle Hecht, "Nuclear Ontologies." *Constellations* 13:3 (2006) 322.
17. Hecht, "Nuclear Ontologies" 323.
18. Gabrielle Hecht, "Rupture-Talk in the Nuclear Age: Conjugating Colonial Power in Africa," *Social Studies of Science* 32.5-6 (2002) 691-727
19. Hecht, "Rupture-Talk" 720.
20. Andreas Huyssen, "Present Pasts: Media, Politics, Amnesia," *Public Culture* 12.1 (2000) 33.
21. The modern prison system is one such example of the incorporation of the remains of previous stages of accumulation. With the abolition of slavery, which Marx argues is one of the five forms of

extra-economic violence (alongside conquest, robbery, murder, and land enclosure) through which the processes of primitive accumulation take place, former slaves that could not be incorporated into the wage-labor system compose a large percentage of the prison population. See Karl Marx, *Capital Vol. I*, trans. Ben Fowkes (New York: Penguin, 1990 [1867]), and Angela Davis's *Are Prisons Obsolete?* (New York: Seven Stories P, 2003). We see a variation of this situation in the closure of former political prisons, such as Robben Island, that have been transformed into museums — the former inmates are often reincorporated as tour guides.

22. Brent Ryan Bellamy, Michael O'Driscoll, and Mark Simpson, "Introduction: Toward a Theory of Resource Aesthetics," *Postmodern Culture* 26:2 (2016).
23. Imre Szeman, "When Energy is the Focus: Methodology, Politics, and Pedagogy — A Conversation with Brent Ryan Bellamy, Stephanie LeMenager, and Imre Szeman," *Postmodern Culture* 26.2 (2016).
24. In the Canadian context, Peter C. Van Wyck claims that the Sahtu Dene of Great Bear Lake, who mined uranium used in the development of the bombs detonated in Japan, suffered a similar eclipse of knowledge. Tracing the trade routes of fissionable uranium in Britain, Canada, and the United States, he states: "Until the bombs were dropped on Hiroshima and Nagasaki in August 1945, virtually all of this was carried out in secret. Workers at the mine site were apparently unaware of the purpose of the ore, or at least this is the claim one finds most frequently." "The Highway of the Atom: Recollections Along a Route," *Topia* 7 (2002) 100n2.
25. Rosalind Krauss, "The Cultural Logic of the Late Capitalist Museum," *October* 54 (1990) 11.
26. Wolfgang Ernst, cited by Susan A. Crane, ed. *Museums and Memory* (Stanford UP, 2000) 27.
27. Walter Benjamin and Rosalind Krauss both anticipated this emerging role of the museum as processor by situating it in the context of the capitalist mode of production, elucidating transitions in the functions of the art object under its industrial mode and the exhibition within its later logic respectively. In "The Work of Art in the Age of Mechanical Reproduction," Benjamin illustrates the ways in which technologies of mass reproduction transformed the work of art from religious to commodity fetish (replacing the divine with the social relations of production), which results in the tipping of the scales in favor of exhibition rather than cult value. And, in "The Cultural Logic of the Late Capitalist Museum," Rosalind Krauss elucidates a similar transformation of the exhibition itself during capital's later stages. Accordingly, Krauss demonstrates the ways in which the synchronic or encyclopedic museum, under the influence of minimalism, "would forego history in the name of a kind of intensity of experience" (9). In short, it would become "a space from which the collection has withdrawn" (4). This new cult of experience represents the generalization of exhibition value, or the exhibitionist properties of the modern museum extended to their logical conclusion. Thus, while the space of exhibition was from the outset a space for working through social and political tensions (a role already evident in the seventeenth-century French salon), its institutionalization within the context of contemporary capital points to the specific role it would come to play in the processing of social and political life, particularly in terms of aesthetic experience.
28. Alison Landsberg, "America, the Holocaust, and the Mass Culture of Memory: Toward a Radical Politics of Empathy," *New German Critique* 71 (1997) 79.
29. Landsberg, "America, the Holocaust, and the Mass Culture of Memory" 79–80.
30. In his historical revision, Ran Zwigenberg places Hiroshima at the center of global memory

- culture. Arguing that the role of the Holocaust was, from the outset, intertwined with Hiroshima, he demonstrates how Hiroshima not only served as a reference point for the factors leading to the Holocaust but also provided the moniker “holocaust” which originally signified “nuclear anxieties”; *Hiroshima: The Origins of Global Memory Culture* (Cambridge: Cambridge UP, 2014) 12–13.
31. Maximillian Mayer, “Nuclear Ontologies, Technopolitics in Postcolonial Spaces, and the Cold War as Transnational History: An interview with Gabrielle Hecht,” *The Global Politics of Science and Technology — Vol. 1: Concepts from International Relations and Other Disciplines* (Berlin: Springer, 2014) 277.
 32. Mayer, “Nuclear Ontologies” 321.
 33. “Nuclear Ontologies” 278.
 34. Ned O’Gorman and Kevin Hamilton, “The Diffusion of an Atomic Icon: Nuclear Hegemony and Cultural Memory Loss,” *Rhetoric, Remembrance, and Visual Form* (New York: Taylor and Francis, 2012).
 35. O’Gorman and Hamilton, “The Diffusion of an Atomic Icon” 8–9.
 36. Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard UP, 2011) 2.
 37. Nixon, *Slow Violence* 3.
 38. Yaeger 309.
 39. Brent Ryan Bellamy, “Into Eternity: On Our Waste Containments and Energy Futures,” *Paradoxa* 26 (2014) 145–158; Vivasvan Soni, “Energy,” *Fueling Culture: 101 Words for Energy and Environment* 133; Imre Szeman, “On Oil and Philosophy,” *Contours Journal* (2015), 36–40n.
 40. Stephanie LeMenager, *Living Oil* (Oxford UP, 2013) 104.
 41. LeMenager, *Living Oil* 27, 193.
 42. Bob Johnson, *Carbon Nation* (Lawrence: UP of Kansas, 2014).
 43. Despite my claims, the clear alignment of literature with the carbon unconscious and photography with the atomic unconscious is necessarily overdetermined. Their polarization is not so clear. Demonstrating the role of photography in the production of a carbon unconscious, LeMenager suggests that Dick Smith’s images of dead shore birds after oil spills recall “photography as itself memory practice — a means of taking something into the self, repurposing it for the self, giving it a story and place” (38). Foregrounding the role of literature in the production of an atomic unconscious, science fiction writers such as H.G. Wells, who included descriptions of nuclear explosions, were read by Leo Szilard long before he began working with Oppenheimer and anticipated the invention of the atomic bomb. Nevertheless, in our present moment the embodied memory of the carbon unconscious is more deeply aligned with a literary consciousness and the atomic with the photographic. For further discussion on the development of a photographic consciousness, see my article “Memory, Trauma, and the Matter of Historical Violence: The Controversial Case of Four Photographs from Auschwitz,” *American Imago* 71.4 (2014) 391–415.
 44. Barbara Macron, “Hiroshima and Nagasaki in the Eye of the Camera: Images and Memory,” *Third Text* 25.6 (2011) 792–793; “The Diffusion of an Atomic Icon” 189–190; Akira Mizuta Lippit, “Phenomenologies of the Surface,” *Qui Parle* 9:2 (1996) 39.
 45. elin o’Hara slavick, “Hiroshima: A Visual Record,” *The Asia-Pacific Journal* 7:30 (2009) <http://apjif.org/-elin-o’Hara-slavick/3196/article.html>
 46. Nicole Shukin, “The Biocapital of Living — and Art of Dying — After Fukushima,” *Postmodern*

Culture 26.2 (2016).

47. Thomas Pringle, "Photographed by the Earth: War and Media in Light of Nuclear Events," *Necus: European Journal of Media Studies* (2014) <http://www.necus-ejms.org/photographed-earth-war-media-light-nuclear-events/>.
48. slavick, "Hiroshima" 310.
49. Yaelle S. Amir, "Curatorial Statement," *Reactive Matters* (Newspace Center for Photography, Portland, OR, 2016).

Petrofiction and Political Economy in the Age of Late Fossil Capital

Amy Riddle

From the title to the last scenes of Helon Habila's novel *Oil on Water* (2010), oil presents itself as mood, environment, and atmosphere. As the narrator Rufus makes his way into the Niger Delta, the atmosphere is heavy with "the suspended stench of dead matter... dead birds draped over tree branches, their outstretched wings black and slick with oil," and grass "suffocated by a film of oil, each blade covered with blotches like the liver spots on a smoker's hands."¹ Oil coats the atmosphere in *Oil on Water* to the point that different things — smells, birds, grass — become expressions of the same thing. Thus by the middle of the novel, even prisoners are covered in oil as a punishment, in what the novel calls a "brutal anointing."² In the last scene of the novel, "gallons of oil floating on the water" are imagined "tight like a hangman's noose around the neck of whatever life-form lay underneath."³ By contrast, in *Cities of Salt* (1984) by Abdelrahman Munif — the novel that, in a review, inspired Amitav Ghosh to coin the term petrofiction — petroleum works behind the scenes in very significant ways, but is never physically present.⁴ Why the abundance of physical descriptions of oil in the more contemporary novel?

That the novels represent oil in such different ways is of course largely due to their differing geographical and historical situations — in particular the uneven environmental crisis created by capital's increasing need for oil. The years between 1980 and 2008 mark a period of increasing globalization where the explosion of Chinese exports and "globally mobile capital" carrying production technology to new locations, requires "massive consumption of fossil energy."⁵ *Oil on Water* was written during the end of this period of late fossil capital, also a period of emissions explosion. Yet Ghosh's famous claim that there is as yet no great oil novel is not due to what we might term a lack of environmental consciousness but rather because in Ghosh's account, the idea of oil is "inconceivable."⁶ The supra-objective qualities of oil as both fuel and plastic, earth and air, subject and system, distinguish it from earlier commodities in literature, like coffee, spices, or sugar.⁷ Which is to say that the

physical presence and absence of oil in these novels is also connected to the different forms of wealth oil stands in for and makes possible: wealth in the value form itself, as an abstraction, may not be directly representable in literature — it is after all not a measurable thing but a historically specific set of social relations — but the ways in which we see the value form as it bears on social relations in literature dealing with oil gives us a way to mediate the fictions themselves. *Cities of Salt*, written in a third-person collective narrative, makes explicit these relations around oil in its commodity form, while something very different happens in *Oil on Water*, where oil itself appears as a hostile object, a distorted form of natural wealth, or an expression of nature as such.

Cities of Salt was first published in Arabic in 1984 and then appeared in English translation in 1987. Munif, an ex-oil engineer and economist, thought of oil not in terms of environmental degradation but as a lost opportunity for the independence and development of the Arab world.⁸ In the novel, when U.S. oil companies discover that the land occupied by Bedouins of a small oasis community in a fictional kingdom of the Arabian Gulf is sitting atop a large deposit of oil, the Bedouins are forcibly removed from their land and must work for the oil company in the coastal refinery center of Harran in order to survive. The pace of the narrative is slow at the beginning of the novel, allowing characters like Miteb al-Hathal the time to ponder the “bonds” of nature, family, and community.⁹ These are the sources of wealth before the implementation of the imported social formation, sources which oil appears to replace. The people eventually understand oil as a potential source of wealth, but wealth that is only ever realized via the accumulation of its money and commodity form by the Americans, the emir, and several designing individuals. For the workers receiving a wage, oil wealth remains obscure.

Oil on Water, published in 2010, follows the scattered memories of journalist, Rufus, as he attempts to make sense of his experiences locating the wife of a British oil executive who has been kidnapped by militants claiming to fight for the restoration of the Niger Delta. The story does not revolve around those working in the formal economy as in *Cities of Salt*, but around those forced into warlike and criminal activity in the informal economy, as either militants surviving off of the kidnapping of foreign oil workers or those involved in what is known in Nigeria as “bunkering” or illicit oil theft from the oil company’s pipelines. The setting is one of an environmental apocalypse — a place where the capacities from natural wealth have been exhausted. There is a clear historical shift between the novels: in *Oil on Water*, we see a world of informal and criminalized economies, horrors of environmental destruction and capital’s increasingly acute demand for raw materials. The work of those who do participate in the formal economy of *Oil on Water*’s Niger Delta is precarious and dependent on the whims of a racialized global order where domestic workers feign stupidity and journalists must chase the stories of white foreigners to get headlines. The economic and physical landscapes are mutually expressive, littered with disastrous

social suffering and material waste. The shoddy infrastructure left by multinational companies is scattered about the landscape, depicting a much deeper crisis than we saw in *Cities of Salt*. Oil is extracted erratically and without the slightest concern for social or environmental costs. Workers are forced to survive entirely through participation in the informal economy, making inevitable the heedless extraction and ceaseless violence and leading to catastrophic spills.

While *Cities of Salt* depicts the transition from a traditional social formation to a colonial-capitalist way of life, *Oil on Water* shows us the end result of this social form. The former emphasizes wasted possibility, while the latter describes the exhaustion shared across physical and social landscapes embedded in the emergent petroeconomy. Additionally, oil impacts social relations in these two novels in very different ways. In *Cities of Salt*, the source of conflict is not oil but the foreign social formation that organizes oil wealth in a particular way. In *Oil on Water* on the other hand, material nature seems to be exhausted because of the presence of oil itself. The novel asks the reader to think ecologically: oil is nature, humans are nature, and human creation is nature. We are reminded at one point in the novel that oil is as natural as light: narrator Rufus, using the oil imagery of “refining” through “sieves,” notices that, “whenever a single ray [of light] found its way through the million leaves and branches and fell on our skin or on the dead leaves below, it looked so pure and startling, as if it had been refined through a thousand sieves.”¹⁰ But this small figurative moment, likening oil to a resource as natural as light, is never contrasted in the novel by a clear representation of how oil as wealth, in commodity form, shapes social relations.

This absent representation of oil as a commodity, in *Oil on Water*, makes the source of degradation indiscernible, as the particular ecological voice of the novel obscures the distinction between oil as wealth in the value form and oil as material or natural wealth. The narrative plays with the representation of oil paraphernalia, often depicting it as part of a natural landscape, as though “sprouting,” or, in the case of the image of crisscrossing pipelines, as “tree roots surfacing far away from the parent tree.”¹¹ Such re-naturalization of oil makes it at times appear to be an unstoppable sinister force of nature. Just how this same oil is related to the socio-ecological horror depicted in the novel is never clear because instead of appearing as wealth in the commodity form, it appears as an exaggerated, caricatured form of natural or material wealth. One version of this implication, for instance, turns the destruction of the Niger Delta into a natural cycle. That the commodity form is conflated with nature in its depiction in literature is part of its invisibility. Though oil coats nearly everything in *Oil on Water*, it is strangely invisible in its merging with everything else.

Literary Form and the Economy of Energy

How may this naturalization of oil manifest the “energy unconscious” that is part of the cultural logic of late fossil capital? Patricia Yeager insists that critics understand

the ways that “energy invisibilities may constitute different kinds of erasures.”¹² It may seem strange to argue that certain forms of petrofiction have an intensified version of “energy unconscious,” yet in *Oil on Water* and petrofiction written in neonaturalistic forms, there is a kind of erasure of social relations that makes oil illegible. Andreas Malm defines a “fossil economy” as one of “self sustaining growth predicated on the growing consumption of fossil fuels.”¹³ Fossil capital in particular is defined as both a relation and a process — “a triangular relation between capital, labor and a certain segment of extra-human nature, in which the exploitation of labor by capital is impelled by the consumption of this particular accessory,” and “an endless flow of successive valorizations of value, at every stage claiming a larger body of fossil energy to burn.”¹⁴ Commodity production, waged or forced labor, and carbon emissions are necessary elements of fossil capital. This economy appears to be driven by invisible inner forces in its self-sustainability, yet depends on what Jeff Diamanti calls the “subsumption of literally unimaginable quantities of non-human energy” entering into production, distribution, and consumption processes.¹⁵ These “invisible inner forces” cannot be understood outside of the social relations and processes that maintain them. Seeing oil as nature could mean seeing its possibility — its use in fueling something other than capital. Conflating it with a naturalized version of the commodity form renders oil and the relations and processes of fossil capital imperceptible. Thus the problem of oil’s political economy is part and parcel of the problem it poses to the literary history that takes it on. This, I am arguing, is tied to the challenges oil poses to the project of environmental representation, on one hand, and its impact on economic value on the other.

Writing from within the tradition of German value critique, Claus Peter Ortlieb isolates the irreconcilability of material wealth and wealth in the value form or what in his title he names “A Contradiction between Matter and Form.”¹⁶ Writing in response to Michael Heinrich’s insistence that capitalism knows no bounds — Heinrich’s insistence, more specifically, that the economic crisis of the 1970s was not the beginning of a terminal crisis — Ortlieb ties the finitude of human and natural resources to the limits of capitalist accumulation.¹⁷ In Ortlieb’s account, capital must increase the sheer mass of commodities produced in order just to maintain, much less increase, the total mass of surplus value. But this increase in the mass of commodities produced obeys merely the blind drive for the accumulation of surplus value on the level of the individual capitalist enterprise. In turn this generates the contradictory result in which the *global* production of the mass of surplus value must tend to decrease since the same mass will have to spread out over more and more commodities — with no hope that their value (hence surplus value) will ever be realized through their sale. A second feature of the same contradiction is that material wealth appears superfluous to capital at the same time that it is essential: for capital must also continuously produce material wealth (or “use values” in this sense) as the only possible bearer of value. Yet capital cannot take the existence of any material

limits or finitude, since the drive for the “self-valorization of value” cannot ever by its very logic reach an end point. Ortlieb’s formulation puts the *sources* of surplus value at inverse relation to the *accumulation* of surplus value: “if the destruction of material wealth serves the valorization of value, then material wealth will be destroyed.”¹⁸ This recalls Marx’s central claim about of “progress” under capitalism, namely that it is premised on “undermining the original sources of all wealth — the soil and the worker.”¹⁹ The pressure of capital to ceaselessly increase relative surplus value through technological improvements in production and the resulting fall in the value of labor power requires an ever-accelerating consumption of limited natural resources.²⁰

What I have been suggesting so far, however, is that the discrepancy between material wealth and the value form of wealth is as much a literary problem as it is a historical one. My argument so far has been that the historical modulation of these two forms of wealth takes place in sociocultural relations embedded in industrial production, which is to say in the cultural fields that negotiate environmental and economic wealth. “Petrofiction” is generally understood as a category of literature that indicates a thematic of oil in the content of the work. In light of Ortlieb’s argument concerning the crucial distinction between material wealth and wealth in the value form, and the tendency with which the two are often conflated in environmental discourse, it is fundamental to analyze the ways in which acclaimed petrofiction may or may not be making this distinction and the resulting possibilities for the representation of conscious human action. As the depiction of the effects of petrol on the environment is often an essential characteristic of contemporary petrofiction, how are these depictions linked to the representation of oil as commodity and oil as material or natural wealth?

Petrofiction: A Category Mistake?

Implicit in my treatment of “petrofiction” in the age of late fossil capital is a reconceptualization of what the modifier “petro” does to the literary history of resource aesthetics. Let us begin, however, with the critical treatment of the term “petrofiction” itself. We have heard of “petrodollars” and “petrocapitalism,” with “petro” generally specifying and defining the second term. But “petrofiction” is a combination of a material thing (petrol) and a social object (fiction), and the “petro” part of the word does not define or specify “fiction.” Instead the term “petrofiction” seems to indicate that a thematic of petrol, drawn from the content of the work, is awkwardly projected as the form of the literature, which has lead to certain problems of interpretation. Peter Theroux, translator of Abdelrahman Munif’s novel *Cities of Salt* — the novel that inspired Amitav Ghosh to coin the term petrofiction — says he felt that “*Cities of Salt* was no more about oil than the *Godfather* was about olive oil.” He says he felt “let down” by readings that emphasize oil as opposed to the story itself.²¹ Theroux’s statement indicates the need for critics to distinguish between petrofiction

as literary theme and literary genre, in order to better understand how oil is used in the narrative. Interpretations of petrofiction as *theme*, that is, in analyzing how oil is depicted in the content of the story, could discern character and setting relations in the work *proximate* to oil. Interpretations of petrofiction as formal *genre* or *mode* are more complicit with drawing oil from the content of the story into the organizing form of the novel, which problematically makes the narrative appear resource determined, and thereby obscures the depiction of socionatural relations.

This naturalistic form is not uncommon in works often labeled as “petrofiction,” as I have shown here in the case of *Oil on Water*. Though Upton Sinclair’s work came well before the idea of “petrofiction,” one might label it an early example of “resource determination” due to its awkward personification of oil capital at the end of the 1927 novel *Oil!* The novel ends with the “black and cruel” demon that must be “chained.”²² Oil in the novel serves as the object of the author’s moral and political agenda of denouncing bourgeois rapacity and greed, which ultimately reverts to bourgeois apologetics. The bourgeoisie’s unchecked immoral behavior is where the narrative locates much of the evil of capital, and the material excesses that oil brings exacerbate this behavior. I locate a more contemporary example of “resource determination” in the practice exhibited in Patrick Chamoiseau’s *Texaco* (1992) of dividing the novel’s timeline, as if it were a sequence of various forms of purely material substances, with the title of the novel itself leaving us squarely, if ironically, under the aegis of oil capital. Chamoiseau’s redefinition of the slum as “urban mangrove,” where the soil appears “strangely free, definitively free,” is already problematic because the novel presents it from the very beginning as separate from and awkwardly immune to social processes.²³ This distancing makes it difficult for the narrative to analyze the relations that lead to socio-ecological destruction, as class consciousness appears to be replaced by ecological consciousness in the novel. Utopian moments depicting slums as nature, assume that the symbolic resistance or infrapolitics of planting roots in polluted soil, noxious with oil fumes, can flower without significant, and not merely symbolic, socio-ecological interventions. Thus in one petrofiction we see oil’s toxicity exerted as a contradiction in the commodity form it materializes — it has turned the very soil from which it came into a hazard — which already runs counter to the “natural” state of the commodity, which is paradoxically to appear without the friction of ecological or social toxicity.

The commodity form in its economic and social manifestation presents itself as natural, in a semblance of objectivity in the commodity. In *History and Class Consciousness* Georg Lukács writes that under capitalism “[e]conomic reality has the appearance of a world governed by the eternal laws of nature, laws to which [one] has to adjust [one’s] activities.”²⁴ Petrofiction in particular may be prone to interpretations of socioeconomic reality as nature (that is, ahistorically determined and not in relation to social processes) because when petrol as commodity is confused with petrol as material, the narrative weighs down in description of the material

and natural world. When looking at petrofiction then, it is necessary to note the ways in which social relations may be stifled by the object in reified narrative form, effectively confusing certain social forms as natural (that is, determined by nature itself). In petrofiction that aims to depict the ecological effects of oil specifically, capitalism can project itself as an ecological force. Jason W. Moore convincingly argues in his work on what, borrowing from Andreas Malm, he calls “the Capitalocene” that capitalism is indeed a force of nature, as social and ecological processes are not separate but moving dialectically, in as he terms it, the “double internality.”²⁵ But this dialectical movement can only be depicted in literature if character and environmental *relations* are established between subjects and objects. When the commodity form is represented as Nature, the social relations that the commodity form acts on disappear. The literary result is much like naturalism, as defined by Lukács, where characters have no connection with the objects described, making the subjects no different than mere objects. I will return to this topic with more detail at the conclusion of this paper. But first, a closer look at *Oil on Water* and *Cities of Salt* as examples of two very different “ecocentric” forms of the novel and the resulting depictions of oil as differing forms of wealth.

***Oil on Water* and Voices without Quotation Marks**

What stands out about the novel *Oil on Water* is its attempt at producing an ecological voice, the goal of which seems to be the decentering of human narration in order to give more weight to the ecological object. In her review of the novel, Jennifer Wenzel observes that “the land and water seem to speak directly in their own voice without quotation marks.”²⁶ Tree branches, roots, seaweed, and the flight formations of birds resemble language, letters, or communication. Descriptions intertwine human and nonhuman nature showing their inclusiveness — the boatman is “as unobtrusive, as natural, as the grass and the trees outside.”²⁷ In one scene, the journalists come upon a scene of post-violence carnage and then describe it by juxtaposing both trees “cut in half, dripping vital sap” and a body with a torn stomach and a “trail of blood that... disappeared into the grass.”²⁸ Material objects are also given lifelike or animistic qualities, particularly in the imagery used to describe abandoned drilling installations: oil paraphernalia is naturalized as “sprouting,” and “growing gas flares and pipelines.”²⁹ In another passage pipelines resemble roots, veins, and writing: “the oil scorched earth, and the ever-present pipelines crisscrossing the landscape, sometimes like tree roots surfacing far away from the parent tree, sometimes like diseased veins on the back of an old shriveled hand, and sometimes in squiggles like ominous writing on the wall.”³⁰ The similes here compare the pipelines to entities that transport and feed living beings (veins and roots) and meaning (writing). But the image is “ominous” as is the foggy setting of the entire novel giving it a tone of doom. This sense of doom is particularly haunting in the image where Rufus sees a human arm “severed at the elbow bobbing” in the water.³¹ Even the dead limb here

seems to have “an ecological voice,” with “its fingers opening and closing, beckoning... sometimes with its middle finger extended.”³²

The nonhuman world appears much more alive and active than the human world in *Oil on Water*. Rufus’s narration contrasts significantly with the depictions of “ecological voice” in the novel. He appears trapped in his human understanding of world and is never quite able to understand the communication of either human or nonhuman voices. Though it is never stated in the novel, one can gather that his mentor, the once great journalist Zaq, represents the defeated hopefulness of the previous generation that saw a partial decolonial movement of Nigeria in 1960 and the expectations that oil wealth would eventually trickle down after new oil fields were discovered in 1973. Rufus eventually absorbs Zaq’s cynical disillusionment, which is only occasionally interrupted by moments of often drunken idealism. After their first meeting, Rufus has to carry Zaq’s intoxicated, passed-out, and ill body with him for long distances until he wakes up, symbolically staggering and carrying the crushing weight of the disillusionment of the previous generation. Zaq remains ill throughout the novel, and Rufus is never quite able to shake the influence of the disillusionment of his mentor. This failure of human understanding of the ecological is inherent in the narrator’s failures, in the foggy memory he describes in the first paragraph, as well as in the unapologetic inability of the novel to capture its ecological object — it can only guess, observe, and describe. Furthermore, that the novel gets narrated from the point of view of a journalist whose aim is to “observe” and “witness” makes the form of the novel descriptive, as if an objective description of the material object gives more weight to the ecological object, making the narrative slightly less fallible in its attempted distance from human consciousness.³³ The result is an awkward depoliticization/naturalization of oil and the description of environmental apocalypse. Yet, this seems to be a conscious move on the part of the novel, as Rufus is at one point scolded by a prisoner he is interviewing for not being able to “see the larger picture.”³⁴ The story should not just be about the recovery of the white woman, and yet Rufus is never quite able to see this in his attempt to find a good story.

Ultimately, like Rufus, most characters are unable to understand the ecological voice. These characters appear to perceive reality through static binaries, much like oil on water — two entities refusing to merge. The kind of thinking that separates alive and dead, male and female, west and east, white and black also separates humanity and nature. Nature here includes oil. The assumption that oil as nature is passive and separate allows its indiscriminate use. Oil, the dead, the east, the female, the black, and nature are generally assumed to be passive and separate by Rufus and other dominant characters in a clearly unecological view. Yet, when the male, the white, and the human make these kinds of false assumptions, it comes back at them negatively, as everything is connected ecologically. This is most apparent through the ways in which men treat women. The Niger Delta at times appears to be telling its own story of suffering through its female characters often serving as an allegory for the way

in which the land is treated: Boma, Rufus's sister, is burned and disfigured by an oil fire as is the Niger Delta, the military sergeant's daughter is raped as Chief Ibiram's land is taken without consent, and the British woman's husband abandons her for a foreigner as chiefs abandon the land for foreign oil money. That the novel more directly relates female characters to the land is not an essentializing feminization of nature but a critique of the ways in which both nature and women are statically perceived as passive, trivialized and valued for beauty only.³⁵ At one point in the novel Rufus overhears a scene of domestic violence: "there was the loud sound of a slap, the crying stopped, the shouting stopped. Peace reigned."³⁶ The irony implicit in the notion that peace follows violence, is most likely also a reference to the particular path of violent resistance the militants use while claiming to want the restoration of the Niger Delta. Their activities such as kidnapping and blowing up pipelines for ransom only end in more sabotage and suffering. There are many faulty claims to truth in the novel, one being from the professor: "This land belongs to us. That is the truth."³⁷ The ecological voice and details in the novel prove otherwise. The assumption that the passive needs violent protection contributes to the cycle of violence that shows no end in the novel.

The ecological voice of the novel aims to make these connections, but the human characters themselves fail to do so. The exception is the island people of an animistic cult who survive and are able to heal in part because of the ecological consciousness that they embody through their rituals and daily practices — the cult refuses oil money, worships natural processes and aims to heal what has been scarred. But there is no sense that this healing is meant to lead to the restoration of the ecosystem. The priest of the animistic cult says, "we believe the sun rising brings renewal... whatever goes wrong in the night has a chance for redemption after a cycle."³⁸ This cyclical view of ecological processes is what distinguishes the novel from typical environmental apocalyptic novels, in that it refuses the didactic ploy, aiming to change the consciousness of the reader with the shock of the doom to come. But this means that instead, the novel is depicting a situation in which the end of the cycle has already come, as it has come to the Niger Delta, and that there is nothing left to do but heal and survive.

Depictions of the specific relations between the colonial subject and oil are missing in the novel. The novel's attempt to emphasize an environmental presence in the narrative has the effect of absorbing social processes into the ecological object, thereby stifling the depiction of relations between the subject and object. In giving Nature what appears to be complete agency, The Force of Nature appears to act on passive objects. The attempt to represent the ecological object in the novel instead renders everything passive. In opposition to dualism, and in what appears to be a purging of social processes, the novel presents a version of monism whereby the relations and connections of organisms to physical surroundings — notably the aim of ecological study — are lost.

One reading of the novel takes the contradictions of the racialized, patriarchal, neocolonial order as evidence of its flawed understanding of nature. At the end of *Oil on Water* Rufus wonders if it is fate that wanted Isabelle, the kidnapped British woman, to see firsthand the human and nonhuman carcasses that were the result of her husband's work as oil engineer. But, in wondering how her life has changed after barely surviving the kidnapping, he concludes that she was most likely not able to recognize the Niger Delta's attempt to communicate with her — that her experience would be “nothing but a memory, an anecdote for the dinner table.”³⁹ Isabelle's indifference to the socio-ecological apocalypse may be a challenge to the Western reader, who despite having more weight in the global order and being the biggest consumers of petroleum, care little for the waste that is disposed of far away. Despite Isabelle's direct experience as a witness to the socio-ecological destruction, she remains indifferent. Yet in spite of the recognition of this problem in the novel, the ways in which oil as a commodity supports this racialized, neocolonial order is missing.

In “Narrate or Describe?” Lukács interrogates literary naturalism and what he calls the “novel of disillusion,” in which “the final victory of capitalist inhumanity is always anticipated.”⁴⁰ The disillusioned tone of the narration radiates from every turn in *Oil on Water*. Though Rufus feels hopeful at the end of the novel, he has been naïve and wrong many times throughout the narrative, and indeed the last word of the novel is “descent,” perhaps indicating the way in which the cycle is moving.⁴¹ Possible ways out of the impasse appear defeated before they are even hinted at. If the title *Oil on Water* presents a metaphorical image of static dualism, its reference to nature further naturalizes such a dualism. But, as with most hints and symbols in the novel, the reader can too easily fall into the pathetic fallacy, reading into nature what is not intended to be interpreted by the human who inevitably falls into the trap, never fully able to decenter his or her consciousness. Lukács says of the “novel of disillusion” that the “inflated metaphor, arbitrary detail, chance similarity [and] accidental meeting,” are “supposed to provide direct expression of important social relationships.”⁴² But because the characters have no clear relation to the objects described, social significance is actually obscured, making it near impossible to extract any kind of meaningful interpretation of the novel. In *Oil on Water* this is essentially related to the naturalized representation of oil. If social forces do not surface dialectically in unity with the ecological forces, how can the reader discern with certainty that the degradation and violence in the novel are not also natural? The narrative's placement of humanity and oil in nature without establishing ecological relations leads to the idea that subjects are doomed more by nature than any kind of social form. If everything is seen as part of nature, then the absolute destruction of the Niger Delta in the novel becomes a problematic if not arbitrary idea because it becomes difficult to locate the relations that entail such devastation.

It could be argued that the novel is simply an expression of eco-social devastation

in its depiction of a moment and location where there does not actually appear to be any agency whatsoever. In the Niger Delta over 550 oil spills have occurred in the last ten years, compared to the ten that have occurred across the whole of Europe in the last forty-five years.⁴³ But, instead of focusing on agency here, I ask if the emphasis that the novel places on the ecological is a feature of an expiring cultural logic of late fossil capital.

It is true that oil is nature before it becomes a commodity. But under capital we actually never experience oil as nature — it can only be experienced as commodity, and it is its naturalized commodity state that prevents us from seeing it as nature. Oil as a naturalized demonic substance in the narrative puts the colonial subject and the object (oil) in opposition, as the subject becomes isolated from the object when it loses its relation with the object. If social processes are isolated in literature, then ecological processes are also isolated and no movement is possible.

Cities of Salt: The Collective Third-Person Narrative Voice

How could oil as a commodity then appear in literature? The answer is that it does *not*, nor does it need to appear as such. An ironic problem that I am proposing is central to the cultural logic of late fossil capital is that the more oil is *described* in a work, the more it disappears. This naturalization of oil indicates a particular kind of “energy unconscious” — that which erases or contributes to the depiction of literally fossilized social relations. I hope to show in the following analysis of *Cities of Salt* the contrast between its ecological form and the ecological voice of *Oil on Water* and how this is related to differing depictions of oil.

Going back to the invisibility of oil as a material substance in *Cities of Salt*, oil does not appear physically but instead manifests itself in the minds of the characters in different ways, mostly as some kind of wealth or gold to come. This is because its particular material form as a commodity is not of importance to the Bedouin. What is important are the social powers it is given and the depiction of its effect on eco-social relations. Indeed oil exists alongside a web of other commodities in the novel. The irrationality of the commodity system is shown through a web of things that have social power without actually being useful to people. The sketchy “doctor” that sees a business opportunity in Harran, Dr. Subhi, claims his needle can fix all sorts of problems — virility in particular — and its purported powers draw even the most loyal customers away from the traditional treatments of Mufaddi, Harran’s traditional healer. The Americans easily keep the emir distracted from his people by presenting him with objects to make him feel powerful, but he is unable to understand any of these object’s potential uses due to his insatiable desire to accumulate more. On the contrary the objects weaken and confuse him with desires: “The emir grasped the telescope as a mother grasps a suckling infant,” but he completely loses sight of his people under these new colonializing circumstances.⁴⁴ His obsession with the telescope further distorts and fragments his vision, proving his inability to see or

understand the whole picture.

We see the power of oil as a commodity in the novel not though its ability to fuel production and development, but in its ability to generate wealth and luxuries — and then only for the American side of Harran. Oil's social powers as a commodity appear infinite — it displaces people, invents work for a wage, creates racial inequalities, complicates family and gender relations, and even rearranges people's relationships with nature. But never does oil itself appear in the novel as an object of natural powers — its influence is conditioned by its social uses. Oil depicted through a constellation of social relations shows the conditioning powers of those relations. In Ortlieb's summation of the crucial significance of pointing to the dissimilitude of material wealth and value, he makes the assertion that "conscious human action" must bring a postcapitalist form of the social into being, before the blind compulsion of the value form finally leads to the merger of terminal capitalist crisis and what may well be a terminal *ecological* crisis that threatens to destroy all sources of material wealth.⁴⁵ That *Cities of Salt* represents oil as a commodity and not as nature allows for the subject-object relations that permit movement in the narrative. This movement recalls Malm's definition of fossil capital mentioned earlier, as both a relation and a process. Without this movement there could be no "conscious human action" depicted in the novel, as the conflation of material wealth (here oil as nature) and wealth in the value form (oil as commodity) naturalize oil's powers without recognizing the social forces behind this influence.

Socionatural relations in *Cities of Salt* fluctuate and change under different social formations — from traditional precapital relations where people own the means of production and survive off the land, to their displacement in Harran, where they become mostly alienated from nature as workers surviving off wages. Under both social forms ecological and social forces are presented dialectically. The third person collective narrative begins with the consciousness of Miteb al Hathal, and remains with him longer than any other character. But the narrative eventually leaves Miteb, entering the stories of numerous characters, to the point that John Updike accuses Munif in his review of *Cities of Salt* of having not even written a narrative recognizable as a novel.⁴⁶ And yet this third-person collective narrative, more than other forms, works with the interconnection that ecological thinking necessarily entails — ecology being the science that studies the relations of organisms to one another and to their surroundings. The narrative weaves in and out of interdependent characters, plants, and animals, highlighting both social and ecological relations and common destinations.

In *Cities of Salt* subjects do not appear as objects of their environment. The novel makes the subject-object relationship to the characters' environment particularly apparent at moments when characters come to consciousness of the nature of their exploitation and the rupture of socionatural relations. The commodity-based social formation organizes eco-social relations, but eco-social relations, though not with

the same intensity, also impact the new social formation. The first victims of the oasis community, once the Americans have found oil and forced the people off their land are the “wailing” trees.⁴⁷ After the community is displaced, they become workers in the coastal city of Harran. They are distraught by their inability to counter the sense of racial inferiority created by their segregated working and living conditions. It is once they leave the city for the desert, that they begin to find ways to meaningfully counter their confused feelings of inferiority. The turn towards empowering social processes is here caused and strengthened by the workers’ connection to their natural environment. The rains that bring plants and animals also have the effect of creating the nostalgia that reminds them of their previous relations. The workers start to engage in guerrilla tactics of resistance — playing practical jokes on the Americans by letting loose rats and lizards in their tents and the strategic placement of a big dead black snake in the American camp, which results in several Americans leaving. The culmination of this moment of empowerment is the offering of a boxful of lizards meant to publicly frighten and humiliate the Americans at the ceremony marking the completion of the pipeline. The Arab workers clap longer than the others in mockery of the show.

This parallel between the flowering of the desert and of social consciousness continues to drive workers to a greater unification as they bring their partially repaired socio-ecological relations back to the city, culminating in their outrage at the dismissal of workers and the emir’s refusal to investigate the murder of traditional healer Mufaddi, who had refused any complicity with the imported social formation. The formal insistence of collective third person turns the slow growth of class consciousness into a kind of vantage from which to assess the impact of oil as a social relation. Oil gets mediated differently across its stages of development — it’s discovery results in general suspicion, curiosity, and desire in the community — it’s extraction leads to fear, alienation and displacement — the refinement process in Harran objectifies them into workers, but during the building of the pipeline — oil’s transportation, the workers recover their subjectivity.

Miteb and Mufaddi are important characters as they frame the novel — the novel starts in the consciousness of Miteb, his ghost appearing and disappearing throughout, and ends with the ghost of Mufaddi. Both are marked by their refusal to adapt to the new economy brought by the Americans, as well as for their particularly strong connection to their environment. Both have female counterparts (not wives or family-based) in Umm Khosh and Khazna, in that when one is affected, the other follows either in strength or weakness. In strength — as Umm Khosh becomes sane near Miteb, and Khazna’s cures become more effective with the presence of Mufaddi — or in weakness — as Umm Khosh reverts to her madness and dies with the disappearance of Miteb, and Khazna becomes blind with the death of Mufaddi. Both Mufaddi and Akoub the truck driver also have human and extra-human counterparts in Amna’s fawn and Akoub’s truck. Akoub the truck driver’s truck breaks down along with him

as his health deteriorates, as does his dog whose leg becomes infected at the same moment as his does. Additionally, tied-up camels suffer with the first prisoners in the first jail, here among many other moments in the narrative in which changes in the social and material environment are depicted as effecting both human and nonhuman nature.

The most striking example of this interconnectedness is the extent to which Mufaddi's death effects his entire environment: his name in Arabic means "the final arbiter" and the emir's refusal to investigate the cause of his murder is the ultimate motivation for the unification of the workers at the end of the novel. The pain caused by his murder brings voice to the suffering workers and finally relief, as Mufaddi's child patient also finds his voice after being unable to talk, when he witnesses the pain of the irons on another — his pretended treatment — and he begins to "bellow" and is cured.⁴⁸ Mufaddi's ghost appears at the height of the marches, and is seen by every single participant; his death proving the extent of his connection to his environment as it reacts in chaos: adults tremble and become thirsty, babies cry, dogs howl, a gazelle jumps into the ocean, and large birds fall prey to hungry dogs.⁴⁹ Additionally, Amna's fawn, Mufaddi's animal counterpart, also suffering under house arrest, presumably dies at the moment of his death.⁵⁰

Despite the many individual differences of characters, the narrative viewpoint is collective, from "the people," and often in connection, through simile, with nature or natural processes, turning the subjects and objects of the setting into an embedded whole. When Um Khosh begins to lose her sanity due to the disappearance of her son, her sadness is said to "[leave] a deep impression in the people's hearts and minds, much as rushing water does in hillsides."⁵¹ When Miteb fully refuses the Americans and their claims, the narrative voice at first reflects society's frustration with his refusal: "He seemed obstinate and imbecilic. He had forgotten his age and dignity."⁵² When the collective narrative of *Cities of Salt* directly expresses an opinion, it is often an opinion held in general by the community. There is no illusion of transparency as there would be in the case of a more conventional third person omniscient narrative. Instead, in the third-person collective, ideologies are laid bare and rendered fluid. Transformation happens collectively, often influenced by those characters lying just outside the collective norms. The people eventually realize that they were wrong about Miteb, and his ghost haunts them for the rest of the novel. The narrator's comments are not intended to capture "reality" but rather the dynamic of collective opinion, while at the same time remaining attentive to those just outside this realm. The dynamic narrative shows the people as initially incapable of imagining future problems or of any critical awareness, much less preventing the oncoming crisis. Unable at first even to recognize their own situation, they nevertheless eventually transition into awareness and the capacity of organizing and fighting back.

Munif, himself formerly an oil engineer with a PhD in oil economics, moves between fiction and nonfiction in the novel, detailing the racist, segregated labor practices and

Jim crow-type laws that clearly evoke the historical situation associated with Aramco (or the Arabia American Oil Company) in Dhahran, Saudi Arabia in the '40s and '50s. In the novel, the workers come to understand the nature of their exploitation and revolt, as in fact the workers did in Dhahran, Saudi Arabia, particularly in 1956. Echoing one of the first slogans actually used to exhort workers to unite in Dhahran in 1945 against Aramco, Munif's workers also shout "we are all one," and the novel concludes with "the masses of people mov[ing] as one man."⁵³ By 1956 in Dhahran, however, the protests had been stopped by a royal decree outlawing strikes. Those who didn't comply with the decree ended up in jails or disappeared. Additionally, poor migrants were kept on hand as a reserve work force, making local worker's demands largely futile. Oil historian Robert Vitalis says that after the royal decree, Aramco's policy planning staff came out with a statement claiming that the workers were more content now and that they even had new TVs courtesy of the company.⁵⁴

Though Amitav Ghosh admires Munif's interaction with oil in *Cities of Salt*, he calls the novel's ending, in which the workers enact some success in "becoming politically active," "an escapist fantasy" and "pure wish fulfillment."⁵⁵ Whether true or not, such a putative exaggeration of the success of the striking workers when considered as a utopian moment within a realist fictional narrative provides a strong contrast to utopian moments from other works categorized and acclaimed as petrofiction. The ending, though not as optimistic as Ghosh implies, leaves breathing room for the possibilities that socio-ecological relations entail. Munif moves into the realm of the magical at the end of the novel as Fawaz and Mugbel (Miteb's sons) are seen "flying through the air like birds" along with the ever-present specters of Mufaddi and Miteb.⁵⁶ The aim of the narrative here is clearly not to describe objective social facts or coincide with empirical reality but to realistically portray social forces and connections as they are seen by the third-person collective. That Miteb's sons are flying highlights the transcendence of material description in order to capture driving social forces that are at play in this moment.⁵⁷ That ghosts are present connects the historical process to a momentum, though the destination of this momentum is not as "wishful" as Ghosh would have it. The novel ends with small concessions given from an unreliable source (the emir), predicted future sacrifices as Ibn Naffeh says "you should ask whose blood is next," and the clear tone of uncertainty, as he "laughs sadly" and says, "Hope for the best"⁵⁸ The point is not that the momentum is hopeful, but that *momentum* exists in the form of the novel. What appears solid (like salt) may not be so. This momentum would not be possible without subject-object relations.

Though the discovery of oil completely changes the lives of the Bedouins, oil itself (as material wealth) is not presented as the catalyst for displacement or the source of suffering or an organizing historical force. It is instead the distinct commodity-based social formation that organizes eco-social relations, allowing for a representation of the relations organized around oil under the value form. When Ibn Naffeh says, "The Americans... are the root of the problem," there is some dramatic irony here,

as the reader can easily discern that it is not the Americans themselves that are the problem, as the entire novel carefully depicts not a history determined by a nation or an inert natural material but the process of the disintegration of relations, from the divorce of the means of production, to working for a wage, to segregation, to iron posts replacing trees, to the reification of women's bodies, to the introduction of luxury goods, to land grabs, and so on.⁵⁹ The title could be pointing to a future collapse (salt easily disintegrates), yet it is not clear by the end of the novel how this collapse may come about. What is clear is that the collapse is not coming from some determined social or ecological process. Both social and ecological driving forces arise organically in the novel and point to an uncertain ending that allows dynamic socio-ecological forces to gain or lose momentum. This also allows for the representation of oil as material wealth (oil as possibility) and oil as commodity (oil as tragedy) to operate simultaneously in dialectical and historical tension.

Neonaturalism and Neorealism

What happens when we rethink Georg Lukács's realism/naturalism distinction in the context of neonaturalist and neorealist narratives about oil in the age of late fossil capital? Naturalism, heavily influenced by Darwin's theory of evolution at the time of its first appearance as a distinct narrative style, tends towards fatalistic notions of environmental determination of social behavior. Lukács charges naturalism with reducing "driving social forces" to mechanical, natural laws of society, as would a scientist observing unmediated facts or as social data available to the novelist as experimentalist trying to discover the "natural laws" of society. In "Narrate or Describe?" Lukács explains that the distinction between realism and naturalism is based on the narrative standpoint: the reified observer of *naturalism* observes and describes a scene whereas the narrative of a *realist* work participates as it narrates the "vicissitudes of human beings," in part by transcending mere observation and description.⁶⁰ In *realism*, this transcendence involves the depiction of setting as something inseparable from its relation to the characters — and vice versa. We have already seen examples of this in *Cities of Salt*. However, in naturalism, as it is understood by Lukács, the characters have no connection with the objects described.⁶¹ The subject and object are represented as isolated from each other. Such mutual isolation becomes, at its logical extreme, a total separation, not just of character and setting, but the severing of reality as such into two independent spheres, as is the traditional depiction of nature *and* man, nature as entirely foreign to the social. And as we have seen in more contemporary literature, this can take the seemingly paradoxical form (as it relates to literary naturalism) in which the ecological object *completely absorbs* the social object. In both cases there are only abstract relations, established between subject and object, which in a sense amounts to the complete absence of relations. In Lukács's account of realism, however, "description of the environment is never 'pure' description but is almost always transformed into action."⁶² In realism

the depiction of environment accords it a dramatic role in the story as a whole, as characters and setting or environment never cease to interpenetrate each other. The two never cease to constitute an underlying *absolute* unity in relation to which their separation is always *relative*. Characters and setting are in continual and singular process — one which manifests itself in both their apparent separation as well as in those moments in which their absolute unity shines through the surface of what only *appears* to be their mutual isolation.

In naturalist observation, the narration “ignores the motive forces of social development and their unremitting influence on even the superficial phenomena of life.”⁶³ There is a great leveling between characters and setting, as everything is described as existing on the same plane, as objects moving in accordance with a putative “natural law” that disguises what is in fact a more total reification of social relations. In naturalism, “[o]bservation is a process with its own logic and its own mode of accentuation. The important and unimportant are described with equal attention... deprived of all human significance.”⁶⁴ The reified narrative style in naturalism is likened to the “static pictures of still lives connected only through the relation of objects arrayed one beside the other according to their own inner logic, never following one from the other, certainly never one out of the other.”⁶⁵ Instead of documenting the dynamic process of the deterioration of relations or hinting at possible relations, there is static defeat. This defeat is the result of the depiction of so-called “subjects” (human characters) as if already absorbed by — and thereby appearing to lack any real relation at all to so-called “objects” (oil, the natural environment, landscape, setting, and so on). Having been severed, in a necessarily false surface relation, from what has now become their true but concealed dialectical unity, subjects themselves appear to be mere objects.

Clearly, there are no “pure specimens” of either narration or description.⁶⁶ The point here is not to label works of literature as either one or the other but to notice different strengths and combinations in order to gauge the relationship with reality that is being depicted.⁶⁷ We cannot say that Rufus is simply describing “social facts,” as did Zola’s third person naturalistic description. But the problems that Lukács found in Zola’s naturalism are very similar to problems we find in *Oil on Water* and other works of “petrofiction.” This is notably related to the novel’s particular kind of ecologically informed imagination, resulting in effects that may appear to differ from the standard naturalist formula critiqued by Lukács: in the moments where ecological processes are depicted, the narration *participates* by moving the typical idea of a pristine, rural, and asocial nature out of this static category and placing it in process with the social. In “petrofiction” this means that oil as commodity is not naturalized but also appears specifically as commodity bearing on the social relations that in essence *are* the domain of novelistic representation. Still, at bottom the novel nevertheless exemplifies reified observation, since in precisely those moments when social processes are depicted as rooted in indifferent ecological material, these social

relations themselves simply disappear. When social processes are not portrayed as developing *in relation to* ecological processes but rather as *entirely subsumed* within ecological processes, then historical time appears to merge with naturalized, nonhuman time — a time of natural decay and a purely material, asocial death — and the historical time of the social appears to come to a standstill.

Notes

1. Helon Habila, *Oil on Water* (New York: Norton, 2010) 9–10.
2. Habila, *Oil on Water* 60.
3. *Oil on Water* 238.
4. See Amitav Ghosh, “Petrofiction: The Oil Encounter and the Novel,” *Incendiary Circumstances* (Boston: Houghton Mifflin Company, 2005 [1992]) 138–151.
5. Andreas Malm, *Fossil Capital* (London: Verso, 2016) 333–334.
6. Ghosh, “Petrofiction” 140.
7. “Crucially, Ghosh does not consider the possibilities of a logic of oil that puts it in the shade, in his eyes, when compared with the creative commodity par excellence, spice (although even here, in the realm of commodities of colonization, he might have made space for the vast histories on sugar and coffee).” Peter Hitchcock, “Oil in an American Imaginary,” *New Formations* 69 (2010) 81.
8. Peter Theroux, “Abdelrahman Munif and the Uses of Oil,” *Words Without Borders: The Online Magazine for International Literature* (October, 2012).
9. Abdelrahman Munif, *Cities of Salt*, trans. Peter Theroux (New York: Vintage International, 1987) 49.
10. *Oil on Water* 140.
11. *Oil on Water* 9, 193.
12. Patricia Yeager, “Editor’s Column: Literature in the Ages of Wood, Tallow, Coal, Whale-Oil, Gasoline, Atomic Power and Other Energy Sources,” *PMLA* 126:2 (2011) 309.
13. Malm, *Fossil Capital* 11.
14. *Fossil Capital* 290.
15. Jeff Diamanti, “Three Theses on Energy and Capital,” *Reviews in Cultural Theory*, 6.3: *Energy Humanities* (2016) 14.
16. Claus Peter Ortlieb, “A Contradiction between Matter and Form: On the Significance of the Production of Relative Surplus Value in the Dynamic of Terminal Crisis,” *Marxism and the Critique of Value*, eds. Neil Larsen, Mathias Nilges, Joshua Robinson, and Nicholas Brown (Chicago: MCM’ Publishing, 2014 [2008]).
17. Ortlieb, “A Contradiction between Matter and Form” 83.
18. “A Contradiction between Matter and Form” 112.
19. Karl Marx, *Capital: Volume I*, trans. Ben Fowkes (New York: Penguin, 1976) 638.

20. "A Contradiction between Matter and Form" 112.
21. Theroux, "Abdelrahman Munif and the Uses of Oil."
22. Upton Sinclair, *Oil!* (New York: Penguin, 1927) 548.
23. Patrick Chamoiseau, *Texaco*, trans. Rose-Myriam Rejouis (New York: Vintage International, 1992) 263, 319.
24. Georg Lukács, *History and Class Consciousness*, trans. Rodney Livingstone (Cambridge: MIT P, 1971) 31.
25. Jason W. Moore, *Capitalism in the Web of Life* (New York: Verso, 2015).
26. Jennifer Wenzel, "Behind the Headlines: Oil on Water," *American Book Review* 33.3 (March/April 2012) 14.
27. *Oil on Water* 178.
28. *Oil on Water* 76, 77.
29. *Oil on Water* 9, 43.
30. *Oil on Water* 193.
31. *Oil on Water* 38.
32. *Oil on Water* 38.
33. *Oil on Water* 60.
34. *Oil on Water* 163.
35. See Elmart Flatschart, "Crisis, Energy, and the Value Form of Gender: Towards a Gender-Sensitive Materialist Understanding of Society-Nature Relations" in this volume.
36. *Oil on Water* 111.
37. *Oil on Water* 232.
38. *Oil on Water* 90.
39. *Oil on Water* 239.
40. Georg Lukács, "Narrate or Describe?" *Writer and Critic and Other Essays*, Trans. Arthur Kahn (Lincoln: iUniverse 2005 [1936]) 146.
41. *Oil on Water* 239; Rufus says, "I turned and began my descent."
42. Lukács, "Narrate or Describe?" 116.
43. See Amnesty International, "Nigeria: Hundreds of oil spills continue to blight Niger Delta," *Amnesty International* (March 19, 2015) <https://www.amnesty.org/en/latest/news/2015/03/hundreds-of-oil-spills-continue-to-blight-niger-delta/>.
44. *Cities of Salt* 421.
45. "A Contradiction between Matter and Form" 117.
46. John Updike, "Satan's Work and Silted Cisterns," *The New Yorker* (October 17, 1988).
47. *Cities of Salt* 106.
48. *Cities of Salt* 570.
49. *Cities of Salt* 579.
50. *Cities of Salt* 575.
51. *Cities of Salt* 53.
52. *Cities of Salt* 71.
53. *Cities of Salt* 613.
54. Robert Vitalis, *America's Kingdom: Mythmaking on the Saudi Oil Frontier* (Stanford: Stanford P, 2007)

187.

- 55. Ghosh 148.
- 56. *Cities of Salt* 615.
- 57. *Cities of Salt* 615.
- 58. *Cities of Salt* 627.
- 59. *Cities of Salt* 626.
- 60. "Narrate or Describe?" 111.
- 61. "Narrate or Describe?" 130–133.
- 62. "Narrate or Describe?" 118.
- 63. "Narrate or Describe?" 122.
- 64. "Narrate or Describe?" 131.
- 65. "Narrate or Describe?" 144.
- 66. "Narrate or Describe?" 116.
- 67. "Narrate or Describe?" 116.

The Political Energies of the Archaeomodern Tool

Amanda Boetzkes

In his provocative account of the relationship between representation and politics in *Representing Capital* (2011), Fredric Jameson observes the many figural flourishes by which Marx discloses a horrified awe of capitalism. Notably, these flourishes are occasioned by those moments in which the capitalist system becomes spontaneously animate in its confrontation with the collective power of labor. Where Jameson attributes an ontological status to these autonomous entities (capitalism and labor power respectively) under the rubric of "spirits" and "forces" as per Marx's historical moment, I would describe them as vital energies whose political vectors are charted by the historically specific scenes of production, reserve, clash, and/or discharge. For example, when the organization of factory machines springs to life, as though at the behest of "demonic power," or when collectivity "begets in most industries a rivalry and a stimulation of the 'animal spirits' which heightens the efficiency of each individual worker," Jameson reflects that "the choice between a 'good' description of capitalism (as constant revolutionizing and innovation) and a bad one (as exploitation and domination) is in fact a political choice and not a logical or scientific one: a choice that must be made in function of the current situation, and whether people can be *politically energized* by the negative — anger — or the positive — hope."¹

In Jameson's characterization of Marx's literary forms, the work of politics and the work of machines share in an energetic current, the ground from which the intentionalities of politics emerge. Not only was Marx keenly aware of the qualitative role of energy in the specific character of capitalism (and not just its quantitative role in powering the perpetual growth of the system), he was also attuned to the way that energy charged his representation of it. More to the point, this energy possesses a coextensive political and aesthetic valence by which multiple political positions could be generated and shaped from within that very system. One might even say that the energetic dimension of representation in Marx becomes the condition for a discursive ecology — a polyphony of criticisms, forces, collisions, oppositions, latencies, and possibilities that stand in resistance to capitalism's seamless absorption of labor.

This chapter shows how the energies of representation implicit in Marx's figurations allow us to rethink critical modes of existence within a political ecology. I consider how political energies have historically been registered as dissimulated forces that haunt the terms of representation but also shape the world to come. This tradition has a striking resonance with the recent preoccupation with an archaeo-modern perspective of the economy, in which political power can be gauged in its representation as a potential energy that inheres in petrified objects. I discuss the thematic of the petro-object through a discussion of several works that appeared in the 2015 Venice Biennale. Here, we see the specific formation of labor energies referenced only by manual tools discovered in posthumous environments — that is, in scenes of ruination in which assemblages of the workforce appear as prehistoric artifacts that have been buried and encrypted in the earth. I argue that this coextensive setting into history and setting into the earth of labor energies signals a paradigmatic shift in materialist thinking from economy to political ecology. However, as Bruno Latour points out, such a reorientation is demanding and not without its share of hauntings from modern conceptions of the political. Yet, following Latour, we may be able to shape such a turn by speaking and seeing political energies “crookedly,” which is to say, by finding them running through new ontological formations. Inasmuch as political energies are generated by and directed within complex assemblages, these same assemblages disclose the potential to take hold of the vectors of political conflicts. More precisely, in rethinking the ontological transections between technology, human labor, and earthly forces that produce such assemblages it becomes possible to chart their potential for redistributing our political capabilities and sensibilities.

The Monstrous Energies of Capital

Marx's varied representations of capitalism frequently revolve around its systemic depletion of energy. While his figurations of capital deal primarily with forms of consumption, these are not to be mistaken for the cultural vices of greed and pleasure in accumulation. Rather, the insights of Marx's figurations develop in *Capital* into an increasingly sophisticated consciousness of capital's insatiability for both human and nonhuman forms of energy. If the feudal landscape consisted of agricultural social relations that were relatively easy to map, the rapidly industrial landscape of the mid-to late nineteenth century took much more critical work. Thus he is at pains to find a modern form that would encompass the paradox of an expanding self-expending system. Such a contradictory energetic model gets figured as monstrous, and thus Marx personifies the shift from mercantile capitalism, a basic exchange model, to its modern form as interest-bearing capital, as the emergence of an economic Moloch, a pagan god that demands the sacrifice of children and animals, and whose appetite is never sated. Marx writes,

The complete *objectification*, *inversion* and *derangement* of capital as interest-bearing capital — in which, however, the inner nature of capitalist production, [its] derangement, merely appears in its most palpable form — is capital which yields “compound interest.” It appears as a Moloch demanding the whole world as a sacrifice belonging to it of right, whose legitimate demands, arising from its very nature, are however never met and are always frustrated by a mysterious fate.²

Capital thus provides no plenitude whatsoever from its accumulation. Rather, its exchange is born of a sacrificial logic. In this reading, capital does not demand like a hell mouth that must be fed, but rather, proliferates through ever more exchanges to become an expanding system that depletes energy with every transaction. Like the Moloch, its appetite is for the world, and therefore it cannot be placated with a token portion of a society’s wealth. Marx’s point is that the demand for sacrifice is integral to the surplus value model of capital, so that the derangement of capital occurs in the world’s circulation of wealth which takes place as its own self-consumption.

In this vein, Frederic Jameson argues that capitalism is both a self-organizing system and a dialectical totality (a unity of opposites) by which it can be understood as open and dynamic, but whose operation is nevertheless premised on a fundamental closure.³ The system must expand and absorb in order to exist; but at the same time its requirement to perpetually enlarge — to find energy sources and absorb them into exchange — is the condition of its closure. It cannot stabilize or else it will begin to die.⁴ Once the system is engaged, moreover, it precludes all economic alternatives or criticisms, which simply become sources of strength and resilience. The lynchpin of this system, however, is the unity of capitalist production and unemployment.⁵ Unemployment is the essential state of depletion on which capitalist production functions and expands, since the strategic control of labor as a form of energy management (whether to keep stockpiled, or to deploy for maximum yield) guarantees the possibility of exploitation at the level of production, which can then be claimed as profit through exchange. Thus, while interest-bearing capital is a system that consumes expansively and uncategorically, it nevertheless demands a sacrifice in its particularity, as the lives of the unemployed given as tribute. The sources of energy that feed the depleting system change over historical epochs, yet unemployment remains capitalism’s universal demand. Thus, the difference between the phases of capitalism, and the specificity of its globalization, are differences in the forms of unemployment reserves.

Where Marx was keenly attuned to the fact that labor was not just the functioning machinery of the system but a source of energy in its own right, Jameson mobilizes his figuration of capitalism to account for the status of labor in the contemporary economy. He therefore notes the global scale of populations who are held in standing reserves of energy precisely through the imprisonment of unemployment. The larger

the reserve of unemployed people, the cheaper labor becomes, and the more demand for the world's resources increases, the more wealth remains in circulation gaining value without being used in the interests of individual livelihoods. This configuration sets the terms for leeching human energies in order to power exchange for its own sake, while impoverishment becomes naturalized through the ideologies perpetuated in events such as war, terrorism, massive refugee migrations, and environmental disasters. The global supremacy of capitalism has been powered by failed nation states, ethnic genocides, terrorism, and environmental crises that guarantee its supremacy as though through a process of traumatic bonding. On this point, Jameson follows Aaron Benanav's emphasis on the relationship between surplus populations and the production of surplus value.⁶ However, where Benanav argues that, concomitantly with the growth of the system, capital accumulation produces surplus populations redundant to the needs of capital, Jameson attenuates this claim to suggest that Marx's key insight is that unemployment is structurally central to the dynamic of accumulation and expansion which constitutes the very nature of capitalism as such. Thus, surplus populations are not mere by-products of the system but are rather the sacrificial lives that it claims as its very energy source. Following Althusser, Jameson draws the conclusion that capitalist accumulation and unemployment are borne out coextensively through an axis of exploitation and domination.⁷

Representation as Derangement of Labor Energies

When Jameson argues that the representation of capitalism finds itself making a political choice to view it positively as constant revolutionizing or negatively as exploitative, and that these choices are energetically charged (positively by hope or negatively by anger), he locates the possibility of rearticulating the mechanisms of that system through precisely these political energies. That is to say, the seemingly magical process of deranging capital into interest-bearing capital can be undertaken as a representational procedure by which labor is inverted from its positive energies to its negative ones. A consciousness of the labor substructure thus occurs through the energetic derangement of representing capital. Moreover, such derangements of representation are ways of tracking shifts in forms and modes of political resistance, in addition to the technical composition of what we might term the fossil-fueled exploitation of industrialized labor. From within capitalism's representation of itself to itself, derangements can occur that give rise to a new visibility.

This insight is crucial to theories of the social history of art. T.J. Clark's analysis of realist painting in the nineteenth century, for example, is attuned to the energetic charges at play in the politics of representation. He notes such charges in Millet's politics, as he elaborated through his paintings of gleaners and other peasant laborers over the course of the mid-nineteenth century.⁸ In his earlier paintings of the 1840s, Millet's aggrandizes his peasants, drawing on Michelangelo's Sibyls or Raphael's Virgins as figural models. These figures incorporate the automaticity and brutality

of their labor, mobilizing a “savage physiognomy.” The combination of grandiosity and brutishness lends his paintings a “philosophic melancholy” in their “monotonous ugliness,” in the words of Baudelaire.⁹ In this regard, Millet’s compositions and figurations open the representation of the peasantry from a poetic mythology of the noble poor to associations with the more dangerous and unruly *banlieue* peasant. As Clark points out, the factory workers of the Paris suburb were considered to have a recognizably degenerate physiognomy. More than this, the *banlieue* peasant was a dislocated and uncertain character of modern life; as people left rural France for work in the city, they relied on gleaning in the woodland of Barbizon, an intermediary zone between the agricultural communities and the urban factories that were also the sites of peasant uprising as gleaning rights became more stringently regulated and even forbidden.¹⁰ The project of classicizing labor was not just a matter of elevating the figure of the peasant, but also of paring down the landscape, rendering it sublime and threatening, suggesting revolutionary power in simplified, ambiguous spaces. Labor power was not simply embodied through figuration, but in his paintings of the mid to the early 1860s, he articulated it as a latent threatening energy that pervaded the landscape (Figure 1).



Figure 1. Jean-François Millet, *Man with a Hoe*, 1860 – 1862, Oil on canvas, 81.9 × 100.3 cm (32 1/4 × 39 1/2 in.). The J. Paul Getty Museum, Los Angeles.

Clark explains:

In 1850 Millet was still ready to draw that terror directly. In his later works he tended to suppress it: there were no more redskins in the forest, and no more twisting lines and contorted postures. But there was always violence, as an undertone to plain description: Death visited the woodcutter, grass smoked like pyres in the landscape behind the Man with a Hoe: an abandoned harrow, a flock of crows or a misshapen tree stood for more than themselves, an *abstract* menace which grew more sinister as Millet grew older.¹¹

In other words, the political force of Millet's work arises in the very abstraction and dispersal of the proletariat, unformed and yet perceptible at the junctions between rural and urban landscapes, traditional and modern life in the mid-nineteenth century. Labor power itself was deranged into a suppressed and seething energy waiting to erupt into revolution. The subtlety of Clark's analysis comes from his assessment of how new formulations of both the labor classes and the unemployed asserted themselves into the visual field as a consciousness that could be abstracted from literal figuration. Moreover, precisely as an abstract disruption, such representations become politically charged, for in their staging of sites of labor but resistance to the existing relationship between figure and ground, worker and land, the paintings open the possibility of a new political form to come. The abstraction signals both an absorption of existing figurations of labor into the unmapped terrain of the Barbizon forest and at the same time, a potential energy which would be carried forth in a figuration that was as yet unrecognizable and therefore uncontainable. Millet therefore redistributed the aesthetic terms of the figure-ground relationship to posit the obsolescence of the rural proletariat and an anticipatory ethos that signaled a future revolutionary whose energy is derived from its emergence out of a feral topography. This return of the figure to its earthly ground in order to encrypt an existing political form, as a gesture toward its energetic reinvigoration and in such a way as to alienate and invoke the reformulation of the visual field, is also at stake in the contemporary era, which is witness to intensive procedures of deterritorialization due to global scale resource extractions and the restless flows of mobile surplus populations.

Petro-Objects and the Ruins of Global Politics

This dialectic of figuration and abstraction informs my reading of the political energies that charged the Arsenale art exhibition of the 2015 Venice Biennale, organized under the title *All the World's Futures*. Important here is the anachronism of *futures* in the aesthetic imaginary of the Biennale which is read against the historicity of land and labor in the nineteenth century. What Millet figured as a future contradiction is refigured as both the obsolescence of industrial labor and the revalencing of politics

through an anticipatory figure inferred only by way of discarded manual tools that wait to be claimed in *All the World's Futures*. The exhibition's Marxist currents were articulated with particular force in the recurrent appearance of inert, broken, or appropriated tools and obsolete sites of manual labor.

The curator, Okwui Enwezor chose three intersecting “filters” by which to govern the thematics of the exhibition, with the goal of producing an aesthetic sense of the global political landscape: “Liveness: On epic duration,” “Garden of Disorder,” and “Capital: A Live Reading.” The three filters convened a set of artworks that articulated the profound turmoil of world politics while foregrounding the representation of labor and exploitation. While the exhibition emphasized the “liveness” of political formations with a focus on mass movements such as protests, immigrants, refugees, and humanitarian catastrophes, the performances, documentary testimonies, and other time-based media were set into relief by the persistence of historical ruins. Thus, the curator opens his statement by quoting Walter Benjamin's famous ninth thesis from his “Theses on the Philosophy of History” about Paul Klee's *Angelus Novus*:

A Klee painting named *Angelus Novus* shows an angel looking as though he is about to move away from something he is fixedly contemplating. His eyes are staring, his mouth is open, his wings are spread. This is how one pictures the angel of history. His face is turned toward the past. Where we perceive a chain of events, he sees one single catastrophe which keeps piling wreckage upon wreckage and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. The storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.¹²

Like Benjamin's angel of history, Enwezor invites a sensitivity to the wreckage of contemporary politics — the debris of failed nation states, abandoned buildings, archaic tools, all of which appear in consonance with a consciousness of the unemployed and other disenfranchised populations.

The most remarkable example of the exhibition's Benjaminian aesthetic was the Latvian pavilion, an installation by Katrina Neiburga and Andris Eglitis entitled *Armpit* (2015) (Figure 2). The installation was designed as a hybrid architectural structure, combining the style of an Eastern European woodshed (common in Latvia, whose prime export has traditionally been lumber) and the private garage, which has become the site of appropriation by cooperatives that repurpose them as workshops. Built out of recovered wood, brick, and metal fragments, the makeshift space of the pavilion featured photographs and videos of a world of male laborers — lumberjacks or rural

workers who, in their leisure time, or in periods of unemployment, take over garages to make a space for tinkering with electronics and other kinds of machinery. One corridor of the pavilion had a large workbench covered in old metal tools. The artists present garage culture in Russia and Eastern Europe characterized as an aesthetic ground, a “brutal techno-romanticism” that takes its inspiration from the Thoreau character in *Walden*, Alek Therien, who borrows an ax and fells some slender pine trees in order to build a hermit shack for himself. Yet, such spaces are predicated on labor that exceeds economic production.¹³ Where Thoreau’s *Walden*, and its meticulous inventory of basic supplies and acts of survival, offers a panacea to the suffocating drudgery of the work scene of the urban factory and its correlate poverty and sensory deprivation, *Armpit* recovers this aesthetic enrichment through the satisfaction of a labor without instrumental purpose or economic gain.



Figure 2. Katrīna Neiburga and Andris Eglītis. *ARMPIT*, 2015 – ongoing. Multimedia art installation. Still from the video. © artists, LCCA.

The curator of the pavilion, Kaspars Vanags, explains that the story of garage men inhabiting the periphery of Europe is a pastoral of the digital age. Yet, he calls their work a form of “self-exploitation as a leisure time activity... a time capsule where neoliberalism has enclosed the postindustrial proletariat.”¹⁴ He considers the terms of the pavilion’s aesthetic:

Here the rules adopted in the world of garages and lumberjacks are clearly felt. One can only guess what they might be... 1. The order of things must be at least natural, if not self-evident. 2. Functionality, with the exception of that associated with a woman, should not be beautiful. 3. Away with the decadent nonsense of metrosexuality — any woman knows that the hairy armpit of a man, albeit sweaty, is perfect for cuddling and feeling at home.¹⁵

Armpit presents an exclusively male world and yet even masculinity is laid bare as a subject formation in its obsolescence. The garage men combine a historical form of artisanship, with an equally long history of manual labor to make a new formation — a tinkerer who appropriates architectural structures in their demise and uses them for nonproductive labor. The wood fragments that make the scaffolding of the pavilion hark on the Latvian woodshed, and thereby suture the figure of the garageman with the tradition of artistic training in Latvia by which students would take over woodsheds as studios to train in plein air painting. Thus, the woodshed space sutures together the men's nonproductive manual work and the aesthetic sensibility for archaic spaces and tool-working.



**Figure 3. herman de vries, sickles from *to be all ways to be*, Venice Biennale, 2015.
Courtesy of the artist.**

Where the Latvian pavilion vividly reproduced these spaces of excess labor, other works in the Biennale take up the political trajectories of excess labor energy solely through the presence of the tools of manual labor in their nonfunctional state. herman de vries's installation, *to be all ways to be* in the Dutch Pavilion undertakes a deconstruction of nature and the agricultural landscape of the Netherlands (Figure 3). Each wall provided a grid of natural specimens — one wall a set of pigments derived from plant substances; another wall a set of samples of the plants themselves; on

pedestals stood a selection of minerals. In the middle of the room was a large circle composed of 108 pounds of dried rose petals whose aroma filled the room. Right next to this, the artist laid out a selection of dozens of sickles and plans. In this way, de Vries redistributes the historic episteme that connected nature, the peasant laborer, and agricultural production into a display of natural history by which botanical specimens and tools alike become artifacts in a common continuum. The manual tool becomes an archaeological entity; a fusion of geological matter and historical form excavated from the earth as though a new type of petroglyph: a petro-object.

Chinese artist Xu Bing likewise mobilized tools and construction debris in his monumental *Phoenix* (Figure 4). The work, actually a pair of two monumental phoenixes, originally commissioned for a set of office buildings in Beijing, is comprised of the remains of the urban development that took place when that city was preparing for the 2008 Olympics. Close inspection of the majestic forms yields metal panels, steel beams, chains, pipes, hard hats, saws, and other remnants of the construction sites. These ready-made components of the phoenixes were a tribute to the migrant workers enlisted to undertake the massive transformations to that city, as well as to the thousands of displaced people who were forcibly removed from their properties for the development projects. The work subtly preserves the evidence of this labor and exploitation, even as it revisits a grand national symbol of China's might. *Phoenix* gives full articulation to global capital itself: a new and beautiful Moloch that simply absorbs ever more elaborate forms of labor, leaving only the obscure material evidence of its energy source.

The rhetorical statement of the Biennale's visualization of labor is clear: the era of manual labor and its energies has been buried and encrypted in the bedrock of the earth itself, a tactic of containment in the era of finance capital. Yet, the remnants of labor return as petro-objects, artifacts of that buried labor. Moreover, it is not coincidental that the tools of labor qua archaeological object appears in an age when extractive technologies provide the global economy's most lucrative resources (fracking for oil and natural gas as well as mining). The staging of an excavation of the remnants of another era of labor signals the rendering inert of labor and its burial as the wasted remains of modernity. Moreover, these excavations make apparent the containment of labor as potential energy. (I would go so far as to describe labor power as a petro-fuel in its own right.) In this sense, the return of manual tools as art encompasses the formation of the labor class in the global economy as both an archaic energy source, and one that might be viewed alternatively as a displaced revolutionary power, here rendered as a sublime ethos in the manner Clark describes the energies of Millet's late paintings. The tools are laid out as neutral objects, but are available to be picked up once again. The archaeological aesthetic threaded through the Biennale galvanizes a consciousness of how prehistoric earthly energies, currently directed into the economy, threaten to change their valence and become revolutionary.



Figure 4. Xu Bing, *Phoenix*, 2015, construction site debris and materials, exhibited at the 56th Venice Biennale, Theme Exhibition, All World's Future, Venice, Italy, 2015.

Courtesy of Xu Bing Studio.

The Energies of Political Ecology

The Venice Biennale formulates a sense of the political landscape not simply by inferring a consciousness of the energies of labor that power the economy in petro-objects, but also by positioning these in “posthumous” environments and situations. (I take the term posthumous to refer both to the understanding of dead environments and the root of the word “humous”, to mean of the soil or earth.) That is to say, the curator’s recall of Benjamin’s angel of history is more than just an invitation to consider the ruins of modernity, vainly and melancholically trying to make sense of them in the aftermath of change; it is to do so with a specifically ecological thrust. Thus, the Benjaminian foundation of the exhibition takes on a new relevance as an earthly politics, charged by the possibility of a revival and redistribution of the intimate relationship between land and labor.

An ecological turn can be deciphered in the latent political energies that reside within the artworks, waiting to be activated by the viewer. In this regard, the exhibition demonstrates what Bruno Latour identifies as a vacillation between a modern notion of economy and ecology.¹⁶ In his *An Inquiry into Modes of Existence: An*

Anthropology of the Moderns, Latour outlines the fallacies of the modern worldview, and its emphasis on science and politics. He takes issue with how these respective models produce facts and truth claims that orient the knowledge of “the moderns.” Significantly, his analysis interprets “the moderns” anthropologically, which is to say, his deconstruction assumes a cultural distance by speculating on a worldview to come. Thus, he examines modern culture in hindsight, as a thing in the past, or at the very least, in its passing. This rhetorical device complements his argument which insists on viewing the world “crookedly,” which is to say, to understand the autonomy of ontological entities that are otherwise rendered invisible to the modern eye, but which are inferred in our very language. Where economy is a production of the modern paradigm that simply cannot account for the emergence of earthly disasters, including global warming and the disastrous positive feedback loops it creates planetwide, Latour advocates for a shift from economy to ecology, which would require an embrace of an entirely new and monstrous political sphere that includes such autonomous entities. His approach is deeply concerned with the speech acts that produce facts, and thus, as he puts it “the ancient division between words and things, language and being.”¹⁷ Ultimately, he seeks to galvanize language, which is otherwise deficient. Language, he says, has to be made capable of absorbing a pluralism of values. This absorption, though, would admit that words carry ontological weight, that they admit beings into existence, so that we regain the power to enter into contact with types of entities that had no place in modern theory, but which can find their place in a political ecology. He proposes a pluriverse as a new political sphere.

Latour introduces several “beings” in his anthropology, and he does so by making incisions into domains of knowledge, demonstrating how to give ontological weight to the beings that such knowledge produces, and then mapping their trajectories, conditions, and alterations to which they are subjected. Of particular relevance is his explanation of beings of technology, which he refers to with the graphic spelling, “[TEC].” Latour executes his own version of Heidegger’s breakdown of technology into the fourfold causes, rejecting the modern penchant for associating technologies with inventions, means, or extensions. Instead, he approaches the concept through the essential qualities of technological beings, namely their capacity for shifting us through displacements in time, in space, and in the type of actor. Technological beings take us through but also implicate us in a global equipment that operates through an altered causal logic. He calls this the recoil effect of technological beings. Humans are not the origin of action (we do not act on matter or manufacture through technology). Rather, humanity is the recoil of a technological detour. The history of technologies is a slow anthropogenesis, a co-extant becoming human and inhuman.¹⁸ Latour therefore aims to free technological beings from any association with instrumentality and, in doing so, shift from the association of technologies with modernization, instead to suggest that when we encounter technological beings, we “ecologize” and are ecologized.

Latour's understanding of technology in the context of ecology is relevant insofar as it opens a way to understand shifts in the valence of political energies in and through technology. Insofar as Jameson notes that the political field is divided between the political energies of hope in capitalism's innovativeness and anger at its exploitative nature, Latour provides a way to view this dialectic as integrated into technological beings and to see ourselves as possessed by technology, within living assemblages of technological equipment. Such an assemblage is the ecological refiguration of Marx's Moloch. Instead of a monstrous self-consuming system, the economy might rather be viewed as an autonomous and heterogeneous technological being that, rather than consuming its own energy source, could be politically charged and redirected from that very source. That is to say, in as much as we are becoming ecological, and as much as we are ecologized (whether we like it or not) by capitalism, its forces and trajectories can be and (must be) taken hold of via an understanding of its energetic systems. In this way, it becomes clear that new materialism emerges from historical materialism, and is strengthened by the acknowledgement of the latter's complex account of the intersections of economy, technology, labor power, and representation.

It is therefore possible to link the recurrence of petro-objects and their archaeological formulation to the capitalist assemblage of extractive technologies by which capitalism powers and consumes itself. Petro-objects represent labor as the prehistory of modern capital — the burial of labor is precisely the procedure by which to render invisible the unemployed who fuel capitalism. Yet they are also provocations to exhume labor force, to see its energy as potential rather than as always already spent. A re-valencing of its energies might therefore be possible through a crooked interpretation of its machinery. We might, for example, see in Xu Bing's phoenixes a revolution of China's migrant workers in its dormancy rather than a show of that country's global economic might. Moreover, the work does not merely dazzle the viewer with yet another display of China's technological prowess, which traditionally displays itself as the sight of masses of people working together as a multitude, whether in factories, public assemblies, or the spectacular choreography of the Olympics. Instead, *Phoenix* charts a map for a reversal of the technological assemblage — each tool was wielded by a worker, who, in joining together with others could potentially take hold and redirect labor power. The work reads the image of the phoenix against the grain of a narrative of imperial resilience and instead subtly asserts a consciousness of labor power as a technological assemblage in and of itself.

Two sets of sculptures in the Arsenale section of the Biennale illustrate this point about the shifting of energies of the capitalist assemblage. Melvin Edwards encapsulates the artistic gesture of petrifying manual tools in order to revive buried histories of oppression. Known for his *Lynch Fragments* series, in which he addressed racial violence and the civil rights movements in the U.S., Edwards exhibited a sample of works that reference different phases of American activism from the 1960s, '70s, and beyond. His sculptures, such as *September Portion* (1991), and *Texas Tale* (1992) are

composed of steel tools — shovels, pitchforks, hooks and chains — fused together into amalgams that suggest the manifold affordances of such objects, whether the instruments of specific forms of labor, the paraphernalia of enslavement, or the weapons of violent uprising (Figure 5). The fragmentary forms are thus invested with a generalized force in its petrified state, but nevertheless infer multiple avenues for the deployment of that force.



Figure 5. Melvin Edwards, *Texas Tale*, 1992. Courtesy of the artist.

Monica Bonvicini likewise created two sculptural amalgams for her *Latent Combustion* (2015) (Figure 6). Here, a grouping of chainsaws and leather straps were cast in concrete and covered in black liquid rubber, and then hung by chains from the

ceiling. Though the chainsaws are perhaps among the most threatening and distinctly masculine of tools, nevertheless, the layout suggests an erotic overlay inspired as it is by the mise-en-scène of S&M sex clubs, so that the suspended grouping of tools is yielded to a libidinally charged probing of the objects' potential energies, rather than their direct deployment in the context of capitalist production or exploitation. The title of the piece, *Latent Combustion*, implicitly draws the amalgam of tools into the domain of energetic systems. Yet the implied combustion is not that of a broiling factory but rather of the expenditure of energies through which subjects constitute (or perhaps reconstitute) one another in practices that deploy tools that have been unexpectedly cathected by their uses in sexual scenarios. The restaging of dominance and submission through the specific roleplaying of power in the S&M encounter not only intimately connects the respective subject positions through the performative use of technological extensions, it does so in such a way as to reveal the potential affordances of those same tools. Thus, not only are the tools recontextualized from scenes of domination through labor to scenes of sexual roleplaying, they also become devices used to take control and redirect the valences through which power relations are forged. Thus, for both Edwards and Bonvicini, the historic tools of labor, though displayed in their latency, seemingly demand to be taken up in the service of energetic potentials that would revalence the assemblages in which we are imbricated.

I link the staging of petro-objects at the Biennale to what Jacques Rancière describes as Walter Benjamin's "archaeomodern turn."¹⁹ Insofar as the curator identifies Benjamin's visualization of modernity in ruins as a guiding trope, the petro-objects of the exhibition are connected to Benjamin's specific materialist history read through the debris of modernity. Benjamin applies his variations of Marxist dialectics specifically to the phantasmagoria of the arcades. Rancière examines Benjamin's dialectical turns that ensue from the specifically archaeological condition. Benjamin shifts the Marxist dream of emancipation to a deferral of that dream through its positioning in a prehistoric (archaeological) fantasy in which emancipation is both in a state of ruins and anticipated as a future to come. He then enacts an infinite regression of emancipation that sinks ever deeper into an archaeomodern phantasmagoria.²⁰ This spiraling movement takes place through linguistic, spatial, and figural turns. Rancière argues that the modern drive forward and postmodern fragmentation were always already dialectical accomplices and that Benjamin leverages the dialectic into a radicalized state of irretrievable meaninglessness. If Hegel characterized the modern condition as an opposition between the prose of modernity (the linguistic mode of economy, bureaucracy, science, and philosophy) and the failure of romanticism (symbolism as the mind trapped inside itself, unable to exteriorize and realize itself as representation), he equally leveraged from this opposition the possibility of a modern imagination with a figurative faculty: a form of reason that is captive within the exteriority of representation, sealed up in exteriority, a "thing of reason." From this, Rancière opposes two fantasies of reason: a "bad" one in which reason is

simply anachronistic and anarchical, and a “good” one, in which reason is sealed in its prehistory, a lateness that is also an anticipation of interpretation, reading, deciphering.²¹ Thus can we understand Benjamin’s archaeomodeln turn as one in which the emancipation from the prose of science and philosophy takes place by locking up the dispersive power of meaning, to make a “sleeping meaning, waiting for its liberation but also anticipating it.”²²



Figure 6. Monica Bonvicini, *Latent Combustion*, 2015. Courtesy of Studio Bonvicini.

Potential Energies and the Archaeomodeln Tool

In this vein, Rancière argues that Benjamin establishes a classic opposition between the factory, the Marxist substructure and presumed original scene of labor oppression, and the arcades, as the superstructure of bourgeois leisure, desire, and consumption. However, Benjamin reverses their position, so that the phantasmagoria of the passages become the originary scene of emancipation: the site where reason and the potential for emancipation are encrypted in a fragmentary state, where it sleeps but also, importantly, where it generates a dream of reason and awaits liberation. Not only has the superstructure become the substructure, but the arcades enact a perpetual deepening of the dispersal of reason. Instead of a demystification of the commodity and its scenes of display and discard, Benjamin finds us engaging more deeply with

it, regarding it archaeologically in the sense that we follow it backward in time, discover the dialectical opposite of modernity in its prehistoricity, its “not-yet” and unfulfillment as a dream of the future to come.

The archaeomodern turn presupposes a new turn — one turn *more*. The deeper the dream, the further the awakening, the more consistent is the evidence of the modern cogito, of the collective subject of modernity. Just as the sleep has become a dream, the dream becomes a phantasmagoria... So the logic of the archaeomodern might be a logic of the one-turn-more, a logic of the *regressio ad infinitum*, located at the core of the modern project.²³

This infinite regression brings Benjamin’s intervention to its full radicality. Yet, it is not without risk as well. Insofar as Benjamin sets the scene for the phantasmagoria as archeomodern return, it invokes a collective, heterogeneous subject position to undertake the recovery and awakening of meaning. There is no presumption of who the revolutionary subject will be — not the bourgeoisie or the laborer — only a radical opening of liberatory subjects. Moreover, there is always the risk that Benjamin’s turns of Marxist dialectics defect to a postmodern condition: an intensification of the phantasmagoria to the point of its reification as simulacrum. Yet, Rancière insists that Benjamin’s ultimate contribution, the final turn of his archaeomodern spiral, is his insistence on a Messianic philosophy which takes the form of a counter-theology whereby the redemption of the object is predicated on the total foreclosure of its extant meaning into arbitrariness and indeterminacy. Hence, the impetus to disidentify with heritage or the ruling order takes the form of a catastrophic blast of the present into ruination. In this way, he reminds us that the phantasmagoria is also a *Lethe*, a river of the dead where:

[M]eaning is produced as the presence of death-in-life and deciphered as the presence of life-in-death. By contrast, a detheologized Benjaminian approach would be tantamount to a ‘postarchaeomodern’ turn, the commodification of everything, the museumization of the shopping mall, a bourgeois dream that remains bound to the victor. Such a discipline would amount to nothing more than a history of the social imaginary as narration of economic processes and social relation — a materialist geography as antique shop or world fair.²⁴

Herein lies the connection between Benjamin’s phantasmagoria and the vitalism at the heart of Bruno Latour’s political ecology. I am suggesting that between the petro-objects and their inference of vital assemblages, the Biennale invokes the emergence of as yet unknown political energies nested within the death and suffering of the

capitalist economy, in its very wreckage. As such, it occasions an emancipatory dreaming that disassociates the petro-object from its originary modern contexture, and imagines it in operation in a different assemblage, politically charged through a crooked interpretation of its potential use or disuse.

The Heterogeneous Energies of the Petro-Object

Fredric Jameson argues that where it is often assumed that Marx conceived of the unemployed as a secondary feature of capitalism, in fact his figurations of capitalism demonstrate the centrality of structural unemployment, a condition that comes to the foreground as one of its core contradictions today. However, it takes the form of massive populations who have “dropped out of history”: failed states, victims of famine and other natural disasters, ethnic genocides that are funded and fueled by First World countries, and other populations who are managed through NGOs and international philanthropy.²⁵ At the 2015 Venice Biennale, this reserve army of the unemployed is inferred through an archaeo-modern lens, in manual tools presented as petro-objects. Such a lens exposes the fact that this reserve labor force has been consumed by the self-sacrificing system — Marx’s Moloch — subsequently buried and lost to history. Yet the curator produces a speculative environment for the recovery of such populations, in the inferences of the energies of their sacrificed labor. These energies become visible as an excavated geological force — tools discovered as though with no preconceived knowledge of their potential use. Such a neutralization of the tools of labor in a posthumous environment generates an alternative perspective of the global condition.

As Latour suggests, we might view technologies themselves as integral to a more expansive and autonomous assemblage of beings. Thus, we might view the energetic field of petro-objects retroactively and proactively, not simply in terms of the encrypted labor energies they harbor, but the potential political energies that they channel forth. Though, as Rancière suggests, such a reading of capitalism’s ruins take place in a *regresio ad infinitum*, so that the object is radically severed from its original installment in the technological equipment of modern labor. Yet, it is precisely the infinite deferral of an instrumental use of the petro-object that yields an opening to the heterogeneous energies of the concealed populations of the unemployed. The petro-object may, then, be the lightening rod for the polyvalent energies of a political ecology that opens the way out of capitalism’s self-expansion — a landscape of historical figurations that awaken the energies of labor from the crypt of a dying earth.

Notes

1. Fredric Jameson, *Representing Capital: A Reading of Volume 1* (London: Verso, 2011) 132, emphasis mine.
2. Karl Marx, "Addenda. Revenue and its Sources. Vulgar Political Economy," *Theories of Surplus Value, Capital Volume IV* (Moscow: Progress Publishers). <https://www.marxists.org/archive/marx/works/1863/theories-surplus-value/>.
3. Jameson, *Representing Capital* 145–146.
4. *Representing Capital* 146.
5. *Representing Capital* 147.
6. The Endnotes Collective, "Misery and Debt: On the Logic and History of Surplus Populations and Surplus Capital," *Endnotes 2* (2010) 20–51.
7. Endnotes Collective, "Misery and Debt" 149–150.
8. T.J. Clark, *The Absolute Bourgeois: Artists and Politics in France 1848-1851* (Princeton, New Jersey: Princeton UP, 1982) 72–98.
9. Charles Baudelaire, in Clark, *The Absolute Bourgeois* 73.
10. *The Absolute Bourgeois* 79.
11. *The Absolute Bourgeois* 82.
12. Walter Benjamin, "Theses on the Philosophy of History," *Illuminations*, ed. Hannah Arendt, trans. Harry Zorn (London: Pimlico, 1999) 249.
13. Indeed, in *Archaeologies of the Future*, Fredric Jameson describes utopian space precisely as a workshop, "a garage space in which all kinds of machinery can be tinkered with and rebuilt." On one hand, he notes that these enclaves are aberrant by-products of social change, like an eddy in a current of progress and therefore not integral to a practical politics, and yet their existence at all registers the existence of agitation in the midst of transitional periods. Fredric Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions* (New York: Verso Books, 2005) 15.
14. Kaspers Vanags, *Armpit: Katrina Neiburgs and Andris Eglitis, Latvian Pavilion* (Venice: Biennale Arts, 2015).
15. Vanags, *Armpit*.
16. Bruno Latour, *An Inquiry into Modes of Existence: An Anthropology of the Moderns*, trans. Catherine Porter (Cambridge, MA: U of Harvard P, 2013) 8–9.
17. Latour *An Inquiry into Modes of Existence* 20–21.
18. *An Inquiry into Modes of Existence* 231–232.
19. Jacques Rancière, "The Archaeomodern Turn," *Walter Benjamin and the Demands of History*, ed. Michael P. Steinberg (Ithaca: Cornell University Press, 1996) 24–40.
20. Rancière "The Archaeomodern Turn" 24–40.
21. "The Archaeomodern Turn" 26.
22. "The Archaeomodern Turn" 27.
23. "The Archaeomodern Turn" 28.
24. "The Archaeomodern Turn" 39.
25. *Representing Capital* 148–149.

Keeping the Lights On: Oil Shocks, Coal Strikes, and the Rise of Electroculture

David Thomas

Writing as the belle epoch drew to its acrimonious conclusion amid a hail of pickets and truncheons, Raymond Williams took issue with a stagist model of social analysis that has remained a stubborn feature of historiographic writing into the present. Williams complained that a scholarly preoccupation with "epochal" social formations often occluded recognition of the historical movements and tendencies that were concurrently active "within and beyond" the "dominant" regimes.¹ Intent on moving beyond this kind of blinkeredness, he prompted cultural sociologists to focus more intently on the effects of "residual" and "emergent" forces, thereby attempting to grasp historical and cultural processes in all their contingent and mutually determining dynamism.² In this chapter I apply Williams's triadic conceptualization of social process — one attentive to the effects of residual, dominant, and emergent forces — to the study of energy systems and their attendant "energy cultures." I attempt to draw out the political implications of these imbricated systems' different technological and social compositions. Repurposing the term "electroculture,"³ I claim that a distinctive set of social formations and relations of production emerge in the wake of the 1970s energy crisis, as policymakers start to develop electricity into the signature fuel — and material medium — of a sweeping cybernetic restructuration of the global energy system.⁴ Yet, in accord with dynamics that Williams found to be typical of historical process, the mainlining of these new technologies not only changed the structural practices of the dominant petroculture, it also served to reactivate residual modes of class struggle that had first been developed in the heyday of steam. As Britain's miners attempted to assert their interests in the context of a changing energy system they used modified versions of their old steam-era tactics to force the British government into an embarrassing series of political capitulations. The short-term success of their struggle hinged on the historical irony that the U.K.'s electricity — the lifeblood of the cybernetic turn — was in large part a product of domestically mined coal.

In discussing "energy cultures" in this fairly loose and expansive fashion, I define

“culture” in the broadest possible sense, and again I follow Williams in considering it as the shared experience of “the institutions, manners, habits of thought, and intentions” that together constitute a way of life.⁵ Yet in focusing on energy I also take up Imre Szeman and Dominic Boyer’s claim that “[w]e can no longer fully understand developments in culture, society, politics, and economics without paying attention to the role played by energy in each domain.”⁶ I build on this contention by attempting to parse the distinct forms of life and modes of struggle that arise through the socio-ecological production of the different — and overlapping — energy systems that are concurrently operative in a given time and place. For energy systems do not simply “power” life in a hidden or subterranean fashion. They are instead lived in such a complete way that we can begin to identify “the institutions, manners, habits of thought, and intentions” that are proper to each. Despite the near self-evident truth of this claim, however, it has taken a surprising amount of time for historiographic analysis to acknowledge how fully questions of energy have determined the unfolding of political struggle and technological development. Indeed, as I review key materialist accounts of the miners’ strikes and the cybernetic turn, it is clear that — with the notable exception of George Caffentzis — contemporary commentators have a tendency to overlook energy’s central significance. Thus at the same time as this paper seeks to revive some of the central categories of Williams’s historiographic theory, it also seeks to address the energy lacuna that reside at the heart of his account of this cycle of struggles.

The Body Electric — Defining Electroculture

The logic of understanding steam and petroleum systems as “residual” and “dominant” is perhaps obvious enough not to warrant too much explanation. But the idea of petroculture being slowly modified and displaced by the emergence of electroculture is arguably more contentious. Can electricity even be said to be a fuel? There is something inherently ambiguous about the abundant and precisely controlled electron flows that now mediate and animate so many facets of life and work in the present day. For one thing, we can never be entirely sure of their provenance. Though “noiseless and, at the point of conversion, absolutely clean,” we know that electricity is produced through diverse means.⁷ Some, such as nuclear fission and coal combustion, threaten titanic forms of ecological misadventure. Others, such as solar and hydro, promise to help the world system evade the grim prospects of climate change and nuclear disaster. No such ambiguity surrounds the combustion engine. We have but to turn the key to see the chemical agents of anthropogenic climate change escaping from the tailpipe. Yet in activating an electrically powered device we are left unsure if the current that supplies it is carrying us into a cleaner future, or a hotter, darker, and dirtier tomorrow.

Electricity’s ambiguity stems from the fact that — unlike the other fuels that we routinely use in the course of a day — it cannot be traced back to a signature

raw material such as natural gas or oil. In the bulk of its industrial and commercial forms, we encounter electricity as a flow of electric current produced through the turbine-driven rotary stimulation of electromagnetic fields. Channeled through the conductive mediums of wires and cables, traveling at somewhere between 50 to 99 percent of the speed of light, electricity is deployed on a planetary scale with industrial force. Moved with infinitesimal precision through silicon microchips in the near instantaneous interplay of billions of mutually responsive transistors, electricity serves as the universal medium of late capital's social-machinic cognition. This comprehensive range of applications has allowed developers and policymakers to use electricity as a terraforming agent, a means of propulsion, and an unrivaled means of informational production and exchange. Energy historian Vaclav Smil writes that the "precise control" of electrical delivery now ranges "from less than one watt for the most efficient microchips to multi-gigawatt flows in large national or regional grids," while its "focused applications" can be found "on any conceivable scale... from micromachining to powering the world's largest excavators and the world's fastest trains."⁸ The near universal range of the potential use values of electricity — even commercial electric flight now seems within reach — allows global governance to countenance the possibility of a wholesale transition to a post-fossil fuel economy.⁹

Yet although the distinct features of what I define as electroculture begin to predominate in the wake of the 1970s energy crisis, it can of course be argued that electroculture began its emergence much earlier. Key breakthroughs in electrical engineering — including the development of experimental electrical trains — were made throughout the nineteenth century, and the world's first electrical supply network was operational by the century's close. The rapid pace of technological innovation that characterized the two world wars also led to key electromagnetic communicational developments such as radio, sonar, and the proto-computer, the Turing machine. In the immediate postwar period, electric lighting and consumer electronics such as refrigerators and radios began to wind their way into the vast bulk of households in high-income countries, while state subsidized research and development departments established the foundations of what Ernest Mandel describes as a "third industrial revolution."¹⁰

It was not, however, until the oil shock of the 1970s that global governance began in earnest to build toward deploying electricity as its signature fuel and its key instrument of worker control and production management. Doubtless, much of the groundwork had been laid in the immediate postwar period. Written at the close of the 1960s, Mandel's magisterial *Late Capitalism* had already identified the harbingers of a "third industrial revolution" centered on computing technology and the intensified automation of the productive process. Yet Mandel's work, so pioneering and prescient in its vision, was still in some respects the fruit of a more energy-innocent age, one that had not yet been compelled to fully countenance the complex socio-ecological contingencies and consequences of capital's ever-deepening

dependency on fossil fuels. Indeed, from our own vantage, it is genuinely surprising that the 1975 English translation of *Late Capitalism* declines even to index the word “energy.” Historiography’s apparent reticence to grasp the historically determinative significance of energy is, however, in no way characteristic of attitudes in policy making circles of the era. Arriving only a few years after the first publication of Mandel’s magnum opus, the 1970s energy crisis brought the matter of energy to the forefront of policy making agendas. And as the initial computational research that Mandel so exhaustively documented concurrently issued in the development of the microchip — Intel launched the world’s first commercial microchip, the 4004, in 1971 — the stage was set for the full emergence of electrocultural policymaking.

After Oil? — The Energy Crisis and the Electrical Fix

The emergence of electrocultural policymaking in key economies such as the U.S. and the U.K., unfolds through two key initial phases. In its first phase the dominant concern of policy makers — spooked by the prospect of peak oil — is that of energy efficiency. Yet, in time, the immediacy of concerns over the burgeoning stagflation crisis begin to override the initial long view. In the U.K., electrocultural policymaking enters its second phase at the cusp of the new decade as Tory party think tanks begin to consider redirecting information technology as a means of improving the “economic efficiency” of the entire productive process. As other governments plotted a similar course, and as the original goal of energy efficiency was made increasingly subordinate to the concept of cost efficiency, the total energetic inefficiency of the world system increased dramatically. Commodity production became a fully globalized phenomenon, distributed across immense intercontinental tracts of time and space. The search for deeper profit margins (“cost efficiency”) saw capital reaching out beyond the old industrial zones, undertaking kilowatt-hungry logistical projects whose end goal was the exploitation of less politically enfranchised workforces. As this tendency became increasingly normative, the effect of this cybernetically orchestrated, just-in-time productive process was to make global GDP contingent on a globalized energy system that relied on continually escalating levels of electrical input. Concurrently, under the ideological banner of “globalization,” shipping lanes and supply lines multiplied and proliferated, leading to the consolidation and expansion of a global seaborne petroculture. This restructuration led to massive carbon outputs, and dependency on coal (and, ironically, oil) has only substantially increased year over year in the aftermath of the oil crisis. In their initial attempts to improve capitalism’s energetic efficiency, planners accelerated carbon emissions as they increasingly redesigned the global energy system around coal, an energy-dense fuel whose combustion is now regarded as the single greatest source of global carbon emissions.¹¹

The proximate causes of our own climate quandaries are, then, in evidence in the “fixes” that capital’s developers and policymakers supplied to an earlier series of

problems that first erupted around the so-called energy crisis. The “oil shock” had been very keenly felt in the United States; indeed, disquiet rippled throughout oil-dependent economies of the global north. With oil production in the U.S. in apparently terminal decline, the Organization of the Petroleum Exporting Countries (OPEC) began to flex its new-found political clout, enacting an oil embargo in response to the U.S.’s support of the Israelis during the 1973 Arab-Israeli War. The resulting shortfalls in oil supply had complex and varied consequences, helping to destabilize the already sluggish global economy, and forcing the Global North to reconsider the geopolitical ramifications of its oil dependency. A new “energy security” discourse emerged in key policy making circles of high income countries.¹² Oil companies began to diversify, investing in coal production in low-income countries, while governments began to consider how they could lessen their dependency on OPEC. In addition to the immediate geopolitical considerations, the jarring prospect of fossil fuel exhaustion — prefigured by the depletion of the U.S.’s vast oil reserves — lurked in the background, and determined the subsequent strategizing by elites.

The response of planners and experts was more considered than a simple reshuffling of their primary fuels. As elites began to consider the prospect of transitioning away from “the oil-auto assembly line economy of the post-war era” their emphasis was not just lessening oil dependence, it was also on increasing the efficiencies of the entire energy system.¹³ In 1975, key U.S. energy advisor — and one time member of the Manhattan Project — Edward Teller drafted a document that exemplified this logic. Moving away from the rough parity that had been established between oil and electricity consumption in the U.S.’s postwar years, Teller’s “Energy: A Plan for Action” “envision[ed] a radically new system where electricity would demand 50 percent of the total energy, with transportation reduced to 11 percent.”¹⁴ Though anti-nuclear activism and concerns over profitability hindered the development of the nuclear generators that Teller saw as crucial components of this plan, and though electricity use has yet to overshadow transportation to the extent that Teller projected, his roadmap for energetic consumption proved influential. The erstwhile dominance of oil slipped into decline as coal began to regain its market share. And as the planners’ IT-driven restructuration began to unfold, the British coal industry, which had been in constant decline in the postwar period, temporarily regained political traction.

But to supply this emergent electro-economy it would initially be necessary to once again ramp up coal production and bring a new generation of nuclear reactors online. Britain was at the forefront of these developments, with the publishing the government white paper the *Plan for Coal* in 1974, and the commissioning of a new series of nuclear reactors the following year. At the heart of the *Plan for Coal* was a new cybernetic flow monitoring system, dubbed MINOS (Mine Operating System), a “highly centralized, hierarchically organized system of remote control and monitoring in mines comprised [of] a series of computerized systems, which allowed control

room operators, as remote supervisors, to collect data and monitor the work of the miners.”¹⁵ This system offered an exemplary instantiation of the strategy that Teller proposed, in which cybernetic systems were mainlined as a means of pushing back against the “inefficient” depletion of the earth’s reserves of usable energy:

Computers have been introduced in central control stations to control inertia for the purpose of optimizing the use of energy by drawing at any time on the cheapest available source of electricity. These computers are also beginning to be used to store and display data about the state of the major components of the generating plants and transmission lines.¹⁶

In the British context — and extending somewhat beyond the plan Teller proposes here — cybernetic technology would be used to manage the energy commodity chain’s every stage, from extraction of raw materials, to distribution of the final product. Faced with the contradictory demand to ensure economic growth while reducing inefficient energy expenditures, the precision with which electricity could be delivered and monitored helped establish it as the informational medium and preferred fuel of the cybernetic restructuring. The functioning of the global economy’s fixed capital rapidly became, in Smil’s words, “universally” contingent “on electronic monitoring and automation” as “electricity’s role as the controller, regulator, and enabler of materials and information flows became... fundamental” to every aspect of the productive process.¹⁷ From this juncture onward capital became more and more irreversibly dependent on electrical current, to such an intrinsic and intensive extent that it would soon become easier to imagine the end of the combustion engine than the end of computing.

By increasing efficiencies, engineers hoped to forestall the danger of resource depletion. Yet in a historical irony that was intrinsic to this particular strategy, the very methods used to ward off the danger were themselves dependent on electrical current. Planners found themselves locked into a recursive loop in which they improved energy efficiency at the same time as electrical demand underwent ongoing expansion. Smil identifies the essential fallacy at the heart of this “anti-limitationist” approach by repeating “Jevons’s venerable paradox” that “it is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.”¹⁸ But despite its apparent contradictions, the anti-limitationist strategy helped to kick-start the frenzied pace of innovation that has defined the tech industry since the early 1970s, leading to the “rapid doublings of performances” and “relentless decline in prices” that has characterized the industry in the intervening decades.¹⁹ A relatively simple material strategy underlies the subsequent complexification of computational technology, in which developers sought an “ever-denser” concentration of transistors on microchips, in order to accelerate the number of multiple inter-transistor exchanges that

could be executed in increasingly tiny fractions of time.²⁰ Innovations within this sector reshaped the productive process, and its attendant social relations, to such a comprehensive extent that it became difficult to grasp the full scale of their impact.

Importantly, however, it has thus far proved all but impossible to replicate the technological gains made in the area of microprocessing in the domain of energy production itself. While consumers in high-income countries have been acclimatized to exponential growth rates in the speed and complexity of information technology, we have yet to find “any established energy production or conversion technique” capable of following the “path of improving performance” that characterized the “microchip era” that was initiated in 1971.²¹

One way to conceptualize the divergent technological tendencies that have subsequently defined electroculture is to distinguish between the system’s “input” and “output” sectors. In the latter sector, microprocessing technology spearheaded a massive cybernetic transformation of the productive process, one that was premised on unlocking the unique material properties and use values of electricity. Although the effects of these developments were certainly felt in the former sector — most notably in management’s deployment of cybernetic flow-managing technologies in mines and power plants — no comparably radical revolution of electricity generation actually materialized. Instead, as the projected transition to nuclear stalled it could even have been said to have undergone a prolonged regression, as policy makers and investors increasingly fell back on technologies whose fundamental operational principles were known to the nineteenth century. Identifying this problem, while critiquing the key fallacy at the heart of capital’s stubborn attachment to its anti-limitationist energy strategy, Smil writes:

Any expectations that the future performance gains of renewable energies in general, and solar PV [photovoltaic] electricity generation in particular, will resemble the post-1971 record of packing transistors on microchips are thus a consequence of succumbing to what I have called Moore’s curse, an unfortunate categorical mistake that takes an exceptional performance as a general norm of coming technical innovation.²²

In referring to this “categorical mistake” as “Moore’s curse,” Smil alludes to Gordon E. Moore, the computer developer who first forecast microprocessing’s decades of exponential developmental growth. Writing in 1965, Intel’s cofounder correctly anticipated the annual to biannual doublings of transistor density that defined technological advance in the coming decades. This phenomenon — which has only begun to wane in very recent years — was subsequently dubbed “Moore’s law.”

Smil’s somewhat classicist recasting of Moore’s prediction is designed to illustrate that the cultural experience of these developments fatefully warped popular understanding of technological innovation. In contrast to Teller’s hopes, it has thus

far proved all but impossible to reconcile the conservation of usable energy with the rapid development of an ever-more automated and energy-hungry productive process. In Smil's estimation, the only reason that this situation surprises us is that consumers in high-income countries have been habituated to the lived experience of Moore's law, and have thus come to mistake an exception set of circumstances for a universal norm. A more sober appraisal of the underlying dynamics forces us to confront the fact that planners are given little scope to reduce absolute energy consumption when energy demands are at the same time being universally expanded in order to sustain the continually rising organic composition of capital.

From "Energy Crisis" to "Climate Crisis" — The Developmental Arc of Electroculture

There are, however, some signs of progress in the domain of renewable energy generation. Peter Simon Vargha — Chief Economist at Hungarian oil and gas company MOL — avers that there is good reason to anticipate a more rapid and economically viable energy transition than agencies such as the IEA (International Energy Agency) have tended to project. Indeed, highlighting "collapsing" renewable energy installation costs, Vargha argues that we are fast approaching a crucial "tipping point" in an emerging energy transition.²³ Writing in 2015, Vargha noted that rapidly changing energy markets have seen the IEA compelled to modify its renewable energy outlooks in a more favorable direction, with every recent report heralding a progressively larger market share for the emerging technologies. His reading of this overall trajectory was apparently confirmed as the IEA's 2016 WEO (World Energy Outlook) report recently trumpeted the "decoupling" of global emissions and economic growth.²⁴ An encouraging, but by no means, specular development lay behind the sweeping rhetoric: The IEA had found that global carbon dioxide emissions had held steady at 32.1 billion tons, "having remained essentially flat since 2013."²⁵ The institution's "preliminary data" suggests that emerging renewable energy markets played a key role in these developments and attributes much of the apparent success to progressive Chinese policy making initiatives. They concluded that China's "restructuring towards less energy-intensive industries and [its] government's efforts to decarbonize electricity generation pushed coal use down."²⁶ To what extent this reduction of carbon emissions and coal usage simply indexes the much-storied slowdown of the Chinese — and, indeed, global — economy is something that the report declines to address.

Yet however capital's energy future actually unfolds, thanks in no small measure to Smil's decades of research, the basic outlines of electroculture's historical development are now clear. While the development of electricity's potential applications unfolded with intensifying velocity, the technologies used to *produce* electricity stagnated and became increasingly dependent on fossil fuel driven turbines. While decades of climate science struggled to divert policy making attention from "energy crisis" to "

climate crisis” these divergent trends continued to ramify leading to a contemporary situation in which capital’s championing of the apparently “immaterial” tech industry manages to both mask and exemplify its underlying and ongoing dependency on the carbon-driven engines of anthropogenic climate change. For the time being, the net effect of these dynamics is that the signature products of the tech industry — the microchip, device, server, automaton, and network — form a complete postindustrial circuit with the power plant and the strip mine.

The situation in which we find ourselves is not, as I have already begun to suggest, simply a product of random contingencies or inadequate foresight on the part of planners. The conflicted developmental arc of electroculture was determined as capital’s general laws of motion — specifically the tendency of the organic composition of capital to rise — became embroiled with the complex material structures and feedback loops of the world’s ecological systems. Compelled by its inner laws of motion to intensify the automation of the productive process, capital has become more and more deeply dependent on electricity, the indispensable fuel of its most sophisticated technologies, and the effective material lifeblood of its key monopolies in the tech industry.

It is no accident that it is within these fields that capital’s postindustrial circuitry works at the highest rate of profit. Indeed, as the viability of the entire postwar valorization process became increasingly contingent on more and more rapid cycles of technological renewal, innovators in key sectors were well placed to effectively monopolize the “technical process.” As Mandel demonstrates, in the postwar period “technological rents” become a key means of profit extraction as “discoveries and inventions which lower the cost of commodities but cannot be generalized (at least in the medium-run) become generalized throughout a given branch of production and applied by all competitors.”²⁷ The structural dynamics that underlay the exercise of “technological rent” are facets of the general functioning of monopoly capital itself, where “difficulties of entry, size, of minimum investment, control of patents, cartel arrangements, and so on” allow key players to function as the gatekeepers of economic survival.²⁸ George Caffentzis identifies a similar set of fundamental patterns at play within the energy sector. In a key essay from the early 1980s, Caffentzis argued that utility companies and extractive industries were now effectively extracting a “power tribute” from a vast network of consumers who depended on electricity for the very reproduction of life.²⁹ It was not only the productive process that demanded escalating energy inputs, but the reproduction of human bodies was now a predominantly electrocultural phenomenon.³⁰

Yet while this deepening electro-dependency resulted in an intensely sophisticated productive process, capital has yet to evolve a means of generating electricity that has proved capable of freeing it from the prospect of massive ecological blowback. In understanding this divergence it helps to recall there are two very different kinds of material and infrastructural challenge under discussion here. Microprocessing — the

beating heart of the automotive turn — relies on the construction of tiny, intensely complex, channels and gates for electrical current. To give an idea of the current complexity of the technology we could look to the Xilinx, which chip boasts the largest FPGA (Field-Programmable Gate Array), containing more than twenty billion transistors. Energy production entails the massive planetary-scale harnessing of the world's contingently concentrated animate forces. The different scales of magnitude on which these tasks are necessarily pursued should not be overlooked, for as the mathematical biologist D'Arcy Wentworth Thompson demonstrated in his study of organic life forms, the intrinsic potentialities of material enterprises are always in key respects determined by the divergent ways in which physical forces impact material structures of different size.³¹ Indeed, the scale of fixed capital's energy appetite has increasingly forced planners into a corner. As governments backed away from fission generators — in deference to public fears over the potential scale of nuclear disasters, and in response to unpromising returns on their investments in nuclear power — they retreated to the use of fossil fuels, a familiar set of energy sources that still, in time, served as the causes of a wholly unfamiliar set of world-ecological quandaries.³² Yet in many respects the apparently divergent prospects of nuclear disaster and climate crisis simply recognize the same fundamental problem: postindustrial capital's energetic appetite now necessarily plays out on a fully planetary scale, with fully planetary consequences.

Lights Out — Syndicalist Struggle in the Age of Microprocessing

With these far broader considerations in mind, I want now to return to the case study that anchors this essay. For despite the conflicted and confounding outcomes of the anti-limitationist turn to electricity, for the British coal miners of the 1970s the changing policy-making climate arrived as an unanticipated boon. In the golden age of Fordist petroculture, oil cut radically into coal's market share, but in the years following the oil crisis of 1973 this transition slipped into reverse. In the immediate postwar period, British coal supplied more than 90 percent of Britain's inland energy consumption: "This coal was priced below what it would fetch on the market, in order to subsidize the profits of the rest of British industry. Miners were constantly exhorted to produce, first by the 1945–51 Labour government, then by its Tory successors."³³ But in 1957 the industry went into steep decline as cheap oil began to displace coal as heavy industry's chief fuel. Things worsened in the 1960s as the development of the North Sea gas fields and the use of diesel engines on the railways deprived Britain's National Coal Board (NCB) of two of its key markets: "Coal dropped from 85.4 per cent of inland energy consumption in 1955 to 46.6 per cent in 1970."³⁴ As demand slowed, the NCB looked for ways to cut production costs, inaugurating a period of rapid mechanization. Here, the "most important development was the spread of power loading, which involved coal-cutting and loading in one single mechanical operation."³⁵ By 1968, 92 percent of British coal was power loaded, a dramatic rise

from only 23 percent in 1957. As Alex Callinicos and Mike Simons write, “[t]he result of these changes for the miners was catastrophic. In 1955 there were 698 collieries. By 1971 the number had fallen to 292.”³⁶ Concerns over global oil supply thus arrived at a particularly opportune moment for Britain’s miners. As electricity emerged as the indispensable medium of capital’s post-Fordist restructuration, some of King Coal’s old luster returned. The emergent energy economy’s intensifying reliance on the signature raw material of the steam era had the effect of revitalizing the residual strategies of Britain’s trade union movement. Thus rather than a simplistic sequential development of energy infrastructures and corresponding modes of struggle — in which new political and technological modalities simply displace the old — we instead observe complicated interrelations between residual forms of class struggle and newly emergent productive forces.

The decade’s definitive conflict arrived in 1974. Yet prior to the 1974 strike, global elites and labor unions had already begun to sense the slowdown that prefigured the oncoming global recession. In the years immediately prior to the oil crisis both parties had grown restive. On the cusp of the technocrats’ full-fledged summons to post-Fordist electroculture, trade unionists had begun a return to modes of combative self-assertion not seen in Britain since the prewar period. In a pattern that would define British coal worker militancy in the aftermath of the belle epoch, the miners’ first strike in 1972 — the first in some fifty years — targeted the nation’s power stations. Arthur Scargill — the leader of the NUM during the famous 1984 strike — was then a rising force in the NUM’s newly militant wing. Looking back on the successes of the early 1970s he describes the miners’ methods: “We produced a thousand pickets in an hour and a half on Ipswich dock, and stopped the dock in an hour. We left a token picket at the docks, moved on, and closed down the power stations one by one. Within two days we’d shut the whole of East Anglia.”³⁷ In tandem with the cessation of coal production, the miners’ picketing strategy allowed them to choke off the coal supply to East Anglia’s power stations.

On the ground, the conflict played out as an essentially logistical struggle that relied on identifying crucial chokepoints in the country’s energy distribution systems. Yet these logistical struggles ultimately took their bearings in relation to a more theoretically grounded appraisal of the coal industry’s changed structural position in Britain’s real economy. The miners had ascertained that the circuit of money capital was now in key respects dependent on the electrical circuits of Britain’s domestically powered grid. With this knowledge in hand, and against the backdrop of a waning oil supply, the miners exerted their new found political clout. Faced with energy shortfalls in oil and coal, Heath capitulated to the miners’ demands, leading to a bump in pay rate that would set the terms for the subsequent strike of 1974. Only a year after the miners’ successful strike, Heath responded to escalating levels of inflation by freezing pay levels throughout the public sector. This policy produced a pushback from workers who had seen real wages fall into decline under the very same set of

economic pressures.

By 1973 the NUM was squaring up for another strike. In preparation, union leaders mandated a work-to-rule policy, eating into the nation's coal stocks. When the miners finally struck again in 1974 Heath put in motion a contingency plan that proved one of the most comprehensive political miscalculations of recent British history. In response to the threat that the miners now posed to the viability of Britain's coal-fueled power stations, Heath returned to the kind of emergency measures that Britain had relied upon in the course of the Second World War. In an attempt to manage consumption, and preserve the nation's scanty coal stocks, Heath mandated a "Three-Day Work Order" which dictated that commercial use of electricity be restricted to only three consecutive days in a week. The policy — popularly known as the Three-Day Work Week — revived the concept of rationing which had been such an entrenched part of the besieged islanders' wartime psyche.

Yet as "the lights went out" across the country, the Three-Day Work Week served as a punctual and spectacular demonstration of how contingent the postwar economy had become on electricity. This was an ill-designed form of political theater that effectively functioned as a monumental illustration of the miners' resurgent power at the heart of Britain's emergent electroculture. Compounding his first mistake Heath then called a snap election, proposing that it would determine "Who governs Britain?" The conservative government lost, returning Labour to power with a mandate to lessen industrial tensions.

In the miners' conflict with Heath it had become evident that the question of "who governs" — the question of sovereignty and popular legitimacy — was now in part contingent on who controlled "the lights." In the course of the strike of 1974, in their attempts to stake their claims to energy sovereignty, Pierre-François Gouffes writes that "[b]oth parties deployed quasi-military resources during these conflicts."³⁸ It should be no surprise, however, that the government's and the miners' different assemblages of strategies and tactics should be recognized as "quasi-military resources" for, as Deborah Cowen has demonstrated, the very concept of logistics originated in the context of military planning. Indeed, the militaristic rationale of logistical practice has remained a crucial feature of its exercise, even in its most superficially benign applications.³⁹

The same field of conditions that produced the planners' turn to electricity had thus presented Britain's miners with a complex confluence of pitfalls and opportunities. The bitter experience of contraction in the postwar years left the miners acutely aware of the threats that technological developments posed to the workforce. Yet taking heart from the new centrality of coal, and fired by the resentments of workers who were increasingly feeling the pinch as global boom turned to global downturn, the miners aimed to redefine how the *Plan for Coal* was implemented. For, while the miners could scarcely stand to reject the government's plans to revitalize their industry, it was clear that the cybernetic project at its heart promised to erode worker autonomy.

Given this field of conditions, what subsequently ensued was a struggle between the residual steam-era political strategies of a resurgent syndicalism and the new strategies of elites who increasingly repurposed electrocultural technologies in reactionary fashion. In their subsequent negotiations with the newly incumbent Labour government the mining unions attempted to hold ministers to their commitment to expand coal development while resisting the fully fledged implementation of MINOS. This strategy was still in effect in 1983, on the cusp of the confrontation with Thatcher. At the national level, the NUM's *Interim Assessment of MINOS* "focused upon the job loss projections which confirmed the existence of a major pit closure programme."⁴⁰ Yet "[r]ank-and-file miners who were experiencing the impact of MINOS upon the labour process... were equally concerned with the issues of deskilling and control."⁴¹ In the course of the miners' discussion of the subject the NUM's South Kirby branch put forward a motion that was ratified at the union's 1983 conference:

The draft agreement sought to establish a procedure for negotiating technological change with the *status quo* prevailing until agreement is reached. The agreement would have preserved jobs through reductions in working time... Moreover, it would have eliminated computer-based work-monitoring systems like FIDO which would be unlawful under the Swedish and Norwegian Work Environment Acts.⁴²

Miners had long been famed for their success in holding Taylorist management techniques in abeyance. In 1925, Cater Gooderich argued "the very geography of the working place inside a mine" underpinned the miner's longstanding capacity for autonomous self-assertion. The characteristic technique of pit mining in the early days — the room and pillar method — saw men working in small teams, compelled to determine "where to cut and how much rock to leave in place to prevent cave-ins."⁴³ As Gooderich puts it "the miners' freedom from supervision is at the opposite end of the spectrum from the carefully ordered and regimented work of the modern machine-feeder."⁴⁴ The miners' evasion of full-bore Taylorist working conditions had thus been contingent on the ways in which their remote working environment — deep pits sometimes saw teams of men working over a kilometer underground — insulated them from the prying eyes of management.

It was now evident, however, that innovations in the microprocessing sector threatened to considerably expand the surveilling capacities of management. As computer monitoring and data collection techniques penetrated into the full depth of the mine, pit miners found themselves exposed, for the first time, to the possibility of constant real-time remote supervision. Moving information at near light speed from periphery to center, new cybernetic technology would allow management to vault the informational distance between coalface and command center. Harnessing the material properties of electricity, engineers furnished management with the capacity

to assess situations and dictate actions in the most remote locations. Under such conditions, miners could no longer count on maintaining the modes of autonomous self-management that they had exercised in the days prior to the microprocessing revolution. The precision and speed with which electricity could be controlled promised to become the speed and precision with which workers could be managed.

As we already have seen, in the postwar period, Taylorist production methods had already made some significant incursions into the miners' workspace. Yet, relative to other sectors, miners continued to enjoy high levels of workplace autonomy, and indeed, though in decline, the old room-and-pillar method was still in use in many quarters. As Timothy Mitchell observes "[t]he militancy that formed in these workplaces was typically an effort to defend this autonomy against the threats of mechanization, or against the pressure to accept more dangerous work practices, longer working hours or lower rates of pay."⁴⁵ The miners drew on this residual set of concerns and tactics that as they assessed the proposed introduction of MINOS. Of particular concern was FIDO (Face Information Digested Online), a crucial component of the larger system, one "that would allow extensive levels of [coalface] supervision over and above that which had previously existed."⁴⁶

In forestalling the implementation of this fully electrocultural environment the miners attempted to revitalize a second set of strategies that were, in Timothy Mitchell's view, the most effective feature of their old modes of militancy. Mitchell argues that while the autonomous nature of their working experience had given miners a taste for self-determination, they were only able to exercise and defend this autonomy as they came to understand their crucial position at the heart of the steam economy's commodity chains. Strikes in the energy sector proved unusually powerful political tools because of the dispersed and widespread impact of energy shortfalls: "the flows of carbon that connected chambers beneath the ground to every factory, office, home or means of transportation that depended on steam or electrical power."⁴⁷ The outcome of these dynamics was that "[t]he flow and concentration of energy made it possible to connect the demands of miners to those of others, and to give that argument a technical force that could not easily be ignored."⁴⁸ For a time, electroculture's full emergence actually amplified the potential reach of the old methods. For in the decade or so that stretched from the oil crisis to the 1984 strike, control over domestic coal flows effectively acted as a proxy for control over the nation's electricity. The strikes of the early 1970s not only reminded the miners of how effective these residual methods could still prove to be, they also served to underscore how essential electrical circuits had become to the smooth functioning of the valorization process — to the circuits of investment, production, circulation and consumption that lay at the heart of capital's real movement.

But just as the unions were reviewing the ways in which the *Plan for Coal* could be turned to their advantage, so too with the Conservatives intent upon regaining the upper ground. These were the years that geographer Matthew Huber defines

as the incubation period of neoliberalism.⁴⁹ In Britain, a chastened and radicalized conservative movement licked its wounds and began to await the opportunity to outmaneuver the miners. In particular, the conservative think tank the Selsdon Group had learned from the miners' successes. They mirrored the miners' strategies, drafting a new playbook of logistical tactics that explicitly understood political power in relation to the nation's grid system. Thus as the Conservative party began to draft a new economic strategy, one of its keys concerns was circumventing the miner's control of the British economy's energy inputs.

"The Enemy Within" — The Ridley Plan and the Changing Face of Energy Security

The Ridley Plan was circulated in 1977, and it proposed to reverse the British recession through the application of a new mode of quant-heavy corporate governance.⁵⁰ The first step toward the marketization of Britain's nationalized heavy industries was obtaining and publishing "unit costs." Ridley spelled out his rationale in the terms of new "cost efficiency" protocols: "any attempt to improve efficiency must start from unit costs."⁵¹ Obtaining this information would allow the government to measure the economic efficiency of every sector, breaking each field down into its smallest constituent units in the hope of isolating, and expelling, elements that were punching below their weight. This was, of course, an atomizing discourse, which inherently subjected industries and workers to a panoptic mode of surveillance. Not for nothing was this process defined, by its exponents, as one of "fragmentation."

Ridley was explicit that this mode of economic rationality marked a departure from the kinds of industrial management that had prevailed in the postwar period, in which production costs had been determined by a "mixture of the political pressures and the union pressures."⁵² In such a context "striving after efficiency" had tended to be "fruitless — because the financial inputs and the financial outputs were the product of political determination."⁵³ Informational analysis would play a key role in restoring industry to market "rationality." The shift of emphasis — from concerns over energy efficiency, to concerns over cost efficiency — is key to understanding the subsequent shape of Britain's economic reorganization, and defines two of the initial phases of the emergent electroculture.

In laying the ground work for the British energy sectors' entry into a more fully "globalized" energy market — a project that entailed restructuring the large publically owned industries that had prevailed since the postwar nationalizations — Ridley argued that the new Tory government's "principal instrumental of control should be to set each concern a financial obligation to achieve."⁵⁴ This new mode of "financial discipline" — government by audit — was tasked with establishing that "the required rate of return was entirely inflexible."⁵⁵ Spelling out this facet of his plan, Ridley deployed a phrase that was to serve as the Tory's primary cudgel of the mining sector: "If the required rate of return on capital was not achieved, either management must

demonstrate that it was taking effective action to rectify the omission, or it must be replaced. Effective action might mean that men would be laid off, or uneconomic plants would be closed down, or whole business sold off or liquidated.”⁵⁶ The goal of unit cost analysis was to identify and expel cost inefficient — or “uneconomic” — units. It should also be noted that audit management and computational technology were natural bedfellows, and the drive to render the productive process in the terms of unit costs was in key respects also a way of making it legible to the fast emerging computational matrix.

It is in the context of these cost efficiency discourses — which emerge in dialectical interaction with declining rates of profit, and the renewal of syndicalist struggle — that the Conservative government finally proved able to push the domestic energy market into completion with emerging extraction industries in low-income countries, many of which were in the Global South. The rise of electroculture’s second, reactionary phase is crucial in the development of what we might term the last and largest phase of the fully dominant petroculture, a moment that arrives as the emergent force of microprocessing helps to orchestrate and stabilize the expansion of the just-in-time process’s seaborne, and petroleum-powered, distributive matrix. Cowen describes the intensified relationship that subsequently developed between information technology, audit governance, and the logistical management of increasingly far-flung supply lines:

At least as important as the rise of computer technologies that enabled new kinds of cost calculation... total cost analysis itself identifies for a firm the “opportunity to increase its profits that it could not have identified or taken advantage of in any other way.” Total cost analysis produced new sources of profit with very different kinds of effects on corporate strategy, and this strategy was inherently spatial. Whether a firm invested in more warehouses, changed the location of production, or invested in more transportation infrastructure would all be decisions made relationally in the broader interest of total cost, or overall profitability.... Because of the “interdisciplinary” nature of the analysis, senior executive support was necessary to undertake total cost analysis, thus propelling logistical questions to a much higher level of management. In fact, with the adoption of total cost, corporate strategy became ever more defined by logistics.

Electronic technology’s capacity to effectively collapse the informational distance between core and periphery would prove an indispensable material instrument of this new mode of governance. The spatial expansion of the productive process, the multiplication and coordination of supply lines, production plants, and distribution centers, would all be synchronized through the key electrocultural command centers of the newly emerging logistical giants.

Yet before British policymakers could begin to initiate this project it proved necessary for them to break the power of the trade union movement. In managerial circles the preferred term for this undertaking was “modernization,” a phrase that implicitly consigned the objectives and commitments of the trade unionism to a now obsolete past. Roughly seven years after the Ridley report’s first circulation, the Thatcher government began to follow through on its recommendations, announcing its ambition to “modernize” Britain’s mining industry. The appointment of infamous union-breaker Ian MacGregor as head of the NCB signaled the government’s turn to a more confrontational industrial strategy. As the first details of the plan began to hit the presses the government declared that it intended to close twenty “uneconomic” pits. The language was that of the Ridley Plan, and as the government prepared for inevitable strike action, they drew on the contingency plans that Ridley had outlined almost a decade ago. The report itself had actually been leaked to the press in 1978, and *The Economist* accurately summarized its contents in the following terms:

- (1) The group believes that the most likely battleground will be the coal industry. They would like a Thatcher government to: (a) build up maximum coal stocks, particularly at the power stations; (b) make contingency plans for the import of coal; (c) encourage the recruitment of non-union lorry drivers by haulage companies to help move coal where necessary; (d) introduce dual coal/oil firing in all power stations as quickly as possible.
- (2) The group believes that the greatest deterrent to any strike would be “to cut off the money supply to the strikers, and make the union finance them.” But strikers in nationalized industries should not be treated differently from strikers in other industries.
- (3) There should be a large, mobile squad of police equipped and prepared to uphold the law against violent picketing. “Good non-union drivers” should be recruited to cross picket lines with police protection.⁵⁷

The strategic core of the plan entailed circumventing the strategies that the trade union movement had employed to exert control over crucial energy flows. And as the Ridley Plan made clear, the Conservative’s government’s new energy strategy was not directed at engineering energy efficiency, it was instead designed to accomplish cost efficiency. In exercising this approach, the Ridley Plan instructed Conservative policymakers that they would be compelled to find new methods of ensuring a docile and compliant workforce.

By this juncture, the Tellerist goal of energy efficiency was already utterly subordinated to economic considerations, and the energetic and environmental cost of outmaneuvering the miners accordingly gave the Selsdon group little pause for thought. Instead, the ensuing struggle coalesced around the miners’ claim to not only have a say in wages and working conditions but to actually collectively determine

the nature of their work. Essaying the fundamental stakes of the conflict, Raymond Williams unequivocally took the side of the miners, arguing that “to deny it or even qualify” the miners’ claims to self-determination was to “subordinate a whole class of men and women to the will of others.”⁵⁸ Williams writes that, as the struggle unfolded, “the term management mutated in the eyes of miners into a label defining the desire of the powerful to run a business for solely financial, rather than social, profitability.”⁵⁹ As we have seen it was not only the miners that took this view of cost efficiency discourses, the Ridley Plan itself understood the stakes in precisely the same terms.

Yet the same logic that declared that an enterprise would be run “for solely financial, rather than social, profitability” also played out in an ecological register.⁶⁰ Indeed from today’s vantage it is perhaps best to rethink Williams’s contention in the terms of Jason W. Moore’s world-ecology — audit governance proved to be a way of organizing not just the input and outputs of production, but nature itself.⁶¹ In their attempts to revive the ailing economy, technocrats subordinated the industrial working class — and the energetic flows of the world-ecology — to a managerial calculus that gave little consideration to socio-ecological “costs” that could not be rendered in the terms of “economic rationality.” It is curious that this dimension of the struggle largely escaped Williams’ notice. Indeed in his contemporary commentary on the 1984 Miners’ Strike, Williams outlines the four “keywords” that, to his mind, defined the fundamental stakes of the struggle. The word “energy” is not found among them.⁶²

Although the vying parties were focused of the foundational role that energy played in the struggle, even contemporary observers as astute as Williams found it hard to conceptualize how radically emerging technologies were changing the socio-ecological praxis of political struggle. Part of the explanation for Williams’s uncharacteristic oversight is perhaps found in the fact that although elites would conclude this series of struggles through a vast cybernetic reorganization of socio-ecological forces, the final event in Britain’s postwar mining struggles was internally structured around the question of worker autonomy. MacGregor understood the full dimensions of the miners’ claim to self-determination. He was on record as stating that his primary concern over the mining sector was not the depletion of coal reserves, or the threat of cheap imports, it was rather that the miners had “evolved a feeling that [they] can be isolated from the benefits to the community as a whole — [they] can operate in a vacuum if you will, and set [their] own conditions for... operation.”⁶³ The concern, then, in the 1984 strikes was explicitly that of worker autonomy, but it was at the same time clear — at least to the parties engaged in the struggle — that the effective exercise and maintenance of this autonomy was now contingent on control of electricity’s circulation.

Cost efficiency management and worker self-management were thought, by both sides, to be fundamentally incompatible. It was precisely for this reason that the two parties assessed the value of cybernetic technologies in inverse terms. In the context of a sluggish economy, information technology offered social planners access to data

that could be used to squeeze additional surplus value from their workers, a project that would entail fragmenting the effective exercise of solidarity, allowing managers to isolate and pick off the weakest members of the herd. From the miners' vantage it was evident that these technologies would decisively disable the material conditions on which the effective exercise of their autonomy was contingent. Yet in forestalling these developments the miners had at their disposal an array of techniques that had very recently proved capable of unseating the nation's government. As the final decisive strike loomed into view the miners and the government found themselves at opposite ends of electroculture's divergent "output" and "input" sectors. For the government to bring the full weight of its emerging electrocultural apparatus to bear, it was necessary for them to first wrest control of the nation's electricity generation from the miners' hands.

The events of the 1984 strike itself are well documented. The Ridley Plan's tool box of strategies and contingency plans finally prevailed over the miners, in the course of a year-long struggle that was waged at greater length and cost than either party had originally thought possible. In addition to the modes of logistical cunning that the Thatcher government employed, the unvarnished use of brute force became an increasingly integral element of their strategy as the confrontation came to a head. The effectiveness of the NUM's pickets was countered with the newly militarized police force that Ridley had first proposed in 1977. In preparing the public for these televised displays of state force, Thatcher infamously characterized the miners as "the enemy within," a phrase that bought the quasi-military nature of the conflict entirely to the fore, as the uninterrupted flow of energy supply lines was explicitly redefined as a matter of national security. According to the same logic NUM senior management also became the target of Britain's security establishment. MI5's assistant director Stella Rimington personally oversaw "the most ambitious counter- subversion operation ever mounted in Britain," a project that saw MI5 launch "the country's largest-ever bugging and telephone-tapping effort."⁶⁴ By this juncture, mining communities found themselves threatened with surveillance, cybernetic discipline, and a militarized police force. It is no accident that that these politically oppressive conditions so nearly foreshadow the experience of "surplus populations" in the post-Fordist economy. The experience of immiseration and disenfranchisement that has characterized life in the postindustrial rusts belts has been maintained through a fortification of the repressive arm of the state that has in many instances relied on the signature technological capacities of the cybernetic turn.

Currents of Capital — Electroculture in the Wake of Syndicalism

Yet although many features of the mining disputes were products of new dynamics brought into play by an emergent electroculture, other features were as old as what Andreas Malm calls "fossil capital."⁶⁵ Nothing better illustrates the paradigmatic aspects of the miners' struggle than the fate of Britain's mining industry in the

aftermath of the failed strike. Reviewing the consequences of the wholesale implementation of MINOS, David Allsop and Moira Calveley observe that in tandem with the rise of “immaterial laborers” tasked with managing and “informating” the productive process, the same restructuration also produced a more highly-surveilled and data-disciplined coalface workforce: “[The] technology has allowed for the creation of information systems that have become ‘information panopticons,’ which are so all-encompassing that they ‘do not even require the presence of an observer.’”⁶⁶

The material properties of electricity were instrumental in effecting this state of affairs, allowing for the construction of vast “surveillant assemblages” that afforded management greater — and more centralized — control over a “fragmented” and globally distributed workforce.⁶⁷ The fragmenting impact of this electrical apparatus was evident to sociologists who surveyed working conditions in British pits of the mid-1990s who found that “the predominantly Taylorist design philosophy, with its emphasis on the removal of workers’ skills and autonomy, has a negative impact on workers and serves to limit the potential of the new technologies, as well as stifling worker ingenuity.”⁶⁸ Here, then, was the lasting impact of the emergent electroculture in Britain’s mining sector. Britain’s “rank-and-file” miners had clearly offered a more incisive appraisal of the long-term consequences of automation and cybernetic flow monitoring systems than was proffered by the techno-utopian theorists of immaterial labor. To paraphrase E.P. Thompson, the British working class was present at its unmaking.

The handful of workers that managed to keep their jobs now told of working conditions that proved less emancipated than scholars such as Maurizio Lazzarato had once anticipated:

[Y]ou have got Big Brother watching from upstairs, so if you have a stand down, they will know up there and questions are asked (Tailgate, underground supervisor).

They sometimes put the brake on if I am cutting too fast for them to cope with the coal that is coming off (Mechanics, face worker).

They know what we are doing all the time and sometimes they slow down the machine (Winders, face worker).

We are easily clamped and easily got at (Tailgate, face worker).⁶⁹

The techno-utopians were not wrong, however, to identify the vast technical ambition of the new age of automation. Among managers in the mining sector it has now become fairly commonplace to anticipate the development of entirely unmanned coalfaces:

We have the technology to take the men off the face, we haven't done that yet. They have coalfaces in Australia that have no men on them, but they have a different union system and union agreements. It is only on the coalface and in the headings, where machines are operated underground. Everything else is operated from the surface, conveyors, bunkers and stage loaders are all automatic (a U.K. Coal automation engineer).⁷⁰

The end result of these kind of strategies has been the widespread blackboxing of the energy production process. The trajectory inherent in the energy security discourse of the early 1970s arrived at a strange apotheosis in which the energy production system was increasingly rendered secure, not against the depletion of fossil fuel reserves or the machinations of petrostates, but against workers themselves.

In truth, the need for wholesale automation is largely moot. Manned by small corps of engineers and technicians, heavily automated fixed capital allows for a workforce so small that it can be kept compliant with a handsome salary. As Nick Dyer-Witheford has recently demonstrated, in the post-Fordist economy elites have increasingly relied on automation to ensure the docility and security of key sectors of the economy.⁷¹ In the decades prior to its recent dissolution, the fate of the U.K. mining sector provided an exemplary case of a broader tendency that continues to play out on a global scale.⁷² These considerations draw attention to another facet of the turn to microprocessing that has perhaps been underplayed in the course of this discussion; for the microprocessing revolution has not only facilitated the precise remote management of workers, it is also — in tandem with the ongoing refinement and miniaturization of the electric motor — allowing for the machinic reduplication of even the most complex and highly-skilled forms of human labor.

In the face of automation on this kind of scale, the characteristic modes of self-assertion that the miners had once so successfully practiced have dwindled. Yet the net result of the rise of electroculture has not been to universally draw workers into the informational sector, as Lazzarato and others had once proposed.⁷³ Instead, alongside new crops of engineers and informational managers there has arisen an increasingly vast vulnerable sector of precariously employed service workers, who have as yet not successfully asserted their interests. As George Caffentzis puts it “[t]he burly, ‘blue collared’ line worker seems to blur in the oil crisis, diffracted into the female service worker and the abstracted computer programmer”:⁷⁴

And it all feels so different! Your wages go up but they evaporate before you spend them, you confront your boss but he cries that “he has bills to pay,” and even more deeply, you don’t see your exploitation any more. On the line, you literally could observe the crystallization of your labor power into the commodity, you could see your life vanishing down the line, you could feel the materialization of your alienation. But in the

service industries, your surplus labor seems to be non-existent, even “non-productive,” just a paid form of “housework,” cleaning bedpans, massaging jogger’s muscles, scrambling eggs.⁷⁵

Yet those that have managed to hang on to a wage in the service sector seem by some measures to be in a more favorable position than others among the growing numbers of people unable to access either a viable legal income or a stable means of subsistence. Many of those expelled from the industrial sector have had to contend with what we now know as characteristic features of life in the post-Fordist rustbelts, the triple-fronted trap of “destitution, drugs, and prison.”⁷⁶

It is salutary to note that elites are hardly in a position to welcome this increasingly volatile state of affairs. Indeed, in Marx’s terms, we can see that capital has again emerged as a limit to itself. Yet the present form of its self-limitation proves in key respects particular to our own historical moment, and proper to the socio-ecological characteristics and energetic demands of post-Fordist electroculture. Contemporary capital’s rising organic composition has not only left it entangled in a toxic, and climatically disruptive, coal dependency, it has also seen it unable to reincorporate living labor back into the productive process. As the research collective Endnotes write:

[C]omputers not only have rapidly decreasing labour requirements themselves (the microchips industry, restricted to only a few factories world-wide, is incredibly mechanised), they also tend to reduce labour requirements across all lines by rapidly increasing the level of automation. Thus rather than reviving a stagnant industrial sector and restoring expanded reproduction — in line with Schumpeter’s predictions — the rise of the computer industry has contributed to deindustrialisation and a diminished scale of accumulation — in line with Marx’s.⁷⁷

In short, the success of elites in countering the threat of worker militancy has also undercut their capacity to secure adequate rates of return on capital; the same strategies that secured the energy production process against sabotage and disruption have also spurred, rather than rectified, the ongoing freefall in rates of profit. Clearly, the emergence of electroculture — and the signature capacities and technologies that define it — has been instrumental in producing this field of conditions.

Yet in contrast to the original forecasts of Marx and Engels, Bue Rübner Hansen finds that “[w]hat is interesting and challenging” about today’s situation “is that, unlike the immiseration thesis of the *Communist Manifesto*, [today’s political strategy] is not predicated on a thesis of the gradual embourgeoisement of the world, or on the homogenization of the proletariat. The reality of surplus populations poses instead the issue of a generalized crisis of reproduction, and the multitude of survival strategies

that arise from it.”⁷⁸ The practices of Britain’s mining communities during the year of the strike actually anticipated many of these “survival strategies.” As the Thatcher government struggled to render Britain’s mining communities superfluous to the functioning of the nation’s economy — as they cut off the supply of money, and rerouted crucial goods and energetic flows from increasingly far flung corners of the globe — mining communities were thrown back onto the kinds of hard-scrabble survival tactics that have come to define the globe’s burgeoning “surplus” communities in the aftermath of the informational turn.

Electroculture “After Oil” — Conclusions and Conjectures

Looking to the future as the global economy generates larger surplus populations, and as the energy demands of fixed capital continue of necessity to rise rather than decline, capital faces two key threats to its popular legitimacy that it has as yet no means to combat. The success of the British government in the early 1980s, and the experience of Britain’s mining communities in those decades, ironically prefigured these dual dilemmas. Having once managed to cut off the monetary supply to mining communities while at the same time ensuring a steady supply of coal, elites now seem unable to incorporate increasingly large numbers of their surplus populations into the wage relation, and are as yet unable to wean the global economy off the coal dependency that serves as the primary engine of anthropogenic climate change.

As we have already noted, significant moves have been made toward a transition from fossil fuels to renewable energy sources, and in recent months the IEA’s newest report has offered solace to those venture capitalists and governments that remain blithely optimistic that “innovation” can supply capital with adequate carbon neutral electrical inputs. Yet even analysts such as Vargha, who adopt a relatively optimistic stance, tend to concede that Smil’s more circumspect appraisal of renewables is founded on a formidable body of scholarship. Indeed, in course of his critique of the IEA’s historically cautious appraisal of renewable energy markets, Vargha poses a rhetorical question that lies near the heart of contemporary energy policy debates and investment strategies: “[S]o will solar and wind energy become dominant in a few years in energy demand?”⁷⁹ He answers by deferring to Smil: “Of course not. As Vaclav Smil has argued convincingly, such transitions are generally slow, because energy investments are capital intensive — we need a large new infrastructure to supply it.”⁸⁰ In the course of the paper that Vargha cites, Smil explains why — despite robust government subsidies and widespread public support — the renewable energy industry still meets such a small fraction of global energy demand: “The slow pace of this energy transition is not surprising. In fact, it is expected. In the U.S. and around the world, each widespread transition from one dominant fuel to another has taken 50 to 60 years.”⁸¹ The fundamental challenge is infrastructural. Of the various renewable alternatives on offer, Smil finds that only solar energy can hope to match the quantitative heft of fossil fuels. But even allowing for the abundance of solar

energy, Smil argues that a key impediment to a rapid solar transition is the fact that contemporary energy systems are contingent, not just on vast quantities of energy, but on vast quantities of densely concentrated energy. Developers have thus far only discovered this energy density in fossil fuels and nuclear fission. Consequently, a wholesale transition to renewable energies will “necessitate a fundamental reshaping of modern energy infrastructures.”⁸² Before it is able to collect and concentrate sufficient quantities of energy in the world’s metropolitan zones and production plants, a post-fossil fuel energy system will have to compensate for the relatively low density of renewable energy dispersal, casting a wider net, and spreading a new photovoltaic apparatus over large expanses of the earth’s surface. The kind of dispersed energy input infrastructure needed to accomplish this feat is poorly served by our own fossil fuel system which is presently dominated by the need to globally distribute highly concentrated fossil fuel energies, extracted at a relatively small number of key input nodes.⁸³

It is here that the attempt to engineer an anti-limitationist response to anthropogenic climate change seems set to encounter profound challenges. The rapidity of information processing advance was in part premised on unlocking the intense energy density of the raw materials — coal, in particular — that fueled it. The pace of change that defined this era serves as no guide at all to the speed with which technology will develop if it is made to rely on weaker energy streams. In truth, however, such considerations seem for the time being entirely theoretical concerns, for, under capitalism, the viability of a renewable energy infrastructure will always remain contingent on its capacity to meet the ever-expanding demands of the planetary assemblage of fixed capital. Should innovations within the renewable energy sector fail to meet this demand, we can anticipate a return to nuclear power and intensified investment in geoengineering technologies such as carbon capture. Although the IEA’s newest report tenders a more promising appraisal of the nascent capacities of renewables that the agency had thus far adopted, it remains the case that the end goal of a wholesale energy transition extends beyond simply arresting the ongoing expansion of fossil fuel demand pushing out toward the more distant prospect of actively reversing it. Whether this latter goal is actually compatible with “business as usual” remains the fundamental conundrum of all contemporary anti-limitationist energy policy.

Still, caveats aside, as global governance attempts to transition to a renewable energy base — leveling increasingly punitive legislation against the oil and coal industries — we can clearly observe electroculture moving into a third phase, one that sees it consolidate its new position as the dominant field of force within which other residual and emergent energy cultures now make their way. Naturally, the old petroculture infrastructure will continue to exert a profound residual influence in the decades to come. Indeed, as Kate Gordon remarks, “[e]ven if they’re now, finally, cost-competitive at the point of sale, low-carbon technologies are still working within

an infrastructure — a utility regulatory system, a power grid, a highway system, a combustion engine-centric fueling system — built for a world powered by fossil fuels.”⁸⁴ Yet as capital attempts to supply itself an anti-limitationist fix to the problem of anthropogenic climate change, and as it remains apparently irreversibly locked into its self-defeating attempt to evade secular stagnation through an ever-intensifying automation of the productive process, there can be little doubt that its assemblage of electrocultural technologies and research hubs will remain indispensable tools.

Here a word of caution regarding the political potentialities of the transition to renewable energy infrastructure is in order. It has become a cliché to point out that fossil fuels are a form of solar power — one condensed, through the contingencies of the geological past, into locally distributed deposits of fossil-stored energy. The cliché is worth repeating, to the extent that it helps us conceptualize the full scope of this nascent infrastructural project. The size of the terraforming projects required to synthetically replicate this geologically-scaled process of energy concentration — one that took place over the course of five hundred million years — should at least lead us to raise the question of how benign renewable energy infrastructure would prove to be under the anti-limitationist prerogatives of electrocultural capital. It is quite conceivable that utility-scale solar facilities would in time — and in the course of attempting to not simply supplement but actually supplant and replace the existent fossil fuel dependent apparatus — develop a sprawling and uncanny resemblance to the Athabasca tar sands, those sites of late petrocultural sublime that Edward Burtynsky’s aerial photography helped to make infamous.⁸⁵ Though the development of such utility-scale projects would help to significantly reduce carbon emissions, while releasing fewer toxins and pollutants, their vast scale would also threaten to transform the ecological dynamics of large tracts of the earth’s surface, rendering them less hospitable to Indigenous life forms, and setting in motion a series of socio-ecological aftereffects that would in all likelihood serve as the proximate causes of a new set of ecological quandaries. In Moore’s terms, we must remember that all energy systems and human economies are “co-produced” with nature, and that in our understanding of the contemporary moment — and the emerging “futures” that it bears within it *in potentia* — “[o]nly a conception of *historical nature* will suffice.”⁸⁶ With these qualifications in mind, I offer two tentative conjectures about the likely outlines of a “renewable-driven” electrocultural capital.

- (1) Even if the transition proves economically viable, fixed capital’s demand for solar-rich space is likely to follow a similar pattern to its voracious appetite for the time-condensed energy of fossil fuels. The IEA estimates that world energy consumption is due to rise thirty-seven percent by 2040,⁸⁷ a figure that seems somewhat conservative in light of the doubling of global energy consumption since 1971.⁸⁸ During the same decades conservative estimates see the global population projected

to rise by two billion, to over eleven billion total. The amount of arable land required to sustain this population will expand accordingly, and as the land footprint of a renewable energy infrastructure also rises — the projected square mile to megawatt ratio is still hotly contested, but a 2013 NREL (National Renewable Energy Laboratory) report puts the figure at 8.3 acres per MW — it becomes harder and harder to imagine a scenario in which an anti-limitationist strategy can perpetually prevail.⁸⁹

(2) A “successful” transition to a renewable — or, for that matter, nuclear — energy base seems unlikely to have immediately propitious political consequences for the world’s burgeoning surplus populations. For, under capital, such a transition would effectively guarantee the ongoing technical viability of the electrocultural apparatus that currently subjects them to surveillance, immiseration, and digital control. The one caveat to add here is that the project of constructing the sprawling infrastructure of a photovoltaic energy system would — in the initial years of its construction — likely demand a significant uptake of labor, though only in the very short term. Whether capital’s beleaguered financial system and cash-strapped governments are actually capable of coordinating such a feat remains to be seen.

However these political and technological questions are ultimately resolved, it seems safe to conclude that there is no end to capital’s electro-dependency in sight. While it is now technologically and politically conceivable that capital could entirely transition away from the combustion engine, there is no prospect of it departing from electricity, which functions as the material medium of its digital brains, and which is capable of being repurposed into its all-but-universal fuel. Just as the concept of petroculture has proved an important means of understanding how the world-system found itself in its contemporary climactic predicament, the concept of electroculture exposes key features of how capital will attempt to sustain its anti-limitationist energy strategy in the face of climate change. Yet as Williams first pointed out decades ago, if these kind of periodizing concepts are to remain incisive — and if our analyses are to “connect with the future as well as the past” — it is crucial that we avoid abstracting them into static systems.⁹⁰ We must instead remain attentive to the residual and emergent forces that are even now attempting to make the way within and beyond electroculture’s newly consolidated dominance.

Notes

1. Raymond Williams, *Marxism and Literature* (New Delhi: Oxford UP, 1977) 121.
2. Williams, *Marxism and Literature* 121.
3. The term “electroculture” was first coined to describe a set of techniques that employ electromagnetic technology to stimulate plant growth. My differing use of the word takes its bearings in relation to the concept of “petroculture,” an analytical concept that was developed to explore how oil use has shaped technological, political, and cultural practice. In the spirit of Williams’s historiographic intervention, I suggest that we can understand petroculture and electroculture as distinct but mutually determining socio-ecological forces. I argue that as electrocultural social formations emerge we can see them modifying and at last displacing the signal social forms and material practices of the dominant petroculture.
4. George Caffentzis, *In Letters of Blood and Fire* (Oakland: PM P, 2013) 11.
5. Raymond Williams, *Culture and Society* (London: Penguin, 1958) 313.
6. Dominic Boyer and Imre Szeman, “The Rise of Energy Humanities,” *University Affairs* (February 12, 2014) <http://www.universityaffairs.ca/opinion/in-my-opinion/the-rise-of-energy-humanities/>.
7. Vaclav Smil, *Energy Transitions: History, Requirements, Prospects* (Santa Barbara: ABC-CLIO, 2010) 39.
8. Smil, *Energy Transitions* 39.
9. Michael Cruickshank, “Siemens Develops Most Powerful Electric Aircraft Motor Ever,” *The Manufacturer* (March 25, 2015) <http://www.themanufacturer.com/articles/siemens-develops-most-powerful-electric-aircraft-motor-ever/>.
10. Ernest Mandel, *Late Capitalism* (London: Verso, 1978) 192.
11. International Energy Agency (IEA), *Excerpt from World CO₂ Emissions from Fuel Combustion* (2015 Edition) (Paris: International Energy Agency, 2015) <https://www.iea.org/publications/freepublications/publication/CO2EmissionsTrends.pdf>.
12. Matthew T. Huber, “Foreign Oil and the Territoriality of Dependence,” in *Lifeblood: Oil, Freedom, and the Forces of Capital* (Minneapolis: U of Minnesota P, 2013) Kindle edition.
13. *In Letters of Blood and Fire*, 16.
14. *In Letters of Blood and Fire* 17.
15. Chandler in David Allsop and Moira Calveley, “Miners’ Identity and the Changing Face of the Labour Process within the U.K. Coal Mining Industry,” *Qualitative Research in Accounting & Management* 6 (2009) 61.
16. Edward Teller, “Energy: A Plan for Action,” *Power & Security*, eds. Edward Teller, Hans Mark, and John S. Foster Jr. (Lexington, MA: Lexington Books, 1976) 1–82.
17. *Energy Transitions* 39.
18. *Energy Transitions* 150.
19. *Energy Transitions* 121.
20. *Energy Transitions* 121.
21. *Energy Transitions* 121.
22. *Energy Transitions* 124–25.
23. Peter Simon Vargha, “Does the IEA’s New World Energy Outlook Miss the Global Transition?” *Energy Post* (November 30, 2015) <http://www.energypost.eu/ieas-new-world-energy-outlook-miss-global->

transition/.

24. "Decoupling of Global Emissions and Economic Growth Confirmed," *International Energy Agency* (March 16, 2016) <http://www.iea.org/newsroomandevents/pressreleases/2016/march /decoupling-of-global-emissions-and-economic-growth-confirmed.html>.
25. "Decoupling of Global Emissions and Economic Growth Confirmed."
26. "Decoupling of Global Emissions and Economic Growth Confirmed."
27. *Late Capitalism* 192.
28. *Late Capitalism* 192.
29. *In Letters of Blood and Fire* 30.
30. See Jasper Bernes's piece in this collection for an account of how energy-intensive agriculture and the reproduction of the body become foreshortened as form of energy capital.
31. D'Arcy Wentworth Thompson, *On Growth and Form* (Cambridge: Cambridge UP, 1945).
32. Vaclav Smil, "The Long Slow Rise of Solar and Wind," *Scientific American* (January 2014) <http://www.vaclavsmil.com/wp-content/uploads/scientificamericano114-521.pdf>.
33. Alex Callinicos and Mike Simons, "Towards Confrontation," *Marxists Internet Archive* <https://www.marxists.org/history/etol/writers/callinicos/1985/miners/chap2.html>.
34. "Towards Confrontation."
35. "Towards Confrontation."
36. "Towards Confrontation."
37. Arthur Scargill, "The New Unionism," *New Left Review* 92 (1975) 12.
38. Pierre-François Gouiffes, "Margaret Thatcher and The Miners: 1972–1985 Thirteen years that changed Britain," *PFG Pierre-Francois Gouiffès* <http://pfgouiffes.net/uploads/files/091231%20Margaret%20Thatcher%20and%20the%20miners.pdf>.
39. Deborah Cowen, *The Deadly Life of Logistics: Mapping Violence in Global Trade* (Minneapolis: U of Minnesota P, 2014) Kindle edition.
40. Jonathan Winterton and Ruth Winterton, *Coal, Crisis, and Conflict: The 1984-85 Miners' Strike in Yorkshire* (Manchester: Manchester UP, 1989) 20.
41. Winterton and Winterton, *Coal, Crisis, and Conflict* 20.
42. *Coal, Crisis, and Conflict* 20.
43. Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London: Verso Books, 2011) 20.
44. Carter Goodrich, *The Miner's Freedom* (Boston: Marshall Jones Co., 1925) 14.
45. Mitchell, *Carbon Democracy* 20–21.
46. Allsop and Calveley, "Miners' Identity" 61.
47. *Carbon Democracy* 20–21.
48. *Carbon Democracy* 20–21.
49. Huber, "Toward a Historical Ecology of Neoliberalism," *Lifeblood*.
50. Nicholas Ridley, "Economy: Report of Nationalised Industries Policy Group," *Margaret Thatcher Foundation*. <http://www.margarethatcher.org/document/110795>.
51. Ridley, "Report of Nationalised Industries Policy Group" 3.
52. "Report of Nationalised Industries Policy Group" 3.
53. "Report of Nationalised Industries Policy Group" 3.

54. "Report of Nationalised Industries Policy Group" 3.
55. "Report of Nationalised Industries Policy Group" 3.
56. "Report of Nationalised Industries Policy Group" 4.
57. "1978 Economist on the Ridley Plan," *Marxist Arborist Group* (March 5, 2009) <http://www.marxist.org.uk/2009/03/05/1978-economist-on-the-ridley-plan/>.
58. Raymond Williams, "Mining the Meaning," *Resources of Hope* (London: Verso, 1989) Kindle edition.
59. Williams, "Mining the Meaning."
60. "Mining the Meaning."
61. Jason W. Moore, "Cheap Food & Bad Money: Food, Frontiers, and Financialization in the Rise and Demise of Neoliberalism," *Review: A Journal of the Fernand Braudel Center* 33 (2012) 227.
62. "Mining the Meaning."
63. Quoted in Katy Shaw, *Mining the Meaning* (Cambridge: Cambridge Scholars Publishing, 2012) 31.
64. Seumas Milne, "What Stella Left Out: The Truth About MI5's Role in the Miners' Strike Will Not Come Out In Rimington's Memoirs," *The Guardian* (October 3, 2000) <http://www.the-guardian.com/comment/story/0,3604,376455,00.html>.
65. Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016).
66. "Miners' Identity" 59.
67. Kevin D. Haggerty and Richard V. Ericson, "The Surveillant Assemblage," *British Journal of Sociology* 51.4 (2000) 605-622.
68. Jonathan Winterton, "The 1984-85 Miners' Strike and Technological Change" *The British Journal for the History of Science* 26.1 (1993) 13.
69. "Miners' Identity" 64.
70. "Miners' Identity" 63.
71. Nick Dyer-Witheford, *Cyber-Proletariat* (London: Pluto Press; 2015) 170-173.
72. Stephen Chen, "Coal Mining 'Robots' Cut Costs and Risks but Threaten Jobs," *South China Morning Post* (September 23, 2014) <http://www.scmp.com/news/china/article/1598242/coal-tunnelling-machines-cut-mine-risks-also-threaten-pit-jobs>.
73. Maurizio Lazzarato, "Immaterial Labour," *Generation Online* <http://www.generation-online.org/c/fcimmateriallabour3.htm>.
74. *In Letters of Blood and Fire* 26.
75. *In Letters of Blood and Fire* 26-27.
76. Benjamin Noys, *Malign Velocities* (Croydon, Zero Books: 2014) 54.
77. Endnotes and Aaron Benanav, "Misery and Debt" *Endnotes* 2 (2010) <http://endnotes.org.uk/en/endnotes-misery-and-debt>.
78. Bue Rübner Hansen, "Surplus Population, Social Reproduction, and the Problem of Class Formation," *Viewpoint Magazine* 5 (2015) <https://viewpointmag.com/2015/10/31/surplus-population-social-reproduction-and-the-problem-of-class-formation/>.
79. "Does the IEA's New World Energy Outlook Miss the Global Transition?"
80. "Does the IEA's New World Energy Outlook Miss the Global Transition?"
81. Vaclav Smil, "The Long Slow Rise of Solar and Wind," *Scientific American* (January 2014) 54.

82. *Energy Transitions* 119.
83. *Energy Transitions* 119.
84. Kate Gordon, "Why Renewable Energy Still Needs Subsidies," *Wall Street Journal* (September 14, 2015) <http://blogs.wsj.com/experts/2015/09/14/why-renewable-energy-still-needs-subsidies/>.
85. See also *Petropolis*, directed by Peter Mettler, NTSD, (Toronto: Mongrel Media, 2010) DVD.
86. Jason W. Moore, *Capitalism in the Web of Life* (London: Verso Books, 2015) 296.
87. International Energy Agency (IEA), *World Energy Outlook 2014: Executive Summary*, International Energy Agency (Paris: International Energy Agency, 2014) 1. https://www.iea.org/publications/freepublications/publication/WEO_2014_ES_English_WEB.pdf.
88. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Mitigation of Climate Change*, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, eds. Bert Metz, et. al. (Cambridge: Cambridge UP, 2007), and British Petroleum, *BP Statistical Review of World Energy June 2015* (London: British Petroleum Co, 2015) 42. <https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-full-report.pdf>.
89. Sean Ong, Clinton Campbell, Paul Denholm, Robert Margolis, and Garvin Heath, *Land-Use Requirements for Solar Power Plants in the United States*, National Renewable Energy Laboratory (NREL), (Golden: National Renewable Energy Laboratory, 2013). <http://www.nrel.gov/docs/fy13osti/56290.pdf>
90. *Marxism and Literature* 121.

Antiphysis/Antipraxis: Universal Exhaustion and the Tragedy of Materiality

Alberto Toscano

If the question of the relation of nature and history is to be seriously posed, then it only offers any chance of solution if it is possible to *comprehend historical being in its most extreme historical determinacy, where it is most historical, as natural being, or if it were possible to comprehend nature as an historical being where it seems to rest most deeply in itself as nature.*¹

Evoking the work of the French psychologist Alfred Binet on school children, Anson Rabinbach, in *The Human Motor* (1990), his masterful history of the energy-labor nexus, notes that "the critical distinction between fatigue and exhaustion was between the normal and the pathological, between the adequate 'speed of reparation,' which rest provided, and the lack of reparation in exhaustion." Exhaustion sets in when the "legitimate boundaries of fatigue" were transgressed. Or, in the cognate definition in Albert Deschamps's 1908 *Les Maladies de l'énergie*, exhaustion is "an accumulation of fatigues which were only incompletely restored."² It is thus possible to propose a preliminary distinction between fatigue and exhaustion by locating fatigue on the side of *production* and exhaustion on that of *reproduction*. Exhaustion occurs, therefore, when a limit or threshold has been crossed such that the reproduction of a certain bodily or relational state is no longer possible.

Though I will not abandon the horizon of individual or subjective exhaustion entirely, in what follows I am concerned with thinking this "energetic" impasse of reproducibility in a more systemic vein, approaching the theme of exhaustion as a prism through which to connect contemporary debates on the consequences of climate change to theorizations of the multiple crises of social reproduction. I will approach exhaustion as a kind of limit concept that allows the exploration of the zones of indiscernibility between the philosophy of history and the philosophy of nature, an indiscernibility whose proper name might be materialism. The theoretical context for this inquiry is twofold. First, I want to address some pioneering recent work that

endeavors to produce a historical materialist critique of the ambient discourse on the “Anthropocene,” in particular the work of Andreas Malm (*Fossil Capital*) and Jason W. Moore (*Capitalism in the Web of Life*). By honing in on the leitmotif of exhaustion — and particularly Moore’s distinction between its relative and absolute modalities — I want to explore how what Malm calls “theory in a warming world” strives to articulate the question of the relationship between the limits to capital and the limits to nature.³ Second, as will hopefully become clear in my concluding considerations on Jean-Paul Sartre’s *Critique of Dialectical Reason*, I want to place the question of exhaustion, and more specifically of the agency “behind” exhaustion, in the framework of an ongoing project to rethink *tragedy* as a political form.⁴ In particular, Sartre’s concept of “matter as inverted praxis,” exemplified by his dialectical vignette on peasant labor and deforestation in China, will allow me to sketch the idea of a *tragedy of materiality*, which I hope can cut across the agential and ontological debates raised by the geological baptism of the Anthropocene, not least the debate about *who* this anthropos might be, and to what extent its actions require either a *dualist* or a *holist* take on the relationship between human Society and Nature (my tentative answer will be: neither).

It is my contention that the problem of “natural history” is at the heart of any reconstruction of a truly dialectical critical theory capable of testing its cognitive powers against a catastrophic present. The nature, which is also to say the necessity, in history has long been the locus of tragedy, but the figure of tragic agency needs to be thoroughly revised in light of what recent theoretical concern with anthropogenic climate change foregrounds but fails to illuminate — the immanence of social praxis to material nature. By way of a historical corrective to the self-congratulatory notes sounded by talk of the Anthropocene — whose claims for novelty are often hard to detach from the conceptual boosterism that infects the critique of capitalism with the spirit of its target — I begin with a short and admittedly impressionistic history of exhaustion. Nineteenth-century concerns with the irrevocable depletion of nature, rich in material lessons, were also accompanied by speculative, cosmopolitical efforts, wherein humanity was thought in terms both of its ends and its end. Attention to the contrasts and overlaps between exhaustion, degradation, and entropy as natural-historical ideologies may perhaps serve as an antidote to the rush to establish the Anthropocene as the keyword of our present. It can also provide us with a more nuanced sense of context for the emergence of a historical materialist theory of the relations between political economy and nature — namely in Marx’s wrestling with debates on soil exhaustion — especially when that theory, creatively revised, is providing the richest counter to what may be the ultimate twist in the ideological work of naturalization: naturalizing humanity’s transformation of nature. The paper then moves to a consideration of Moore’s contribution to the thinking of the exhaustion of historical natures, foregrounding the interaction of logics of appropriation and exploitation, and thence to an exploration of how the very

structure of the exploitation of labor power gives capitalist exhaustion its shape as the accelerating wastage of material natures. Notwithstanding the wealth of theoretical articulation and insight produced by the debates under review, I contend that they reach an impasse of sorts when they are translated into the metaphysical discourse of dualism or monism. Whence the perhaps unfashionable, concluding suggestion that we turn to Sartre's dialectical excavation of the tragic structure that haunts relations between praxis and matter as a possible model for incorporating a theory of action into our arguments about exhaustion.

Exhaustion, Degradation, Entropology

The expression "universal" or "general exhaustion" (*die allgemeine Erschöpfung* in German) is taken from a famously "prophetic" text of Friedrich Engels from 1887 which anticipated, with grim lucidity, the unraveling of World War I three decades thence:⁵

Eight to ten millions of soldiers will massacre one another and in doing so devour the whole of Europe until they have stripped it barer than any swarm of locusts has ever done. The devastations of the Thirty Years' War compressed into three or four years, and spread over the whole Continent; famine, pestilence, general demoralisation both of the armies and of the mass of the people produced by acute distress... absolute impossibility of foreseeing how it will all end and who will come out of the struggle as victor; only one result is absolutely certain: general exhaustion and the establishment of the conditions for the ultimate victory of the working class.⁶

Prospected from within the ambit of Marxism's overall political epistemology of crisis, this *exhaustion* is figured as a prelude to proletarian victory, in which the horrific autophagic agony of bourgeois civilization shades into the birth pangs of socialist society. Spent, no longer able to reproduce itself, capitalism is exhausted in the sense of *irreparable*. *Exhaustion* is a revolutionary precursor. It is striking how much this model repeats another text on war and humanity's emancipation, from a hundred years before, namely Immanuel Kant's 1784 "Idea of Universal History on a Cosmopolitical Plan," which I quote here in Thomas De Quincey's translation:

Nature accordingly avails herself of the spirit of enmity in Man, as existing even in the great national corporations of that animal, for the purpose of attaining through the inevitable antagonism of this spirit a state of rest and security: i.e. by wars, by the immoderate exhaustion of incessant preparations for war, and by the pressure of evil consequences.... [S]he drives nations to all sorts of experiments and expedients; and finally,

after infinite devastations, ruin, and universal exhaustion of energy, to one which reason should have suggested without the cost of so sad an experience, — viz. to quit the barbarous condition of lawless power, and to enter into a federal league of nations.⁷

Collective will is born from an antagonism (unsociable sociability, class struggle, world war, and civil war) that requires the *exhaustion* of the energies fixed in the prior dispensation of powers, the crossing of a threshold of reproducibility. It is a concept in a philosophy of history (and in Kant's case of nature and natural purpose) — as signaled by its "inevitability." For Kant, nature's cosmopolitical plan is "the *inevitable* resource and mode of escape under that pressure of evil which nations reciprocally inflict." For Engels addressing the masters of war, this entails that "at the end of the tragedy [they] will be ruined and the victory of the proletariat will either have already been achieved or else *inevitable*."⁸

Yet Engels was also the thinker of another inevitability, another exhaustion: the exhaustion of (human) history in and by nature. Responding to widespread, contentious debates on the laws of thermodynamics and the thesis of a heat death of the universe (a theme revived in more recent times by Jean-François Lyotard in *The Inhuman* and Ray Brassier in *Nihil Unbound*), Engels, while strenuously rejecting the idea of a *universal* heat death — which he regarded as saturated with crypto-theological eschatologies of exhaustion — contemplated the... inevitable demise of humanity.⁹ He did so in a lyrical passage that the Italian Marxist philologist and philosopher Sebastiano Timpanaro, advancing a pessimist and naturalist materialism equal parts Marx and Giacomo Leopardi, praised for showing that socialism need not require delusions of species immortality.¹⁰ In the Introduction to his *Dialectics of Nature*, Engels writes:

Millions of years may elapse, hundreds of thousands of generations be born and die, but inexorably the time will come when the declining warmth of the sun will no longer suffice to melt the ice thrusting itself forward from the poles; when the human race, crowding more and more about the equator, will finally no longer find even there enough heat for life; when gradually even the last trace of organic life will vanish; and the earth, an extinct frozen globe like the moon, will circle in deepest darkness and in an ever narrower orbit about the equally extinct sun, and at last fall into it.¹¹

Engels also acknowledged his precursors, writing in *Anti-Dühring*: "As Kant introduced into natural science the ultimate destruction of the earth, so Fourier introduced into historical thought the ultimate extinction of humanity."¹² It is to Charles Fourier that the historians of science Christophe Bonneuil and Jean-Baptiste Fressoz, in their

The Shock of the Anthropocene, have recently turned to show how — contrary to the weird self-congratulatory tendencies of contemporary commentators — nineteenth-century thought did not just entertain apocalyptic visions particular to the its industrial, imperial and financialized regimes of accumulation but was strikingly cognizant of anthropogenic climate and environmental change.¹³ Ironically, from our present vantage, Fourier's concern was the *cooling* of the climate, a "malady of the earth" that he regarded as a product of social immobility and stagnation, of the delay of a transition to socialism. The material suffering of the planet was of a piece with human suffering, and, as he observed in his unpublished 1822 manuscript *De la détérioration matérielle de la planète*, "the prolongation of the social limbo causes a rapid progress in climactic vices," leading to forms of material and social exhaustion that bourgeois society is congenitally incapable of preventing.¹⁴

The preoccupation with social and material exhaustion, anthropogenic and otherwise, traverses the Victorian era, surfacing, for instance, in the anarchist geographer Piotr Kropotkin's work on the climactic sources of Eurasian desiccation (recently recovered by Mike Davis), in Gabriel Tarde's science-fiction of "solar anaemia," in Antoine Augustin Cournot's warning to Léon Walras that the *laissez-faire* "curves of intensive and extensive utility" would lead to devastating deforestation and racial domination, or in Ruskin's delirious speculations on "The Storm-Cloud of the Nineteenth Century," wherein wind "figures the degradation of all existing structures."¹⁵ "Ruskin," Thomas Richards tell us, "closes his lecture by meditating on that sunless entropic end: 'the Empire of England, on which formerly the sun never set, has become one on which he never rises.' Here the heat-death of the universe has become the heat-death of the Empire."¹⁶ This recalls George Caffentzis's observation about capitalist apocalypticism: "Whenever the ongoing model of exploitation becomes untenable, capital has intimations of mortality *qua* the world's end."¹⁷

A striking index of the resilience of these overlapping nineteenth-century discourses of exhaustion and degradation can be found in the work of Claude Lévi-Strauss. As Patrick Wilcken recounts in his recent biography, Lévi-Strauss, having been invited by UNESCO in 1971 to reprise the critique of racial thought articulated in the 1952 *Race and History*, caused notable embarrassment to his hosts by evoking the warnings about cultural and racial dedifferentiation infamously voiced by Count Gobineau in that seminal tract of racist theory, *An Essay on the Inequality of Human Races*.¹⁸ What is symptomatic in Lévi-Strauss's anthropological plea for the defense of cultural diversity is the extent to which it bears witness to the lamination in his thought of two nineteenth-century discourses of exhaustion, that of (cultural, racial, and biological) *degradation* — deployed both to bolster the efforts of criminological science¹⁹ and to justify the genocidal tendencies of settler colonialism²⁰ — and the thermodynamic discourses of *entropy*. In the concluding pages of his melancholy masterpiece *Tristes Tropiques*, Lévi-Strauss, echoing the figure of species annihilation already rehearsed by Engels in the *Dialectics of Nature*, to reflect upon the task of the

anthropologist, doubling the exhaustion of the very cultures he studies with the exhaustion of the human race as such. The latter, far from a conserver of cultural and historical diversity, is depicted in all its tragic-ironic ambivalence: protection turns into destruction, the fixing of difference accelerates dedifferentiation.²¹ Lévi-Strauss anticipates the invocation of inertia of his great opponent, Sartre, while trying to transcode entropy into a discourse about culture:

[Man's] role is itself a machine, brought perhaps to a greater point of perfection than any other, whose activity hastens the disintegration of an initial order and precipitates a powerfully organized Matter towards a condition of inertia which grows ever greater and will one day prove definitive. From the day when he first learned how to breathe and how to keep himself alive, through the discovery of fire and right up to the invention of the atomic and thermonuclear devices of the present day, Man has never save only when he reproduces himself done other than cheerfully dismantle million upon million of structures and reduce their elements to a state in which they can no longer be reintegrated. No doubt he has built cities and brought the soil to fruition; but if we examine these activities closely we shall find that they also are inertia-producing machines, whose scale and speed of action are infinitely greater than the amount of organization implied in them.... Taken as a whole, therefore, civilization can be described as a prodigiously complicated mechanism: tempting as it would be to regard it as our universe's best hope of survival, its true function is to produce what physicists call entropy: inertia, that is to say.

Whence Lévi-Strauss's punning proposal to rechristen anthropology as *entropology*, the "discipline that devotes itself to the study of this process of disintegration in its most highly evolved forms."²² The cosmic-cultural pessimism of the final pages of *Tristes Tropiques*, leavened or even redeemed by an aestheticized figure of "grace,"²³ is modulated somewhat in Lévi-Strauss's later speculations on how "just" societies could be considered in terms of entropy-transfers, from society to culture; riffing on a Saint-Simonian dictum, he proposes that:

A society is at once a machine and the work done by that machine. As a steam engine, it produces entropy, but if we look upon it as a mechanism, it produces order. This dual aspect — order and disorder — corresponds, in the language of anthropology, to two ways of looking at any civilisation: there is, on the one hand, culture, and on the other, society. By culture, we mean the relationships that the members of a given civilisation have with the external world, and by society, we mean more especially the relations

men have with each other. Culture produces organisation: ploughing the land, building houses, manufacturing objects, etc.... [S]ociety... produces entropy, or disorder. “Government of men” corresponds to society and increasing entropy; “administration of things” corresponds to culture and the creation of an increasingly varied and complex order.²⁴

Lévi-Strauss “entropological” musings on the exhaustion of cultural difference, and his tentative speculations on social justice as an energetic balancing-act, can be approached both as a speculative synthesis of many of the aforementioned strands of nineteenth-century thought (thus providing a somewhat different genealogy to structuralist anti-humanism than we are accustomed to) and as an important contrast to what we could, by way of approximation, term a dialectical tradition in the thinking of exhaustion. In what follows I explore this tradition, beginning with Marx’s deployment of the language of exhaustion, through recent Marxist critiques of the dominant discourses of the Anthropocene, and concluding with the (tragic) place of material exhaustion in the account of historical praxis in the *Critique of Dialectical Reason* — the very target of Lévi-Strauss’s *The Savage Mind*.

The Historical Nature of Exhaustion and the Exhaustion of Historical Natures

The most complex *social* figure of exhaustion emerging from the multifarious debates of the nineteenth century — with their abrupt shifts in register, from the energetic to the racial, the biological to the climactic, and so on — was arguably the one drawn by Marx from the soil exhaustion debates. Unlike the negative philosophies of history that could be distilled from ideologies of degeneration and entropy, Marx’s metabolic thinking sought to reckon with the deeply destructive impact of bourgeois society’s exploitation of human, animal, and material natures while having no truck with speculative philosophies of history anchored in various strains of civilizational pessimism, with all their dubious variations on the theme of the decline of the West. As proponents of the “metabolic rift” interpretation of ecological Marxism have argued, it was in his readings of the work of scientists like Justus von Liebig on soil chemistry or Carl Fraas on agrarian crises, readings which filled copious notebooks during the composition of *Capital*, that Marx developed a conception of the immanent relations between capitalist accumulation and natural exhaustion. In this conceptualization of socio-ecological exhaustion, Marx developed the insight of nature as an internal limit to (the reproduction of) capital and capital as an internal limit to (the reproduction of) nature.

In the first volume of *Capital*, Marx would write of how the capitalist mode of production

collects the population together in great centres, and causes the urban population to achieve an ever-greater preponderance.... [It] disturbs the

metabolic interaction between man and the earth, i.e., it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil. Thus it destroys at the same time the physical health of the urban worker, and the intellectual life of the rural worker.²⁵

This insight was joined by related ones, namely that the *time required for the reproduction of nature is generally too long for capital, and indeed is in contradiction with its turnover times*; that capital accumulation requires an *accelerating exhaustion of nature*; and that, most significantly, such exhaustion can only be prevented by *the social planning of this metabolism*. (Marx remarked upon the way in which contemporary accounts of environmental exhaustion, be it through deforestation, desiccation or soil exhaustion were haunted by an “unconscious socialist tendency.”)²⁶

The analogy and dialectic between the exhaustion of natural “resources” and the exhaustion — beyond fatigue, beyond reproduction — of the bodies of laborers is a critical juncture in *Das Kapital* itself. As Marx writes,

Capital asks no questions about the length of life of labor-power. What interests it is purely and simply the maximum of labor-power that can be set in motion in a working day. It attains this objective by shortening the life of labor-power, *in the same way as a greedy farmer snatches more produce from the soil by robbing it of its fertility*.²⁷

Labor may be conceived by Marx as a paradoxical “extinguishing fire,” the productive consumption of fixed capital and raw materials, but it also a self-extinguishing which is at work under the accelerative imperatives of capital — an extinguishing or degradation of the actual, physiological bearers of concrete living labors, which goes hand in hand with the extinguishing or degradation of nature.²⁸ In this parallel, between the worker and the soil (or nature), as the sole ultimate sources of social wealth, Marx alerts us to the possibility, immanent to the imperatives of capital, of *an expanding crisis of reproduction*, in which the living sources of value come to be exhausted — a process which, as the entire chapter on the working day demonstrates, with its meticulous attention to the degradation of laboring bodies, diets, reproductive systems, and so on, is profoundly affected by class struggles, which are always (and I am tempted to argue above all) struggles over reproduction.

While the theme and notion of exhaustion pervades the writing of Marx and Engels, circulating between the enervation of proletarian bodies, the depletion of natural processes, and the degradations of bourgeois civilization, and resonating with a vast array of contemporaneous literatures of exhaustion, it is not as such the object of sustained, direct theoretical treatment.

By way of rectification, I want to turn here to Jason W. Moore's *Capitalism in the Web of Life*, which includes an illuminating discussion of the distinction between relative and absolute exhaustion.²⁹ Some basic coordinates to Moore's complex and ambitious theoretical work are in order. *Capitalism in the Web of Life* is a critical intervention into the ecological Marxist debate, combining the historical methodology of world-systems theory and an ontological claim about the "double internality" of nature and capitalism in an insistent polemic against any dualism of nature and society (of which he also accuses "metabolic rift" ecological Marxism). It is not surprising then, in arguing against what he sees as the Cartesian prejudice of a Green Thought that would treat nature as an independent limit to social manipulation, that he himself would turn to the question of exhaustion. For Moore, capitalist accumulation, ever since its fifteenth century inception, has relied on a combination of exploitation (of paid labor in the immediate process of production) and appropriation (the dispossession and "free" use of unpaid work/energy, what Maria Mies had called, in *Patriarchy and Accumulation on a World Scale*, the capitalist basis, and invisible iceberg, of "women, nature and colonies").³⁰ Capitalism's increases in productivity and its constant struggles against the falling rate of profit have depended on successive assaults on commodity frontiers (from the silver mines of Potosí to the forests of Norway, from the coal fields of nineteenth-century England to contemporary oceans and aquifers). According to Moore, "capitalism must commodify life/work but depends upon the 'free ride' of uncommodified life/work to do so. Hence the centrality of the frontier."³¹ Building on Rosa Luxemburg and David Harvey's theories of imperialism, while supplementing them with an account of capitalism as the co-production of "historical natures," Moore argues that without these "free gifts," which is to say these violent thefts, the production of surplus value would have never gotten off the ground. This is why "the problem of exhaustion," according to Moore, "is a problem of how capital puts nature to work."³²

The violent abstraction and appropriation, which is also to say the co-production of "Nature," is thus key to capitalism as a "world-ecology" in its own right. This is what Moore terms

capital's *correspondence project*, through which capital seeks to remake reality in its own image, and according to its own rhythms. Agricultural landscapes become exhausted because capital must extract unpaid work faster than agro-ecological relations can reproduce themselves. Working classes become exhausted because capital must extract surplus labor as fast as possible. Particular capitalists might gain in the process, but over time, *capital as a whole suffers*, because the system-wide capitalization of reproduction costs proceeds apace. The share of unpaid work declines. The ecological surplus falls.³³

Capital is what Moore calls a praxis of external nature, combining “productivity and plunder.”³⁴ Surplus value generated from the exploitation of abstract labor within the circuit of capital thus depends on the appropriation of unpaid/work energy in a value relation with what is (relatively) outside that circuit. With time, however, each arrangement of this exploitation/appropriation dialectic is undone, as capital is forced to internalize (“capitalise,” in Moore’s vocabulary) the appropriated natures — say, to plant “sustainable” forests rather than to deforest at will. For the sake of historical and systemic understanding (as well as of political praxis) what is critical here is not primarily the finitude of resources that may be “wiped out,” but the collapse of a particular relation of exploitation and appropriation, which can be, to use Moore’s terminology, “maxed out.” As he writes:

It is not an *absolute* exhaustion of an abstract and historical nature that “causes”... crises of profitability. Rather, it is the exhaustion of specific complexes of socio-ecological relations that induce transitions from one systemic cycle to the next. Put simply, there is simultaneous exhaustion of the organizational structures and of the historical nature specific to the old accumulation regime.³⁵

A “maxed out” historical nature “no longer delivers a rising stream of work/energy into — or in support of — the circuit of capital.”³⁶ Relational, rather than absolute exhaustion, then, is not just relative to particular structures and conjunctures of work-energy, it is an *exhaustion of relations*.³⁷ The basic (value) relation that comes to be exhausted is the one that leads to a falling rate of profit through the increase in the ration of constant to variable capital (what Marx terms the organic composition of capital) within the valorization process. Successive capitalist strategies to produce, appropriate (and exhaust) “Cheap Nature,” also understood as the “ecological surplus” — composed of what Moore calls the “Four Cheaps” (food, energy, raw materials, human living labor) — are all aimed at depressing the cost of circulating capital. But the returns are inevitably diminishing. As Moore notes, “These broadly entropic transitions highlight the self-consuming character of the capital relation, which tends to burn through its necessary biophysical conditions (included workers) and in so doing to jack up the organic composition of capital.”³⁸ The double process of exploitation and appropriation must take place simultaneously “because life-activity within the circuit of capital is subject to relentless exhaustion” — as re-reading Marx’s chapter on the working day or attending to the ethnography of factories on neoliberalism’s contemporary frontiers readily attests.³⁹

We are returned here, on a grand systemic and environmental scale, the scale of world-ecology, to the initial domain of the fatigue/exhaustion distinction in the nineteenth century, that of human labor (paid and unpaid, visible and invisible) and its conditions: “The dialectic of capitalization and appropriation turns, fundamentally,

on the relations through which humans are re/produced.”⁴⁰ Now, though Moore argues that limits are co-produced by nature and capital, or rather by capitalism in the web of life, he is also arguing in the final analysis that relative exhaustion (of Cheap Nature) is palpably turning into a kind of absolute exhaustion — not just in the sense of the total exhaustion of certain natures, but as the exhaustion of the crucial strategy of accumulation itself, the dialectic of exploitation and appropriation, with the latter always needing to be “larger” and “faster” than the former to preempt crises of profitability. “Relative to capital as a whole, the opportunities for appropriation have never been fewer, while the demand for such appropriations has never been greater.”⁴¹ The historical-material relation of exhaustion, the relative turning into the absolute (or as absolute as we could hope, or fear), in the “end of cheap nature,” resurrects after its own fashion the “pessoptimistic” philosophy of history we encountered at the beginning with Kant and Engels, exhaustion and antagonism as a prelude to a revolution that can only be planetary.

The Baleful Dialectic of Exhaustion and Acceleration

To the extent that “[e]very act of exploitation implies an even greater act of appropriation,” the capitalist world ecology is defined at its core by a (negative) dialectic of exhaustion and acceleration.⁴² Marx had already glimpsed this dynamic, a speculative (and financialized) logic, in his *Theories of Surplus Value*, again putting matters in terms of the twin degradation of human bodies and natural systems:

Anticipation of the future — real anticipation — occurs in the production of wealth in relation to the worker and to the land. The future can indeed be anticipated and ruined in both cases by premature overexertion and exhaustion, and by the disturbance of the balance between expenditure and income. In capitalist production this happens to both the worker and the land.... What is shortened here exists as power and the life span of this power is shortened as a result of accelerated expenditure.⁴³

That acceleration is an intrinsic trait of the social form of capitalism is a lesson easily garnered from much of Marx’s work, but what is its specifically ecological dimension? In his *Time, Labor and Social Domination*, Moishe Postone has tried to specify it by remarking upon capital’s tendency “to generate a constant acceleration in the growth of productivity.”⁴⁴ But these increases in productivity only increase surplus value indirectly. Thus, “the ever-increasing levels of productivity generated by capital accumulation entail directly corresponding increases in the masses of products produced and of raw materials consumed in production,” but these do not necessarily give rise to increases in surplus value — as we can see today when (a point also stressed by Moore) the accelerating consumption of natural resources gives diminishing returns in profit terms (requiring precarious supplementation by

financial instruments). Following Marx's remarks on the metabolic rift that capital wreaks on soil fertility, a paradigm of capitalist exhaustion as such, Postone remarks upon the "accelerating destruction of the natural environment" as an intrinsic feature of capitalist accumulation.⁴⁵ Rightly, Postone indicates Marx's transcendence of critiques of capitalism from a productivist stance (where it is a fetter to productive forces requiring liberation) or ones that center on the domination of nature:

The relation of humans and nature mediated by labor becomes a one-way process of consumption, rather than a cyclical interaction. It acquires the form of an accelerating transformation of qualitatively particular raw materials into "matter," into qualitatively homogeneous bearers of objectified time. The problem with capital accumulation, then, is not only that it is unbalanced and crisis-ridden, but also that its underlying form of growth is marked by runaway productivity that neither is controlled by the producers nor functions directly to their benefit.⁴⁶

In his landmark book *Fossil Capital*, Andreas Malm has further specified this accelerating exhaustion of nature, exploring the consequences of capital's structural indifference to natural boundaries (as opposed to intra-capitalist limits), its qualitative neglect and quantitative over-taxing of nature — a process that takes the form of a spiral, in which the "more biophysical resources [the capitalist] has withdrawn for profit-making, the more he is able to withdraw in the following round."⁴⁷ Referencing the work of his collaborator, the ecologist Alf Hornborg, Malm details how profit-driven accumulation determines the capacity to draw on increasingly greater quanta of energy and materials, showing how monetary accumulation determines an acceleration in the claims upon and dissipation of "other people's resources." The social relations within which capital accumulation and resource use are embedded, and in which human, animal, and material natures exist only relative to the measures and expediencies of accumulation, mean that dissipation is not castigated or checked, but positively rewarded. The more the capitalist successfully exploits and wastes, the more he will be able to continue to do so — capitalist growth has ecological crisis wired into its DNA.⁴⁸ This image of the spiral of accumulation and dissipation resonates with the one drawn by John Bellamy Foster and Brett Clark from William Stanley Jevons's *The Coal Question*, a key text in the nineteenth-century preoccupation with exhaustion. According to the Jevons paradox, far from diminishing resource usage, a more efficient and "economic" employment of matter and energy (in this instance, coal) serves to increase it. As Jevons noted: "If the quantity of coal used in a blast-furnace, for instance, be diminished in comparison with the yield, the profits of the trade will increase, new capital will be attracted, the price of pig-iron will fall, but the demand for it increase; and eventually the greater number of furnaces will more than make up for the diminished consumption of each."⁴⁹ (As Bellamy Foster

and Clark observe, by contrast with Marx and Engels, the great marginalist economist did not turn this observation into a critique of capitalist model of growth and resource use, but rather into its tragic-heroic assumption; having posed the alternative [for the British Empire] as one of between the doomed pursuit of glory in the present and “longer continued mediocrity,” Jevons opted for the former.⁵⁰)

Notwithstanding their decisive methodological and theoretical disagreements, both Malm and Moore have raised the problem of the ideologies of species agency that govern the recent infatuation with the discourse of the Anthropocene, which both have rechristened the Capitalocene.⁵¹ The problem of exhaustion is for both an occasion to revisit the question of agency — Moore opting for a broadly “monist” take on the “co-production” of historical natures by capitalism through the “web of life,” Malm a “dualist” vision in which the impact of capital on nature is to be understood through the internal class antagonism sundering any putative “humanity” (as he pointedly writes “no other species can have its metabolism organized through such sharp internal divisions”⁵²). By way of a philosophical coda, whose aim is to open a way of thinking exhaustion — the limits to capital and the limits of nature — in a manner diagonal to this dualist-monist divide, hopefully applying further dialectical torque to a debate already rich with insights about the contradictions and negativity attendant to the nature in and of social relations, I want to touch on Jean-Paul Sartre’s idea of “matter as inverted praxis,” as advanced in the first volume of his *Critique of Dialectical Reason*.

Deforestation and Tragic Form

Relying on René Grousset’s 1942 *Histoire de la Chine*, Sartre depicts the scene of peasant deforestation as a paradigmatic instance of how “serial” human action is unified, as a “counter-finality,” by matter, giving rise to a situation in which man becomes his own Other, his own enemy. It is in terms of this figure of *oneself as an enemy*, so critical to Hegel’s account of the tragic, that I propose to interpret Sartre’s *Critique* as, among other things, a *tragedy of materiality*. This is the very counter-finality of which Engels had spoken in *The Dialectics of Nature*, intimating the possibility of a “revenge of nature” against our daydreams of mastery: “Every victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only too often cancel the first.”⁵³ Sartre begins from the position of what Moore would term “Cartesian dualism,” though as the *Critique* advances, he twists it beyond all recognition.

Praxis, he writes, is “primarily an instrumentalization of material reality” giving the things it envelops a “pseudo-organic unity,” one borrowed from the unity of the individual as a practical organism.⁵⁴ But matter’s unity (and in a sense its agency) endures through *inertia*. In working upon matter, individually and serially, directly and indirectly, humankind produces a *practico-inert* reality, the world as a kind of “petrified backlash” of our own activity. Reified material objects reflect our praxis,

but in its passivity. In an acerbic variation on the idea of the alienation of human capacities in the product of labor, Sartre writes of how “practice absorbed by its ‘material’ becomes a material caricature of the human.”⁵⁵ In materializing itself, mediating itself through the inertias of matter, human action “enters into relation with the entire Universe,” such that “infinitely many unforeseeable relations are established, through the mediation of social practice, between the matter which absorbs *praxis* and other materialised significations.”⁵⁶ What the example of the *praxis* of peasant deforestation and the subsequent “tragedy” of flooding instantiate is a broader truth about the ontology of human action, namely that the “[i]nert *praxis* which imbibes matter transforms natural, meaningless forces into quasi-human practices, that is to say, into passivized actions.”⁵⁷ I’d like to propose that such a concept of “passivized action” can go some way to cutting across or rearticulating the antinomies of agency in the Anthropocene (or Capitalocene), including as it does within it a kind of phenomenology of the genesis of our ideologies of action.

In Sartre’s example, the Chinese peasants’ historic conquest of the soil could not foresee the lack that would turn against them, the absence of trees. Deforestation, as a passivized practice whose explicit finality was not the removal of trees but the plenitude of harvests, took place in the wilds, in the “frontiers” (to return to that theme from Moore) that at the time represented the “historical limits of society.” The removal of obstacles was transmuted or inverted into the lack of protection, turning the human activity of deforestation into the production of a virtually unified enemy of the peasant, an enemy who, embodied in nature as his inverted *praxis*, is ultimately “himself.” Sartre’s summation could, with some tweaking (mainly in terms of the potential for foresight) be adapted to the so-called Anthropocene:

Thus, the whole history of the terrible Chinese floods appears as an intentionally constructed mechanism. If some enemy of mankind had wanted to persecute the peasants of the Great Plain, he would have ordered mercenary troops to deforest the mountains systematically. The positive system of agriculture was transformed into an infernal machine. But the enemy who introduced the loess, the river, the gravity, the whole of hydrodynamics, into this destructive apparatus was the peasant himself. Yet, taken in the moment of its living development, his action does not include this rebound, either intentionally or in reality.⁵⁸

All counter-finality, of which the flooding haunting traditional Chinese agriculture is but an example, is adumbrated for Sartre by “a kind of *disposition* of matter.” In counter-finality, human action becomes a strange, reified destiny, serially produced, and collectively experienced. In counter-finality,

human praxis has to become a fatality and to be absorbed by inertia, taking on both the strictness of physical causation and the obstinate precision of human labor. Destruction by Nature is imprecise: it leaves little islands, even whole archipelagos. Human destruction is systematic: a particular farmer proceeds on the basis of an approach to a limit which conditions his praxis — quite simply, the idea that every tree growing in his field should be destroyed.⁵⁹

Thus humanity is unified in its own alienated antagonism against itself: “deforestation as the action of Others becomes everyone’s action as Other in matter... Others are fused, as Others, in the passive synthesis of a false unity; and, conversely, the Oneness stamped on matter reveals itself as Other than Oneness. The peasant becomes his own material fatality; he produces the floods which destroy him.”⁶⁰ Counter-finality creates a unity-in-potential-catastrophe which the previous uncoordinated actions of groups could never manifest, though it also launches fierce and unprecedented antagonisms. As Sartre remarks, Chinese deforestation “creates universal solidarity in the face of a single danger. But at the same time it aggravates antagonisms, because it represents a social future both for the peasants and for the land-owners. This future is both absurd, in that it comes to man from the nonhuman, and rational, in that it merely accentuates the essential features of the society.”⁶¹

In exhaustion and catastrophe, the historical limits of human action become the very sources of political, or even species, unity, a unity of necessity beset by antagonisms — which Sartre encapsulates in the notion of *anti-physis*:

This... relation of man to the non-human — where Nature becomes the negation of man precisely to the extent that man is made *anti-physis* and that the actions in exteriority of the atomised masses are united by the communal character of their results — does not as yet integrate materiality with the social, but makes mere Nature, as a brutal, exterior limitation of society, into the unity of men. What has happened is that, through the mediation of matter, men have realised and perfected a joint undertaking because of their radical separation. Nature, as an exterior constraint on society, at least in this particular form, constrains society as an interiority based on the objectification in exteriority of that society.... Nature, though transcended, reappears within society, as the totalising relation of all materiality to itself and of all workers to one another.⁶²

This relation of inverted praxis goes beyond the holism of “double internality” posited by Moore, to reveal a process in which “we” become our own enemy in the shape of a nature that bears the imprint of our praxis (in ways specific to its material disposition). Nature’s externality, albeit painfully real (in the form here of recurrent flooding) is

also an inner relation of society. Nature, seemingly transcended through mankind's work on matter, "transforms human praxis into *antipraxis*, that is to say, into a praxis without an author, transcending the given towards rigid ends, whose hidden meaning is counter-finality."⁶³ Nature is a historical limit of society, and of capital, only to the extent that society has externalized itself in it. It is in this, dialectical, sense, that we can begin thinking the relation between the limits of capital and the limits of nature in a manner neither endogenous nor exogenous, dualist nor holistic; in other words, that we can begin to think the Anthropocene, or rather the Capitalocene, as a geological and historical figure of alienated agency "where Nature," as Sartre writes, "becomes the negation of man precisely to the extent that man is made *anti-physis*," anti-nature.

Notes

1. Theodor W. Adorno, "The Idea of Natural History" (1932) *Telos* 60 (1984) 117.
2. Anson Rabinbach, *The Human Motor: Energy, Fatigue and the Origins of Modernity* (Berkeley: U of California P, 1992) 152, 163.
3. Andreas Malm, *The Progress of this Storm: Nature and Society in a Warming World* (London: Verso, 2017) 8.
4. For some iterations of this project, see my "Politics in a Tragic Key," *Radical Philosophy* 180 (July–August 2013) 25–34; "Taming the Furies: Badiou and Hegel on The Eumenides," *Badiou and Hegel: Infinity, Dialectics, Subjectivity*, ed. Antonio Calcagno and Jim Vernon (Lanham: Rowman & Littlefield/Lexington Books, 2015); "Transition et tragédie," *Période*, April 10, 2014, <http://revueperiode.net/transition-et-tragedie/>
5. See V.I. Lenin, "Prophetic Words," (*Pravda*, July 2, 1918) *Collected Works*, Vol. 27 (Moscow: Progress Publishers, 1972) 494–499, available at <https://www.marxists.org/archive/lenin/works/1918/jun/29b.htm>
6. Friedrich Engels, "Introduction [To Sigismund Borkheim's Pamphlet, *In Memory of the German Blood-and-Thunder Patriots, 1806–1807*]," Karl Marx and Friedrich Engels, *Collected Works*, Vol. 26 (London: Lawrence & Wishart, 1990) 451.
7. Translation from Thomas de Quincey, *The Collected Writings of Thomas de Quincey*, Vol. 9 (London: A. & C. Black, 1896) 428–444. De Quincey filters Kant through a thermodynamic vocabulary, as we can see by comparing his translation to the more accurate (if less evocative) translation by Nisbet, which renders the phrase *und selbst durchgängiger innerer Erschöpfung ihrer Kräfte* as "and even complete exhaustion of their powers." See Immanuel Kant, *Political Writings*, 2nd ed., ed. Hans Reiss, trans. H.S. Nisbet (Cambridge: Cambridge UP, 1991) 47.
8. Engels, "Introduction" 451; my emphasis.
9. For a thorough refutation of the widespread notion that Engels denied the second law of

thermodynamics and an illuminating review of the nineteenth-century debates on the heat death of the universe, see John Bellamy Foster and Richard Burkett, *Marx and the Earth: An Anti-Critique* (Leiden: Brill, 2016) 170–197.

10. If not of intelligence, which Engels deemed an... inevitable by-product of the combinatorial powers of matter. Here anthropological or species pessimism is combined with cosmological and cognitive optimism, of the kind manifested by the Russian scientist Lavrov, as cited by Engels, in this wonderful phrase: “Then the remains of the dead world become material for hastening the process of formation of the new world.” Quoted in Foster and Burkett, *Marx and the Earth* 182.
11. Cited in Sebastiano Timpanaro, *On Materialism* (London: New Left Books, 1975) 98–99. Consider also this remark by Bukharin, from *Philosophical Arabesques*: “Engels... considered inevitable both the decline of humanity and its extinction, together with the ending of life on the earth as a planet. In other words, human history cannot be divorced in any way from the history of the earth as the base, *locus standi* and source of nourishment of society.” Quoted in *Marx and the Earth* 197.
12. Cited in Timpanaro, *On Materialism* 98.
13. On the articulation between historical configurations of capital and variants of apocalypticism — as well as on the intimate nexus between the exploitation of labor and ideologies of energy, see George Caffentzis, “The Work/Energy Crisis and the Apocalypse” (1980), in *Letters of Blood and Fire: Work, Machines, and the Crisis of Capitalism* (Oakland: PM Press, 2013) 11–57.
14. René Scherer, *L’Écosophie de Charles Fourier* (Paris: Anthropos, 2001); Christophe Bonneuil and Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History and Us* (London: Verso, 2016); Jean-Baptiste Fressoz and Fabien Locher, “The Fragile Climate of Modernity: A Short History of Environmental Reflexivity,” *Books & Ideas*, March 31, 2014, <http://www.booksandideas.net/The-Fragile-Climate-of-Modernity.html>
15. Mike Davis, “The Coming Desert: Kropotkin, Mars and the Pulse of Asia,” *New Left Review* 97 (Jan–Feb 2016) 23–43; see Tarde’s 1896 novel *Fragment d’histoire future*, translated into English, with a preface by H.G. Wells, as *Underground Man* (London: Duckworth & Co., 1905), and the brief discussion in my “Powers of Pacification: State and Empire in Gabriel Tarde,” *Economy & Society* 36.4 (2007) 597–613; on Cournot, resource exhaustion and deforestation, see Perry Anderson, “The Ends of History,” *A Zone of Engagement* (London: Verso, 1992) 304–308.
16. Thomas Richards, *The Imperial Archive: Knowledge and the Fantasy of Empire* (London: Verso, 1993) 86–87. For a late imperial *détournement* of this image of exhaustion, consider the following, from E.M. Forster’s 1952 essay “Art for Art’s Sake”: “How can man get into harmony with his surroundings when he is constantly altering them? The future of our race is, in this direction, more unpleasant than we care to admit, and it has sometimes seemed to me that its best chance lies through apathy, uninventiveness, and inertia. Universal exhaustion might promote that Change of Heart which is at present so briskly recommended from a thousand pulpits. Universal exhaustion would certainly be a new experience. The human race has never undergone it, and is still too perky to admit that it may be coming and might result in a sprouting of new growth through the decay.” E.M. Forster, “Art for Art’s Sake,” *Two Cheers for Democracy* (London: E. Arnold, 1951) 89.
17. Caffentzis, “The Work/Energy Crisis and the Apocalypse” 14. Caffentzis’s comment on the link between capital and entropy is also worth reproducing here: “The Second Law announces the

apocalypse characteristic of a productivity-craving capital: heat death. Each cycle of work increases the unavailability of energy for work.... “The world is living on its capital’ and all around is the whisper of its impending silence” (14).

18. Patrick Wilcken, *Claude Lévi-Strauss: The Poet in the Laboratory* (London: Bloomsbury, 2010) 355.
19. See Daniel Pick, *Faces of Degeneration: A European Disorder, c. 1848–c.1918* (Cambridge: Cambridge UP, 1989).
20. Charles Darwin’s chilling observation: “Wherever the European has trod, death seems to pursue the aboriginal.” Quoted in Brewton Berry, “The Myth of the Vanishing Indian,” *Phylon* 21.1 (1960) 53.
21. For a nuanced and sympathetic account of Lévi-Strauss’s entropological plea for cultural diversity and his pessimistic analysis of Western modernity and humanism, see Emmanuel Terray, “Claude Lévi-Strauss’s World-View,” *L’Homme* 193 (2010): i–xix.
22. Claude Lévi-Strauss, *Tristes Tropiques*, trans. John Russell (New York: Criterion, 1955) 397–398.
23. “Even if the rainbow of human cultures should go down for ever into the abyss which we are so insanely creating, there will still remain open to us provided we are alive and the world is in existence a precarious arch that points towards the inaccessible.” Lévi-Strauss, *Tristes Tropiques* 398.
24. Georges Charbonnier, ed., *Conversations with Claude Lévi-Strauss*, trans. John and Doreen Weightman (London: Cape, 1969) 42.
25. Quoted in Kohei Saito, “Marx’s Ecological Notebooks,” *Monthly Review* 67.9 (Feb 2016) 26. The metabolic rift thesis extrapolates from Leibig’s work on the way “in which soil nutrients are removed from the soil in the form of food and fibre and exported hundreds, sometimes thousands, of miles to the towns, where the nutrients end up as pollution, failing to return to the soil.” See Foster and Burkett, *Marx and the Earth* 25.
26. Letter to Engels, March 25, 1868, quoted in Saito, “Marx’s Ecological Notebooks” 35.
27. Karl Marx, *Capital: A Critique of Political Economy Vol I*, trans. Ben Fowkes (London: Penguin Books, 1976 [1867]) 376. My emphasis.
28. Fredric Jameson directs our attention to the relationship between the extinguishing fire of labor and the consumption and resurrection of the value embodied in fixed capital in his *Representing Capital: A Commentary on Volume 1* (London: Verso, 2011) 97–98: “labor already underway, specific and completing itself, becomes a veritable fire, which not only ‘extinguishes’ the previous characteristics of the raw materials (including that labor power itself), but also prepares the climax of the figure as such: for as paradoxical as it may seem for fire to extinguish (rather than to be itself extinguished), it does one thing whose name and verb unite the literal and the figurative (so to speak): it *consumes*. The consumption of its ingredients by the fire of labor is also the consumption by the capitalist labor process of its own capital (constant as well as variable); and now illustrates the paradox rehearsed over and over again elsewhere (particularly in the *Grundrisse*), that production is a consumption (just as from another standpoint consumption is a production).” See my commentary on these passages in “The World is Already Without Us,” *Social Text* 34.2 (2016) 107–122.
29. It is not capital or nature that is exhausted but “regionally specific relations of capitalization and appropriation.” Jason W. Moore, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital* (London: Verso, 2015) 123; “exhaustion is not a substantial property. It is a *relational* property of the specifically capitalist *oikeios*”; “Exhaustion happens when particular natures — crystallised

- in specific re/production complexes — can no longer deliver more and more work/energy” (124).
30. “The imperative faced by capital to expand the zone of unpaid work faster than the capitalization of the *oikeios* is the historical basis through which capitalist power lumped together the epoch-making appropriation of ‘women, nature, and colonies.’ Without women, nature, and colonies — a stylized list, to be sure — accumulation falters” (Moore, *Capitalism in the Web of Life* 240). Mies writes in *Patriarchy and Accumulation on a World Scale: Women in the International Division of Labor* (London: Zed Books, 1986) about “the contradictory process... by which, in the course of the last four or five centuries women, nature and colonies were externalized, declared to be outside civilized society, pushed down, and thus made invisible as the under-water part of an iceberg is invisible, yet constitute the base of the whole” (77).
 31. *Capitalism in the Web of Life* 192.
 32. *Capitalism in the Web of Life* 120.
 33. *Capitalism in the Web of Life* 235.
 34. *Capitalism in the Web of Life* 156.
 35. *Capitalism in the Web of Life* 162.
 36. *Capitalism in the Web of Life* 225.
 37. “The normal course of capital accumulation tends to exhaust the establishing relations of re/production that inaugurate a great wave of accumulation” (*Capitalism in the Web of Life* 118).
 38. *Capitalism in the Web of Life* 174. The term organic composition, referring to the ratio of constant to variable capital, is (ironically) borrowed from the writings of Leibig on soil fertility.
 39. *Capitalism in the Web of Life* 193.
 40. *Capitalism in the Web of Life* 221.
 41. *Capitalism in the Web of Life* 165.
 42. *Capitalism in the Web of Life* 214.
 43. Quoted in *Marx and the Earth* 149.
 44. Moishe Postone, *Time, Labor and Social Domination: A Re-interpretation of Marx’s Critical Theory* (Cambridge: Cambridge UP, 1993) 311.
 45. Postone, *Time, Labor and Social Domination* 311.
 46. *Time, Labor and Social Domination* 312.
 47. It could be argued that Moore’s historical-philosophical and socio-ontological optimism lies in thinking that there is a tendential convergence between the limits to nature and the limits to capital, once we reconceive capitalism, via “double internality,” as operating in the web of life. For an extreme — but not for that exceptional — counter to this consider the words of the neoclassical political economist Robert Solow: “If it is very easy to substitute other factors for natural resources, then there is in principle no ‘problem.’ The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe” (quoted in *Marx and the Earth* 232–233n31).
 48. Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016) 284.
 49. Quoted in Brett Clark and John Bellamy Foster, “William Stanley Jevons and *The Coal Question*,” *Organization & Environment* 14.1 (2001) 95.
 50. Clark and Foster, “William Stanley Jevons and *The Coal Question*” 97.

51. Moore acknowledges Malm's initial coinage in his Introduction to *Anthropocene or Capitalocene?: Nature, History, and the Crisis of Capitalism*, ed. Jason W. Moore (Oakland: PM Press, 2016) 5.
52. Malm, *Fossil Capital* 280.
53. Cited in John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift: Capitalism's War on the Earth* (New York: Monthly Review Press, 2010) 241.
54. Jean-Paul Sartre, *Critique of Dialectical Reason*, vol. 1, trans. Alan Sheridan-Smith, edited by Jonathan Rée (London: Verso, 2004) 161.
55. Sartre, *Critique of Dialectical Reason* 161.
56. *Critique of Dialectical Reason* 161.
57. *Critique of Dialectical Reason* 161.
58. *Critique of Dialectical Reason* 161.
59. *Critique of Dialectical Reason* 163.
60. *Critique of Dialectical Reason* 163.
61. *Critique of Dialectical Reason* 164.
62. *Critique of Dialectical Reason* 165. For a criticism of Sartre's inability to fully assume the negativity in nature and the historicity of matter beyond human subjectivity, see Richard James Blackburn, *The Vampire of Reason: An Essay in the Philosophy of History* (London: Verso, 1990) 16–18. For Blackburn, *Homo sapiens* "is persistently assailed by vampirish objects and agencies whose collective negativity can be designated as the predatory enemy of rationality, the vampire of reason" (22).
63. *Critique of Dialectical Reason* 166.

Afterword

Oxana Timofeeva

How much can we take from nature? Can it always provide enough resources to satisfy the needs of humankind, or is it in danger of complete exhaustion—of being eaten up? Rather than a simple “yes” or “no” answer, these questions demand a complex vision: our relationship to nature contains a paradox, that is nicely introduced by Ovid in book 8 of *Metamorphoses*. It recounts a legend of Baucis and Philemon that originates in Greek and Roman mythology. In order to test the humanity of mortals, two gods, Jupiter and Mercury, come down to Earth disguised as strangers. They go from one house to another and knock on a thousand doors, but each time are turned away: no one recognizes them in their beggarly look.¹ Finally, an old, poor family couple, Philemon and Baucis, open to strangers the door of their small cottage. They do not have much to propose, but they welcome guests with all their sincere hospitality. They serve modest, poor food, like cabbage, radishes, milk, eggs, or fruits. They also serve some wine, and, suddenly, a miracle happens: they pour from the vase, but it fills itself up with wine again and again. That’s how a hospitable couple realizes that the guests are not mere mortals:

But while they served, the wine-bowl often drained,
as often was replenished, though unfilled,
and Baucis and Philemon, full of fear,
as they observed the wine spontaneous well,
increasing when it should diminish, raised
their hands in supplication, and implored
indulgence for their simple home and fare.²

In *The Parasite*, Michel Serres cites this story, together with other ancient fables, where the entire system of the world economy is described in terms of parasitism. The parasite lives at the expense of the other, who is called the host; it attaches to the body of the host, or digs inside it, and eats it. Thus a host provides a parasite with both home and nourishment. A parasitic relation is not mutual — not the one of exchange — since a parasite never gives anything back to his host, but a parasite can itself become a host for another parasite. All living beings, including humans, are assembled into a complex parasitic chain. On Serres’ account, ultimate and universal host is nature, on whose body we dwell and board, and whose resources miraculously

never end. Nature is the last (or the first) link of a chain; it does not parasite on anything, but can only host. Baucis and Philemon appear as generous hosts, ready to share gratuitously everything they have. But even if the host's resources are limited, they are never entirely ruined and devastated, or, better, they are drawn, again and again, from the very devastation and exhaustion of the host – this is what Serres calls “a daily miracle of the parasite.”³ Commenting on this, Serres evokes the image of Phoenix, a bird which cyclically burns itself and then reappears out of its own ashes:

It is the daily miracle of the parasite. It is always the table d'hôte and the phoenix of the hosts. Parasitism doesn't stop. The host repeatedly is reborn from his ashes, from the ashes expelled through the stercoral door. Sit down at the *table d'hôte*; the host always makes the meal. He is there for that. The host is reborn from his consumption, from his consumption by fire, and the wine springs again from his destruction.⁴

Long before Serres, the figure of Phoenix was already introduced in a similar sense by Hegel, who, in the closing paragraphs of his *Philosophy of Nature*, presents the aim of nature as death, on its own accord, or self-annihilation for the sake of spirit: “The purpose of nature is to extinguish itself, and to break through its rind of immediate and sensuous being, to consume itself like a Phoenix in order to emerge from this externality rejuvenated as spirit.”⁵ Phoenix sacrifices itself, or, as Hegel puts it, consumes itself, but then always awakens anew. One might therefore assume that our spiritual universe knows nature as an undead body, whose miraculous hospitality has no limit. Today's name for this hospitality is energy, and the phoenix that is constantly burned down is, almost literally, fossil fuels, a highly exploited, undead, non-human material agency.

As Brent Ryan Bellamy and Jeff Diamanti argue in their preface to this special issue of *Mediations*, a theory of conservation of energy—according to which energy can neither be created, not destroyed, but only transformed—is immanent to capitalist modernity, and Nietzschean idea of the eternal return appears as its metaphysical double. An eternal return of energy creates a paradigm, whose function is to immunize the world against ecological and social catastrophe. As opposed to this paradigm, and roughly at the same time, Marxist theory emerges, that sees the materiality of energy not as an eternal return, but as a social relation.⁶ One can describe this relation as a parasitic one, where the main parasite is capital, attached to the host body of nature, which is considered as a material source, and, crucially, as a source of energy.

Capital is a twofold process. Its two sides are the so called basis, or economy, and infrastructure, or ideology. The link between capitalist economy and capitalist ideology is a value form (an exchange value and a surplus value are doubled with spiritual, cultural values). On the side of economy there is production, and on the side of ideology there is consumption. Production and consumption are linked by

the commodity. The relation of production to the commodity can be characterized as alienation: not only does a product not belong to a producer, but a producer in the process of production does not belong to herself, as she only sells herself as a working force. The relation of consumption to the commodity takes the shape of commodity fetishism. Commodity fetishism is a flip side of alienation: we lose ourselves in production and try to find ourselves in consumption, but always in vain. Both vectors of this two-fold movement could not be possible without a certain energy supply. The process of production is driven by material energy that mainly presents a concatenation of fossil fuels and labor power, whereas consumption feeds on libidinal energy, whose investments are provided by desires and drives.

Thus fossil fuels, labor, and desire constitute a kind of heterogeneous, underground, and highly explosive realm upon which capitalist system is based. This is, so to say, an unconscious level of the world economy, which now collides with the world ecology, since capitalist technological developments bring catastrophic side effects. Fossil fuels and labor force are an industrial component of a post-industrial, digital society where they seem to be overcome, but in fact are rather repressed and preserve themselves in this repressed form somewhere beneath the ground: oil — between geological layers; and labor force — in underground sweatshops. In this sense, they are in fact a kind of unconscious, and one of the laws of the unconscious is applicable to them: the one of the return of the repressed. It is neither a mere conservation, nor an eternal return, but an eternal return of the repressed that governs the energy triangle of capital — labor, fuels, and desire.

What a worker and oil have in common is that they are not only the repressed, but also the oppressed; not only the unconscious layer of the society in which we exchange life for money, but the exploited and consumed, burned up as they are in the production of surplus. The worker is exploited as a living labor, burning out when transformed into dead capital, while oil is exploited as a natural resource, that burns for the sake of profit. The third side of this energetic triangle is desire, a source of libidinal energy that generously invests into commodified objects whose value is generated by fetishistic projections. This is the phoenix triangle of capitalism, its undead underground currents, its concrete materiality compelled by an abstract value form. Can its potential be different than the one indicated by a current technocapitalist conjuncture? Marxist dialectics is a method that allows us to open up, through a materialist critique of energy, the horizon of its other possibilities.

Notes

1. Ovid, *Metamorphosis: Philemon and Baucis*. <http://hompi.sogang.ac.kr/anthony/Classics/OvidPhilemonBaucis.htm>
2. Ovid, *Metamorphosis*.
3. Michel Serres, *The Parasite* (Minneapolis: U Of Minnesota Press 2007) 99.
4. Serres, *The Parasite* 99.
5. *The Parasite* 444.
6. Brent Ryan Bellamy and Jeff Diamanti, "Materialism and the Critique of Energy" *Mediations* 31.2 (2018).

Thomas A. Laughlin. "Anthropocene Marxism: John Bellamy Foster's and Paul Burkett's Marx and the Earth."
Mediations 32.1 (Spring 2018) 149-156. www.mediationsjournal.org/articles/anthropocene-marxism

Marx and the Earth

John Bellamy Foster and Paul Burkett

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Anthropocene Marxism

Thomas A. Laughlin

The Anthropocene poses certain aesthetic and cognitive problems of scale. To put it simply, we are the problem, but we can't see it. In fact, even how we chose to define and conceptualize this "we" is part of the problem.¹ We have lots of models for thinking individuality, but very few for thinking "totality" — not just humanity as a whole, but also humanity in its interaction with non-human nature, what Marx called "external nature."² The conceptual purchase of "the Anthropocene," as a hypothetical name for a new geological epoch, is the suggestion contained within it — that we have entered a "new human" age in which we must understand our existence as a species not separated from nature but embedded within and coevolving with nature.³ Coevolution, however, should not be taken to imply harmony and symbiosis: through our socially organized and mediated relationship with "external nature," we are actively creating an increasingly hostile environment for human development and at the same time threatening the existence of thousands of other species.⁴ But these are social-ecological challenges that are hard to see when we take an individualized point of view.

How to tell this story from the perspective of the whole? This requires new — or at least refurbished — cognitive tools, narrative devices, and perhaps even aesthetic dimensions to grasp. It is to these challenges that John Bellamy Foster and Paul Burkett turn in *Marx and the Earth: An Anticritique* (2016). Both authors have made a name for themselves as proponents of ecological Marxism: Burkett in *Marx and Nature* (1999) and Foster in *Marx's Ecology* (2000). What distinguishes Burkett and Foster from other ecosocialists is their insistence that ecology is not something alien to Marx that then

needs to be grafted on to his system in what an edited volume from the 1990s referred to as *The Greening of Marxism*. To clarify their position within these debates, they to put forward a theory of “stages” of ecosocialist thought. In the 70s and 80s, Marxists increasingly tarried with environmental issues; these however seemed to have no place in the Marxism they had learned (3). Many erstwhile-Marxists thus felt a need to modify, or even break with, Marxism in order to address the important environmental issues of their day. This break resulted in first-stage ecosocialism. However, as more Marxists assimilated environmental issues to their critique of capitalism, the more that they also began rediscovering in Marx’s writing an original ecological critique of capitalism. There thus emerged in the 90s a second-stage ecosocialism in which writers like Foster and Burkett sought to uncover what in fact had been hiding in plain sight all along — Marx’s ecology. “These second-stage investigations,” Foster and Burkett write, “led to the rediscovery of the ecological depths of classical Marxist thought and to the rejection within ecological Marxism of many of the presumptions of first-stage ecosocialism itself” (3-4). Foster and Burkett aver that we are now in the midst of a budding third-stage ecosocialism, in which the original insights of Marx and Engels have been rescued and are now being updated and applied to social and ecological contradictions of the twenty-first century.

The reason the authors refer to their work as “an anti-critique” is to suggest that they are not simply defending classical Marxism from criticisms lobbied by first-stage ecosocialists and ecological economists (which they lump together for similar attitudes to Marxism), but that in the process of deflecting and disarming these critiques they are at once also deepening our and their own understanding of Marx’s ecology — anti-critique in other words is an *active*, rather than a purely reactive, process. The concept of anti-critique originates with Rosa Luxemburg’s pamphlet *The Accumulation of Capital: An Anti-Critique* (1915) (not to be confused with her major work which came first). However, the idea also has precedence in Engels’s famous discussion of Herr Eugen Dühring’s *Revolution in Science* (1878), popularly referred to as *Anti-Dühring*: “As Engels observed... he was ‘compelled to follow’ Dühring ‘wherever he went and to oppose my conceptions to his. In the process of carrying this out my negative criticism became positive; it was transformed into a more or less connected exposition of the dialectical method and of the communist world outlook represented by Marx and myself’” (Foster and Burkett viii).

In a similar fashion, Foster and Burkett’s book chapters evolve largely as rebuttals to important and influential ecosocialists and ecological economists, in which they return to the primary texts of Marx and Engels to read *what the authors actually said*, rather than taking for granted clichés about classical Marxism, for example, that it is “promethean.” The end result, as in *Anti-Dühring*, is not a mere defense, but rather a full-blown exposition of ecological Marxism. Here, they are at pains to challenge the following presumptions about classical Marxism: (1) that it ignores nature’s intrinsic value; (2) that Marx was anti-ecological by referring to nature as “man’s inorganic

body”; (3) that Marx and Engels, in rejecting both energeticism and the second law of thermodynamics (entropy), failed to factor energy into their theory of value; (4) that they adopted energy neutrality by not distinguishing renewable from non-renewable resources; and (5) that Marx’s value theory neglected “material flows” and ecological limits in his examination of capitalism’s reproductive cycles (7-8).

Tackling the first, Foster and Burkett point out that Joel Kovel’s criticism that Marx neglected intrinsic value of nature confuses Marx’s critique of political economy with Marx’s own point of view. It is capitalism that neglects nature’s intrinsic value, focusing instead on exchange value. From the perspective of exchange-value nature presents capitalism with a treasure trove of “free gifts” — nature’s proverbial tap — which the capitalist eagerly expropriates without thinking about the environmental and social costs or consequences of such plundering. As Marx observes such “robbery” of nature’s wares often has negative consequences for the social metabolism that mediates a society’s relationship to nature, leading to rifts in the reproducibility (or what we would now call sustainability) of these exchanges between society and nature.⁵ For Marx, socialism/communism seeks to overcome this “alienation of nature” that results from capitalist metrics of exchange-value, focusing instead on the sustainable generation of communal use-values. As Foster and Burkett observe, Marx’s interpretation of the labor process “leave[s] room for intrinsic valuation since it is part of use value broadly defined, and can be treated as a form of primary appropriative labour, including that of a mental and even spiritual type” (41).

As Foster and Burkett repeatedly remind their reader, human society cannot separate itself from nature. Human existence depends on the species’ ability to use nature — that is, on appropriative labor. That the young Marx refers to nature as “man’s inorganic body,” however, does not imply that nature is simply there to be dominated. As the authors point out, Marx is using “organ” and “organic” in a more old-fashioned, Aristotelian sense, as referring to, or being related to, tools (65). Organs, in other words, are tools and nature is the “inorganic body” from which “man” draws “his” tools and, in so doing, develops “his” organic composition in a co-evolution with nature.⁶ There is thus nothing inherently anti-ecological in calling nature “man’s inorganic body”; in fact, in many ways the expression points to an early sensitivity in Marx to the co-evolution of society and nature through appropriative labor: “For Marx, human beings are active, living, transformative creatures in charge of their own bodies and drives; at the same time, they are ‘natural, corporeal, sensuous, objective’ beings who suffer, whose natural objects, the conditions of their existence, the inorganic body of nature by which they seek to extend themselves, are to be found outside of themselves” (69). Thus, far from presupposing any kind of anthropocentrism, Marx’s conception of nature as “man’s inorganic body” instead sought to put human history in a dialectical and co-evolutionary relationship with nature (72-73).

Foster and Burkett have a similar rebuttal to the ecological economist J. Martínez-

Alier's claim that Marx and Engels failed to incorporate energy into their theory of value, when they rejected the Ukrainian socialist and physician Sergei Podolinsky's energeticist accounting in "Socialism and the Unity of Physical Forces" (1881).⁷ As the authors note, while Podolinsky was clearly influenced and inspired by Marx's theory of surplus value (109), his essay is primarily concerned with labor's ability "to accumulate [solar] energy in useful forms on the earth and that this unique capability implies that the human being fulfills the thermodynamic requirements of a so-called perfect machine," a then-popular concept in physics (92). One of Podolinsky's examples is the way in which human agriculture is able to increase the amount of plant life storing energy: "The essential idea here was the notion that human labour had increased the throughput in energy terms over what would be found in forests or in natural pastures" (103). Podolinsky's energetics thus work more like David Ricardo's labor theory of value than Marx's value theory of labor, in that, for Podolinsky, inputs of human and animal labor in agriculture add "value" to agricultural yields by multiplying the accumulation of energy over that which is naturally existing. The result is what Foster and Burkett rightly term energy reductionism: the reduction of value to energy returned on energy invested. Whereas, for Marx, "value, or abstract labour time, is not a natural-physical substance [in-forming value], but rather an alienated material-social relation," which results from measuring everything by metrics of exchange-value (i.e. profitability) at the expense of other communal or ecologically sustainable values (110).⁸

Moreover, Podolinsky's energy accounting, aside from bearing little relationship to Marxist value theory, is far too complicated to be ever made exact. Podolinsky, for example, failed to account for additional energy inputs from fertilizer and coal in the case of mechanized agricultural production or "in terms of the total caloric consumption of humans" (105). Part of the problem is that Podolinsky relied on the then-popular thermodynamic model of the steam engine, arguing that humans were "perfect machines" capable of refueling their own "fireboxes":

The extreme difficulty that Podolinsky runs into here stems from his insufficient recognition that the analysis of the steam engine carried out by physicist-engineers like Carnot, Clausius, and Thomson is constructed in terms of a closed system and an ideal, frictionless engine. In contrast, the human economy (like life itself), despite the emphasis of economists on the circular flow, is not a closed system but one that continually draws on its external environment so as to accumulate energy (or low entropy) within its own (open) system while simultaneously dissipating energy and material waste back into its environment. Indeed, the capitalist economy is arguably the most extreme example possible of a system that draws on a resource tap (at ever increasing rates) and dissipates waste into the environmental sink (also at ever increasing rates), in ways that

accelerate entropic degradation. (114)

Capitalism, even if experienced as narrow and closed, is an “open system”; it exchanges material with other systems: coal comes from the ground (the Earth system) before it enters production (the social system) as a fossil-fuel throughput, but it then also leaves production as carbon-emitting smoke pollution entering back into the same biosphere that humans inhabit. The energy stored in fossil fuel has dissipated, i.e. become not useable, but with important consequences for the environment (one of them, ironically, being *more* heat/energy retention, which Podolinsky took as an “unalloyed good” [102]). In other words, there is constant dissipation of energy at the same time that there is accumulation.

It is for these reasons that Foster and Burkett say that Marx and Engels were wary of embracing Podolinsky’s energetics, not because they wanted to ignore energy, but because his crude energy accounting (while revelatory in its novelty) was reductionist and thus incompatible with a dialectical and materialist ecology, which distinguished between closed and open systems. Presciently Engels wrote Marx to say,

What Podolinski has completely forgotten is that the working individual is not only a stabiliser of present but also, and to a far greater extent, a squanderer of past, solar heat. As to what we have done in the way of squandering our reserves of energy, our coal, ore, forests, etc., you are better informed than I am. From this point of view, hunting and fishing may be seen not as stabilisers of fresh solar heat but as exhausters and even incipient squanderers of the solar energy that has accumulated from the past. (quoted in Foster and Burkett 124)

Engels’s comments show, despite Daniel Tanuro’s claims to the contrary, that both thinkers had an acute sensitivity and interest in problems of non-renewable energy.⁹

Part of the confusion for first-stage ecosocialists has been the misperception that Marx and Engels rejected the second law of thermodynamics, or entropy. This is a misunderstanding that undergirds the ecological economist Nicholas Geogrescu-Roegen’s otherwise enthusiastic appraisal of Marx and Engels’s theories. However, as Foster and Burkett carefully argue, what Marx and Engels rejected was not the second law of thermodynamics itself, but rather “its extrapolation into a theory of the heat death of the universe” and “the questionable cosmology that was being built on it” (172-73). As the authors show through a close reading of passages from Engels’s *Dialectics of Nature* (the key text in this debate), the heat death hypothesis was neither consistently scientific nor materialist: for the idea that the universe’s energy was finite and therefore could be depleted (i.e. consumed in cosmic heat death) led also to the non-scientific inference of a deistic “*impulse from outside*,” which had provided “original heat to the nebular ball” (Engels quoted. in Foster and Burkett 175-76). This

was the Christian-eschatological view promoted the physicists Thomson and Tait. Engels, however, argued more cautiously that energy lost to earth was radiated back out into space where in fact it may be re-utilized, or converted, again. The universe, like the mode of production, is an open system in which conversion and dissipation operate simultaneously: “the death of one star, and one solar system (and indeed one ‘island universe’), could possibly become the basis for the formation and evolution of others under the force of gravitation. This theory [i.e. Engels’s] did not contradict the entropy law because it was conceptualized in open terms, that is, in relation to the interaction of solar systems and island universes (plural), not isolated systems” (Foster and Burkett 181).

Each chapter of Foster and Burkett’s anti-critique shows with lucid brilliance that the stereotype of Marx and Engels as rigid mechanical and/or economic thinkers is wildly out of sync with what their works actually say. What emerges from the pages of *Marx and the Earth* is a very clear and persuasive representation of Marx and Engels not just as socialists/communists, but also as ecological materialists. The last chapter of the book, for example, takes to task the accusation that Marx ignored material (ecological) limits to the reproduction of capitalism. As the authors observe, “criticisms of Marx’s reproduction schemes are all rooted in the claim that these schemes treat the economy as a self-reproducing system *not dependent on its natural environment*” (205, emphasis added). However, through a reevaluation of Marx’s response to Quensay and the Physiocrats, Foster and Burkett show that the circularity of monetary flows back to the capitalist in the form surplus value are in no way mirrored (in either Marx or the Physiocrats) by an equal or automatic *circular* restoration of nature’s “free gifts.” While there are capitalist crises of a purely economic character, immanent to monetary flows alone, these at the same time can intersect and become concomitant with environmental crises, which result from metabolic rifts in the sustainability of material flows between nature and society (for example, Marx’s famous discussion of nutrient depletion under agricultural capitalism). As the authors note in the preceding chapter, “The common element in capitalism’s tendencies to overexploit land and labour power is the failure to provide sufficient time (and biochemical energy inputs) for the restoration of productive power” (148). This brief nod to time — the temporal rhythms of capitalist production and reproduction — is a telling one, for what Foster and Burkett essentially argue is that ecosocialism cannot be reduced to a better and fairer system of ecological accounting, but must in fact involve a qualitative rupture as well:

it is not enough to be a materialist; it is necessary to be dialectical too. It is precisely this, in fact, that is most crucial to the development of a complex, historical, open-systems approach to society and nature. In sharp contrast, an energeticism that fetishises the mere quantitative — thereby mimicking capitalist (exchange-value) relations, while

downplaying qualitative (use-value) relations—inevitably leads back to the same old dualistic antinomies, the same timeless form of mechanism and reduction, that characterise the prevailing worldview. (236)

Readers familiar with both authors' works will not be surprised at these conclusions nor, in fact, with many of the preceding chapters, which have been published before in slightly different versions. However, the sheer thoroughness of the book once these independent parts are brought together into one single *anti-critique* makes an even stronger and more compelling case for the ecological-materialist character of classical Marxism.

One of the previously unpublished sections, however, may come as a surprise and will be of special interest to literary and cultural historians seeking a specifically Marxist mode of ecocriticism. Towards the end of their introduction Foster and Burkett argue, via Margret A. Rose's reconstruction of Marx's lost aesthetic theory, that Marx had specifically opposed the Hegelian idea that aesthetic beauty was the antithesis of natural beauty. For Hegel, natural beauty is appreciated via the senses, whereas "artistic beauty starts higher than nature" (quoted in Foster and Burkett 51).¹⁰ Hegel noted that although "as a discipline... 'Aesthetic' means 'the science of sensation or feeling,'" his *Lectures on Aesthetics* were "explicitly designed to contest this, and to remove the aesthetic from this sensory basis, separating it from external nature" (51).

For Marx, on the other hand, "the emancipation of all human senses and qualities', but also at the same time their active cultivation, through the education of the senses... was nothing other than the freeing up of human creative powers in history" (quoted in Foster and Burkett 54). An unalienated, emancipatory aesthetic would thus be one able to reconnect sensual experience, currently petrified in the airless realm of *artificial beauty*, with nature and humanity's embeddedness in nature as a species whose entire culture and society is dependent on metabolic exchanges with nature. Here lies a whole research project outside the purview of what Foster and Burkett (through no fault of their own) are able to achieve in their book. But it is a suggestive thumbnail of where a Marxist ecocriticism may want to focus its attention and has an obvious applicability to a reassessment of Thomas Hardy's novels of character and environment, Williams Morris proto-ecosocialist utopia *News from Nowhere* (1890), Bessie Head's postcolonial-georgic *When Rain Clouds Gather* (1968), as well as Raymond Williams's highly suggestive treatment of literature's "structures of feeling." A book that persuasively settles old scores at the same time that it opens new vistas in cross-disciplinary exchanges is one that warrants serious consideration. *Marx and the Earth* is that book.

Notes

1. For an overview of the debate about who is the “we” in the Anthropocene hypothesis, see Ian Angus, “Confusions and Misconceptions,” *Facing the Anthropocene: Fossil Capitalism and the Crisis of the Earth System* (New York: Monthly Review, 2016) 224-32.
2. Karl Marx, *Capital: A Critique of Political Economy, Volume 1*, trans. Ben Fowkes (London: Penguin 1976) 283.
3. John Bellamy Foster, Brett Clark, and Richard York. *The Ecological Rift: Capitalism’s War on the Earth* (New York: Monthly Review, 2010) 13-14.
4. Foster, Clark, and York, *The Ecological Rift* 14-15.
5. For a discussion of Marx’s metabolic rift theory, see John Bellamy Foster, “Marx’s Theory of Metabolic Rift: Classical Foundations of Environmental Sociology,” *American Journal of Sociology* 105.2 (1999): 366-405.
6. Implicit here, although not mentioned, is a clarification of why Marx refers to the aggregated fixed capital in the production process — factories and machines — as the “Organic Composition of Capital.” See Marx, *Capital* vol. 1, 762.
7. Marx and the Earth contains appendices with English translations of both this version of Podolinsky’s essay and the one published after Marx’s death as “Human Labour and the Unity of Forces” (1883).
8. On Marx’s disagreement with Ricardo, see David Harvey, “Marx’s Refusal of the Labour Theory of Value,” *Davidharvey*, 14 March 2018, <http://davidharvey.org/2018/03/marxs-refusal-of-the-labour-theory-of-value-by-david-harvey/>
9. For their full critique of Tanuro’s charge that Marx and Engels were guilty of energy neutrality, see Foster and Burkett 15-33.
10. The quotation is from Georg Wilhelm Friedrich Hegel, *Introductory Lectures on Aesthetics*, trans. Bernard Bosanquet, ed. Michael Inwood (London: Penguin 1993) 4. However, Foster and Burkett have substituted “starts” for “stands” in the original quotation. I’ve preserved the substitution above in case it’s important to their intended meaning.

Jordan B. Kinder. “‘In the Heat of this Ongoing Past’: Three Lessons on Energy, Climate, and Materialism.”
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Fossil Capital: The Rise of Steam Power and the Roots of Global Warming

Andreas Malm

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The Progress of This Storm: Nature and Society in a Warming World

Andreas Malm

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“In the Heat of this Ongoing Past”: Three Lessons on Energy, Climate, and Materialism

Jordan B. Kinder

The thermometer can be legitimately suspected as a barometer of the rolling invasion of the past into the present.¹

In a warming world, the past materially invades the present and future. Decades after Fukuyama’s declaration of the supposed end of history, the sentiment could not be farther from the truth. In the wake of intensified anthropogenic climate change, the result of centuries of pumping CO₂ into the atmosphere, history is made present, if it indeed ever left us the first place. We can feel it; we will continue to feel it. To confront and alter this course of history, we must think historically and we must think materially. This thesis is the kernel around which Andreas Malm’s *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (Verso 2015) and *The Progress of This Storm: Nature and Society in a Warming World* (Verso 2018) are shaped. Turning his attention to the energy transition that offered the bedrock for the energetic relations of today, Malm’s *Fossil Capital* investigates the transition from the use of water power in industrial production to coal-fueled steam power, or as Malm understands it, from

“flow” to “stock” — terms Malm employs to describe animate and inanimate energy forms more precisely. In this transition, he finds a reorganization of the forces of production that strengthened capitalist relations and established the foundations for the fossil economy we know so well today. *The Progress of This Storm* broadens the scope of *Fossil Capital*, interrogating conceptions of relations between humans and nature in a warming world while taking to task popular theoretical movements such as constructionism, new materialism, hybridism, and posthumanism. In doing so, Malm ultimately argues for a renewed attention to historical materialism and radical politics as a means through which to confront what he calls the “warming condition.”

Taken together, Malm’s works are not only compelling for the ways in which they develop an account of energy as a social relations through intricate research of past transitions or for how he builds a vision of the relation between society and nature that provides the foundations for moving beyond the political and agential deadlock that he asserts is the consequence of much contemporary thinking of nature. These particular characteristics of *Fossil Capital* and *The Progress of This Storm* respectively are, to be sure, significant and productive lines of thought. But the larger contributions Malm’s work makes are in the ways that the future figures into the past and present as a space for possibility in both positive and negative registers. In other words, the diagnoses of the past and present that *Fossil Capital* and *The Progress of This Storm* together provide contain within them a prognosis as well, a program for a more socially and ecologically just future alongside stark recognitions of the consequences of maintaining business as usual. If we are to understand the present and the possible futures (both desirable and undesirable), then we must understand past and present materially.

There is no doubt, however, that Malm’s criticisms of both emerging and dominant views of nature and society found in *The Progress of This Storm* will leave a bad taste in some mouths, particularly for those who have critical allegiances to the methods and theories that he places in his critical sights. Some trajectories in Malm’s critique of new materialists and posthumanists in particular could be attended to in a more careful manner, including the ways in which Malm understands the role of nonhuman animals in production and the question of whether or not animals labor, as well as in the scale through which artificial intelligence continues to develop in relation to production. There is, further, a value in those modes of thought that demonstrate similarities between, for instance, animals and humans at a time and in a system that historically relies on the subjugation of one for the betterment of the other. Yet this is not Malm’s aim in criticizing those who see hybridity rather than separation in the world. His point, instead, is that by taking on a position of hybridity in a moment constitutively marked by separation and inequity, one risks further reproducing such separation and inequality, regardless of intention. It is worth pointing out as well that many of these characteristics of what I have identified as a kind of new historical materialism emerge from conversation with and against positions put forward by the

likes of Latour and others.

Despite these objections to some aspects of *The Progress of This Storm*, in both *Fossil Capital* and *The Progress of This Storm*, Malm offers us three important lessons to help us understand the dynamics of climate change and to build the radical politics necessary to combat it.

“Capitalism gave birth to the fossil economy”

Early in *Fossil Capital*, Malm references Marx’s oft-cited observation from *The Poverty of Philosophy* that “[t]he hand-mill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist.”² Much ink has been spilled over this statement, especially considerations of its degrees of economic and technological determinism. Rather than take Marx at his word, Malm revises the classical formula by inverting it, declaring that “steam begets capital — not the other way around” (Fossil 33). “More precisely,” he elaborates, “steam engenders the division and organisation of labour we recognise as typically capitalist” (Fossil 33). Given the task to find the most important statements in *Fossil Capital*, one could certainly do worse than these two. Indeed, this inversion serves a crucial purpose in illustrating the conclusions of Malm’s investigation into the rise of steam power, the solidification of the fossil economy, and the seeding of the roots of global warming.

In the transition from flow to stock, Malm does not find the conventional story of the Industrial Revolution — one based on, among other things, human innovation discovering ways to technologically overcome natural limits. These accounts are widespread, found in the pages of books like William Rosen’s 2012 study of the rise of the steam engine, *The Most Powerful Idea in the World: A Story of Steam, Industry, and Invention*, which traces the steam engine’s invention and its later widespread adoption to an “idea,” ascribing to the steam engine a quasi-mystical status that Malm names in *Fossil Capital* as a kind of “steam fetishism.” Summarizing popular views of the days of rising steam power, Malm cites Michael Angelo Garvey, who “suggested that the ‘real prime mover and director’ of steam was ‘the mind itself’ — the sheer intelligence of Britain’s engineers” (Fossil 218). In contention with such view, Malm instead finds in this transition from flow to stock a materialization of the kinds of class-based struggles endemic to the Industrial Revolution’s birthing of the bourgeois and proletarian classes. Just as the Industrial Revolution *in toto* was not a smooth, uncontested affair aimed at increasing efficiency of productivity for the benefit of all, neither was the adoption of steam power. The *dramatis personae* in this tale are not benevolent inventors fueled by the forces of transcendental human innovation and progress, but a *ruling class* that sought to strengthen its position further as a ruling class. Malm’s wager follows this point, “that steam arose as a form of power exercised by some people against others” (Fossil 36). At the core of this claim is the understanding of fossil fuels — and indeed energy in general — as a social relation. As Malm puts it:

No piece of coal or drop of oil has yet turned itself into fuel, and no humans have yet engaged in systemic large-scale extraction of either to satisfy subsistence needs: fossil fuels necessitate waged or forced labour — the power of some to direct the labour of others — as conditions of their very existence. (*Fossil* 19)

Becoming fuel, put simply, is a fundamentally *social* process; the stock does not animate itself.

Ultimately, Malm's account in *Fossil Capital* demonstrates the ways in which energetic relations are embedded in social and economic relations by showing how the transition from water to steam, or the "flow" to the "stock," was an intentional transition on part of the bourgeoisie, creating the conditions for intensified industrial-capitalist relations of production by simultaneously "deepening" both capital and the production and consumption of fossil fuels. It was not the historical inevitability found in techno-utopian, teleological accounts of the adoption of fossil fuels that cite its economic and material efficiency. Visions of the past such as these have remained dominant, shaping our historical experience of and relation to the fossil economy beyond the bourgeois circles. In *The Progress of This Storm*, Malm critiques Jason Moore's thesis of the "Four Cheaps," which asserts that "[f]or profit rates to be high, nature [food, labour-power, energy and raw materials]... must be cheap" demonstrating how even Marxist accounts of energy can internalize and prioritize the kinds of worldviews that suggest the way to solve the global ecological crisis is through interventions at the level of cost and price, at the level of the market (Malm *Progress* 191). Such logics result in popular claims that, for instance, coal was adopted because it was *cheaper* than other energy sources. But this transition was not the result of rational actors adopting a new, cheaper technology — it was *class warfare*. Malm's summarizing argument that "[s]team was advanced as the materialised power of the bourgeoisie" then serves as a powerful, politically mobilizing point, suggesting that there exists a materialized power beyond and against the bourgeoisie that is collectively attainable (*Fossil* 218). This is precisely why Malm points out in the opening pages of *Fossil Capital* that "the next transition cannot share the canonical features of the British Industrial Revolution; above all, this time it would have to be *collectively planned*" (*Fossil* 14, emphasis in original).

"Less of Latour, more of Lenin: that is what the warming condition calls for"

"Not too long ago," Alexander Galloway writes in his contribution to *Questionnaire on Materialism* (2016) "being a materialist meant something rather specific, despite the capacious; it meant one was a Marxist." However, he continues, "[t]hese days materialism generally means non-Marxism."³ It is within this setting — a setting marked by tension between old and new materialisms, between Marxisms and non-Marxisms — where Malm's *The Progress of This Storm* stages its primary polemical interventions with fervor and with particular attention to the relationship between

nature and society as conceived in these visions of old and new. *The Progress of This Storm* is, in the first instance, both a virulent critique of prominent contemporary understandings of nature and society and a simultaneous defense of a renewed historical materialist approach to nature that serves as a foundation for a radical politics capable of addressing global warming and altering its current path of further intensification. Its rhetorical mode hearkens back to Friedrich Engels' *Anti-Dühring* (1878), which served as a polemical space for Engels to build the vision of a historical materialist project through a methodical criticism against the claims of idealistic, utopian socialism as articulated by the eponymous Herr Eugen Dühring.⁴ *The Progress of This Storm* could in turn be alternatively titled *Anti-Latour*, as much of Malm's critical energies are directed towards challenging Bruno Latour's influential oeuvre — who, as Malm reminds us, is known to have said “[l]ike God, capitalism does not exist” — and its consequences for thinking and acting in nature and society in a warming world.⁵

For Malm, the material turn, embodied in work from figures such as Jane Bennett, Bruno Latour, and Timothy Morton, problematically flattens the agencies of humans and nonhumans, including objects and things, at a time when a particular class of humans continues to disproportionately affect both social and natural relations. At the core of new materialist thought is the assertion of a fundamental agency in all that surrounds us and is in part a reaction to the hegemony of constructionism within social science and humanities disciplines. Malm's account and critique of dominant approaches to the nature-society relation develops through a careful historicization of the major shifts in humanities and social science discourses as expressed through a spectrum of dominant modes of thought in the latter portion of the twentieth century and into the twenty-first — from constructionism and hybridism, to the more recent of posthumanism and new materialism, none of which Malm finds suitable for confronting the problems of the day, namely the warming condition.

What Malm views as a widespread and particularly troublesome characteristic consistent throughout the epistemologies of these divergent schools of thought relates primarily to the question of boundaries and of separation. In constructionism, hybridism, posthumanism, and new materialism, dichotomies and separations are considered as powerful fictions established, maintained, and reproduced by Enlightenment discourses; this, of course, is a fundamental insight derived from post-structuralism that permeates through many of these schools of thought and their relatives. Such positions that problematize separations *tout court* are tied to other major shifts in the humanities and social sciences, including most recently a movement against critique — a practice some thinkers believe reproduces the problematic epistemologies that place human rationality above all else, to the detriment of all else. Enter what is commonly referred to as the post-critique school, a school of thought building on the work of Eve Kosofsky Sedgwick, whose practice of reparative reading distinguished from paranoid or suspicious reading (that

is, critique) forms its methodological core. Here, Malm takes aim at Rita Felski, a figurehead of the post-critique school and noted Latourian. Taking on her position that asks “instead of criticizing institutions, can we also learn to trust them,” Malm observes that not only does trust in institutions maintain the status quo and produce climate denial, it perpetuates inequity.⁶ “The demographic segments least invested in the prevailing order and therefore most prone to mistrust it — inhabitants, of the global South, women, people of colour, the left — are also most appreciative of climate science” (*Progress* 136). In other words, it is easy to flatten when in one occupies a privileged position in a pre-flattened social, ecological, and economic landscape.

Malm’s solutions to the impasses of the warming condition are clear. Both *Fossil Capital* and *The Progress of This Storm* contain varying levels of calls to action that form a sort of two-pronged approach: (1) a commitment to *historical* materialism that sees in the warming condition a set of particular historical circumstances and (2) a commitment to a radical politics that is capable of intervening upon and dismantling the fossil economy. As a means to develop both of these positions, Malm proposes a framework of socialist climate realism that contains three central tenets: first, that “social relations have real causal primacy in the development of fossil energy and technologies based on it”; second, “by recursive loops of reinforcement, these relations have been cemented in the obdurate structure of the fossil economy”; and third, “that totality has in its turn fired up the totality of the earth system, so that (some) humans have real reason to be afraid” (Malm *Progress* 149).⁷ The language Malm uses here is telling — “social relations,” “causal primacy,” “totality” — as it taps into the kind of lexicon that many whom Malm builds his position against (e.g. Latour) hope to do away with. Malm’s reasoning for turning to what can be called a new historical materialism, articulated in the wake of the rising popularity of flattening, and in maintaining separations is convincing: “When eight individuals — as of 2017; the number seems to shrink as fast as CO₂ concentrations rise — possess as much wealth as half of humanity, one cannot afford *not* to draw lines of separation” (*Progress* 189).

“It is a bad time to call it a day for radical politics”

The degree to which fossil fuels and other secondary forms of energy such as electricity have become embedded in the everyday lives of so many across the globe, but especially the West, over the past century is staggering. Political economists of energy, such as Bernard C. Beaudreau, name this dynamic energy deepening, a process deeply entwined with the rise of capitalism as a dominant mode of production.⁸ Without directly engaging this vocabulary of energy deepening, Malm’s *Fossil Capital* is primarily centered on a key historical episode that further cemented this deepening — that is, the Industrial Revolution in general and the shift from flow to stock in particular. This deepening of both fossil and capital is precisely what the signifier “fossil economy” aims to hone in on as it points towards the energetic and economic

foundations of fossil fueled society, what Malm calls the “two partners of the fossil economy”: “self-sustaining growth” and “energy from the stock” (*Fossil* 47). This partnership has and continues to intensify inequality through, for instance, lack of access or, more significantly, the disparity of the consequences of burning the stock, which affects less affluent populations more than the affluent populations of affluent nations who set the fire in the first place. Those who take the fossil economy for granted are in turn those most deeply attached to it. “If the fossil economy is a train that never stops but always accelerates, even when approaching the precipice,” Malm writes, “the task is to pull the brakes (or maybe jump off) in time, and if there is a driver who seeks to keep this from happening, she has probably been seated in the locomotive for some time” (*Fossil* 15). A cultural, ideological, and material deadlock results from energy deepening, as Malm’s metaphor demonstrates, wherein the future is enclosed by the influence of those “seated in the locomotive for time”; a fossil-fueled life is understood as all that is reasonable and desirable though this need (and must) not continue being the case.

If energy deepening is linked to capital deepening, and both are processes that cement particular social, ecological, and economic relations that, among many other things, overwhelmingly contribute to the warming condition, then the solution cannot occur solely in the domain of the economic or the technological. The solution, it follows, is a political one. Malm’s commitment to radical politics runs deep in both *Fossil Capital* and *The Progress of This Storm*. In radical politics, Malm finds the tools necessary for a widespread, collective intervention into the fossil economy that seeks as its first aim to shut that economy down. If the bourgeois classes could do it in the nineteenth century and continue to do it well into the twenty-first with fossil fuels, then there is no reason that a proletarian class could not also do so by dismantling the fossil economy and developing an alternative, more equitable energy system now and in the future. This is precisely why I find in both *Fossil Capital* and *The Progress of This Storm* undercurrents of a politically enabling sense of possibility in addressing the warming condition. Such possibility shines throughout *Fossil Capital* when Malm discusses an energy transition through “solar provenance” (*Fossil* 38) and in the closing pages when he speculates about the necessity of “a return to the flow” (*Fossil* 366). “Our best hope,” Malm writes, “is an immediate return to the flow” that utilizes the vast amounts of available solar energy, including wind (*Fossil* 367). A transition in this way would carry with it an altogether different, more equitable set of relations than those that have become normalized under the fossil economy. The future remains uncertain, but it is clear that in the heat of the past we should “[e]xpect more gifts of history to be withdrawn, one after the other, primarily from those who never received very many of them in the first place” (Malm *Progress* 219). It is in this heat from the past that our future is shaped and to alter its course demands a radical politics able to intervene on a wide scale to halt the continued expansion of the fossil economy and its role in perpetuating the warming condition.

Notes

1. Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso 2016).
2. Karl Marx, *The Poverty of Philosophy* (London: Martin Lawrence Limited, 1847), 92.
3. Alexander Galloway, *A Questionnaire on Materialism*, *October* 155 (2016): 45.
4. Friedrich Engels, *Marx and Engels Collected Works, Volume 25* (Moscow: Progress Publishers 1987).
5. Bruno Latour quoted in Malm, *The Progress of This Storm: Nature and Society in a Warming World* (London, Verso 2018) 148.
6. Rita Felski quoted in Malm, *Progress of This Storm* 136.
7. For more on the aesthetics and politics of climate realism, see the forthcoming (2019) special issue of *Resilience* edited by Lynn Badia, Marija Cetinic, and Jeff Diamanti, as well as recordings of a 2017 Media@McGill colloquium organized around the topic. <http://www.climaterealism.ca/conference-videos/>
8. Bernard C. Beaudreau, *Energy and the Rise and Fall of Political Economy* (Westport, CT: Greenwood Press 1999).

Stacey Balkan. "Aesthetics and Activism." *Mediations* 31.2 (Spring 2018) 165-172.

www.mediationsjournal.org/articles/aesthetics-activism

Imagining the Future of Climate Change: World-Making Through Science Fiction and Activism

Shelley Streeby

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Aesthetics and Activism

Stacey Balkan

In a recent essay for the journal *Electra Street*, Stephanie LeMenager urges her readers to read Octavia Butler in order to “get ready for climate change” — to “[skill] up,” as Butler’s protagonist “Lauren Olamina” in the *Parable* novels puts it.¹ LeMenager suggests that Butler’s *Parable* series figures a productive departure from an Anthropocene imaginary, whose teleological nature posits the “end of nature” as its most radical political horizon: “whereas [Bill] McKibben laments the end of Nature,” LeMenager writes, “because Nature has been a refuge from the inauthentic and conflictual qualities of social life, Butler recognizes the end of the Nature concept, which served to marginalize people of color, as an opportunity to begin genuine social building.”

Perhaps the essay should have included Donna Haraway on this score, although LeMenager is also concerned to place Butler in a genealogy of Black feminist thought and thus a “Black Anthropocene.” Nonetheless, both extol a gospel of radical collectivism, whether Butler’s “symbionts” (from the *Parable* series) or Haraway’s “terran critters” from *Staying with the Trouble* (2016).² Both imagine a future wherein environmental collapse, wrought from extractive economies and fossil capitalism will usher in not a new version of “possessive individualism” but instead what Ashley Dawson has called “disaster communism.”³ So too, both employ the tools of speculative fiction to imagine such a world.

Contesting Amitav Ghosh’s argument regarding the dearth of “serious” fictional representations of climate change and its impacts, Butler’s oeuvre is essentially a praxis for “world-making through science fiction and activism” — “world-making” a

term used by Shelley Streeby to describe “the transformative dimensions of the worlds and futures imagined by Indigenous people and people of color in confronting settler colonialism, environmental racism, and climate change” (149).⁴ Of course, Butler’s creation of “hyperempathy” in *Parable of the Sower* (1993) — surely a catalyst for radical collectivism — applies primarily to Anthropos and not necessarily Haraway’s “multispecies muddle”; hence LeMenager’s assertion, like Streeby’s, that Butler is concerned with the human species — one in which intersectional solidarities can be forged among communities of color and about which histories of settler-colonialism and systemic racism shall no longer be elided in the historical record.

Streeby’s new book *Imagining the Future of Climate Change: World-Making Through Science Fiction and Activism* traces a genealogy of speculative fiction — a category inclusive of science fiction — making a case for its political and imaginative utility, while also foregrounding (at least in part) explicit instances of fossil capitalism such as the Dakota Access Pipeline.⁵ The book’s conceit is that figures like Butler, Rachel Carson, Leslie Marmon Silko and others, rely on the tropes of speculative fiction — primarily its alternative and transformative time scales — to figure new worlds. “Our answers about the future of climate change,” says Streeby, “must not come solely from the sphere of science and technology, or they will be too narrow, not capacious enough” (30). In fact, science fiction in her view is a means of world-making. As her many examples make clear, the world-making efforts of artists like Butler, along with writer and activist adrienne marie brown and Anishinaabe writer Gerald Vizenor serve as guides for reimagining our dystopian present and making possible just futures. In many cases, as in brown’s *Detroit*, the line between aesthetic expression and political activism becomes blurred. Indeed, brown’s stories work directly toward realizing redistributive justice; in her view, “the realm of speculative and science fiction could be a great place to intentionally practice the futures we long for” (119).

Streeby’s is thus a far more expansive project than merely cataloguing science fiction writers: For example, she lovingly attends to the Butler archive at the Huntingdon Library in Los Angeles — its contents a testament to the imbricated chronologies of American neoliberalism and the emergence of global warming as a popular trope in political discourse; and she is equally concerned to demonstrate the role of world-making through activism. The book is the fifth installment of the University of California Press’s “American Studies Now: Critical Histories of the Present” series (which also includes primers on the BDS and Black Lives Matter movements) and it is divided into three sections that move deftly between science fiction and specific instances of direct action.⁶ Following the introduction, which for such a slim volume demonstrates extraordinary breadth — effectively tracing the history of sci-fi from Mary Shelley to Jules Verne to W.E.B. DuBois to Rachel Carson and finally to the work of Silko and Butler — she devotes much of the book to Indigenous futurisms and world-making through movements ranging from #NoDAPL to earlier instantiations of water-protector movements during colonial occupation.

So too, Streeby offers a compelling history of direct action, tracing its inception (in the U.S.) to the Industrial Workers of the World through the U.S. Civil Rights movement and to the contemporary scene in the Dakotas. She states: “Indigenous futurisms are at the forefront of efforts to imagine a future of climate change other than that envisioned by the fossil fuel industry” (28). Toward that end, while she opens by lauding the 2013 film *Snowpiercer* for its critique of such geo-engineering projects as were also present in Jules Verne 1889 *The Purchase of the North Pole*—both imagining “a geo-engineering scheme hatched by avaricious capitalists in the service of resource extraction” (21)—she ultimately turns to Alex Riviera’s *Sleep Dealer* (2016) to make a case for world-making through Indigenous futurisms. This is, then, the thrust of the first chapter.

For the uninitiated, the introduction also includes “a brief history of global warming” before moving on to Rachel Carson and reminding her readers of the fable with which her famous book opens: “an allegory for tomorrow.” In *Silent Spring*, Carson succinctly demonstrates Samuel Delany’s contention that “science fiction is not about the future; it uses the future as a narrative convention to present significant distortions of the present” (18). The tension between science fiction and speculative fiction is also addressed in the introduction. Margaret Atwood, it seems, was careful to distinguish sci-fi from spec-fi, arguing that sci-fi was squarely concerned with “green monsters on other planets or galaxies” (20). But this, Streeby implies, is a rather facile distinction, and one that Ursula LeGuin also contested. *Pace* Delany, LeGuin, whose “green monsters” in novels like the 1972 *The Word for World is Forest* were clear analogues for native communities in postcolonial states, if also Vietnamese citizens, stated: “‘one of the things’ science fiction does is ‘extrapolate imaginatively from current trends and events to a near-future that’s half-prediction, half satire’” (20). It is precisely in this vein that Streeby considers Paolo Bacigalupi’s 2015 *The Water Knife*, which imagines a near future in the throes of dearth-induced water wars.

I would also recommend Bacigalupi’s earlier *Shipbreaker* (2011), which borrows from a contemporary site of salvage — Chittagong, a coastal city in Bangladesh — and which literary and cultural scholar Jennifer Wenzel reads as a documentary of our “accidental future.”⁷ Thus Bacigalupi might, in a sense, be read as an “HistoroFuturist” like Butler, a term she coined to describe the ability to “[extrapolate] from the historical and technological past as well as the present in imagining the future” (24). Though Bacigalupi is also, and notably, imagining a post-fossil fuel future, Butler’s work examines a specifically racialized past offering, in the *Parable* novels, a “neo-slave narrative” albeit with global warming as a principle character.

In defining speculative fiction, Streeby also looks to Sheree Thomas’s 2000 *Dark Matter: Speculative Fictions from the African Diaspora* in which Thomas “used the term ‘speculative fiction’ to define the genre expansively and to highlight writing that had previously been invisible but was there all along” (25). Notably, Butler, at the 2005 “Black to the Future” festival, pointedly asked the audience who had read the book.

More to the point, this more expansive notion of the genre allows for the inclusion of writers like brown and, consequently, for Streeby to explore different modes of world-making in the ensuing chapters that demonstrate the intersections between aesthetic expression and political action. She likewise traces the intersectionality of resistance movements from Flint, Michigan to the #NoDAPL movement in South Dakota.

In the first chapter, in highlighting the legacy of removal in the context of extractive economies, Streeby charts modes of Indigenous world-making as well as intersectional responses to environmental violence through allegiances forged between Indigenous and Black communities. Reminding her readers that both communities have long been at the “forefront of taking action against extractive industries” (45) and have tended to be the victims of “wastelanding” — “the extraction of resources in racialized spaces that combined with environmental racism renders ‘space marginal, worthless, and pollutable’” (44) — she proceeds to offer a robust history of resistance highlighting the struggles at Standing Rock and Flint. She further remarks: “the chemicals used for fracking and the materials used to build pipelines are also used in water containment and sanitation plants in Black communities like Flint” (47).

Here, she also turns to the trope of “slipstream” — “a species of speculative fiction within the sf realm that ‘infuses stories with time travel, alternative realities and multiverses, and alternative histories’” — and the work of Gerald Vizenor, whose 1990 novel *Bearheart: The Heirship Chronicles* is set in a near future wherein the U.S. government “invades reservations to extract resources in the dying days of the fossil fuel economy” (52). His earlier story, “Custer on the Slipstream,” which employs the trope to emphasize the historical continuities between colonial occupation and current modes of dispossession and removal, was featured in the syllabus created by the Standing Rock Collective.⁸ Silko’s *Almanac* also features here in this regard: “Silko... extrapolates from her present and moves backwards, forwards, and around in time to create a powerful Indigenous futurism in the face of ongoing battles over resource extraction and the wastelanding of Indigenous places in the U.S. Southwest and elsewhere in the Americas” (69).

Almanac, Streeby argues, offers an example of “world-making” in its figuring of a transnational community of Indigenous peoples from across the Americas who forge an alliance under the banner of environmental justice. Such communities, it is noted, would exist well before the emergence of mainstream environmental movements during the post-war era, thereby attesting to the existence of a robust “environmentalism of the poor” in the Global North.⁹ Streeby offers the example of Hopi leader Thomas Banyacya, who was imprisoned for refusing to serve in WWII. Later examples include the Southwest Network for Environmental and Economic Justice and (in the Global South) the Declaration of Quito, which vowed to “defend and conserve [their] natural resources [from] transnational corporations” (60). In Streeby’s view, such Indigenous futurisms, as articulated by groups like the Southwest

Network, also deploy slipstream by “remix[ing] older forms of culture and knowledge with new technologies” in order to “[imagine] a future of climate change” unhinged from fossil capitalism (68).

Butler would read about figures like Banyacya while researching her 1993 *Parable of the Sower*. “Critical of human efforts to remake places they settled in destructive ways,” Butler persistently chronicled such world-making activities; her archive at the Huntingdon reveals a lifelong commitment to climate activism (70). Contesting the emergence, really proliferation, of neoliberalism in the 1980s under Ronald Reagan, Butler came to reflect on the bankrupt notions of the individual that allowed for the continued pillage of native communities. Here too she imagined the resonances of statelessness for African-American communities; thus, *Parable* reflects a desire to “write long horribly or beautifully seductive novels about Humans of Earth becoming true mutualistic symbionts of other individual worlds” — establishing, it seems, a community that would defy a neoliberal commitment to possessive individualism through an apocalyptic collectivism (80).

Butler meticulously catalogued the activities of Native activists, global warming science and an ascendant denialism under Reagan, citing “Reagan’s efforts to roll back new, post-1970 environmental regulations while opening up lands to oil, coal, and gas extraction” (87-8). Not surprisingly, *Parable of the Sower* was set in the “dry, harsh, austere world” produced at the hands of oil barons. According to Streeby, “Butler imagined neoliberal globalization from above as a kind of scorched earth disaster, one to which her imaginings of different worlds and communities and other, more sustainable ways of living responded” (98). It seems that Butler also prophesied the urban farms in places like Detroit, which are now being realized by activists Grace Lee Boggs and adrienne marie brown. Linking Butler’s work with that of Boggs and brown, Streeby again makes clear the relationship between science fiction and direct action.

brown figures as the fulcrum of the final chapter, “Climate Change as a World Problem.” Inspired by Butler, brown’s activist work is intersectional, moving between social movements, cultural production and world-making through direct action. Interested in the imbrications between climate justice and the legacies of systemic racism and settler-colonialism, brown’s work resonates with broader concerns regarding forms of “climate apartheid,” which render historically marginal communities more vulnerable to climate chaos. Given the failures of international governing bodies to enact binding legislation that would lower emissions and thus ameliorate the impact of climate change, climate justice organizations have assumed the mantle of resistance to an international economic community committed to fossil capitalism.

The first climate justice summit, we learn, was held at The Hague in 2000. Thereafter, the International Climate Justice Network created the Bali Principles of Climate Justice. This coalition sought, among other things, to charge “Northern

governments, particularly the United States' with compromising the 'democratic nature of the United Nations as it attempts to address the problem' of climate change, as well as violating the Universal Declaration of Human Rights in abetting threats to, for example, food security (108). Reminiscent of the Cold War-era Non-Aligned Movement, the Bali principles are centrally concerned with the legacy of colonialism as it obtains in discussions of climate change. In this chapter, Streeby also documents forms of climate injustice, citing the aftermath of Hurricane Katrina as well as a lawsuit filed by the Inuit Circumpolar Council against the United States for unchecked emissions that will directly compromise their existence. No decision was made, but this laid the foundation for the UN to adopt the UN Declaration of Rights of Indigenous Peoples the following year in 2007.

Returning to brown and a discussion of direct action in the face of political inertia, Streeby paraphrases brown's commitment to direct action in the form of "guerillas putting up solar panels in the hood" (116) or "guerilla gardens" like those in *Parable* (115). Here too, Streeby discusses brown as a writer deeply committed to practicing world-making through science fiction. This is realized in her story "The River," which imagines Detroit in the near future where the river "rises up tsunami-style to wipe out disaster capitalism, thereby allowing those who remain to make another world" (121). In brown's view, it seems that "the key to surviving disaster is making movements that center on what people can create together rather than what powerful nation-states and corporations are willing to give" (126).

Streeby concludes with a plea to embrace more "collective envisionings of the future" — that this might just be "our best hope in imagining other worlds in the wake of the climate change disaster that is now upon us" (126). This may seem a utopian prospect, but such a perspective has become increasingly popular among scholars and activists. Some, like Haraway, also look to science fiction — what the veteran feminist calls simply "sf" to stand in for everything from science fiction to speculative fiction to "string figures" and what she calls "speculative fabulation." Some, like Ashley Dawson, trace the material histories of disaster response in order to imagine our collective future. Each confirms that despite the best efforts of neoliberal thinkers to hijack evolutionary biology in support of pseudoscientific notions of an innate selfishness, humans are actually hardwired for the sorts of "collective envisioning" that sf writers have long imagined.¹⁰

One of the great strengths of Streeby's study is its attention to the intersections between aesthetics and activism. The book reads as a primer for teachers of speculative fiction and Indigenous futurisms and a call to action for activists to recognize new modes of "world-making." My only quibble is that it is a project that seems too expansive for its venue: at times, it felt (perhaps necessarily) elliptical. Particularly in light of the popularity of Ghosh's latest book, I do hope to see the longer version soon.¹¹ As Sheree Thomas's aforementioned anthology confirms, there is a great deal of "serious" fiction attending to our imperiled world.

Notes

1. Stephanie LeMenager. "To Get Ready for Climate Change, Read Octavia Butler." *Electra Street*. (November 2017).
2. Donna Haraway. *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press 2016).
3. Ashley Dawson. *Extreme Cities: The Peril and Promise of Urban Life in the Age of Climate Change* (New York: Verso 2017).
4. Amitav Ghosh. *The Great Derangement: Climate Change and the Unthinkable* (Chicago: University of Chicago Press, 2016). The term "world making" was also used by the philosopher Nelson Goodman in the early 1970s. Others have used it since, such as Ian Hacking.
5. Fossil capitalism generally refers to the imbricated chronologies of fossil fuel use and modern capitalism. The two, according to critics, are inextricably linked. See also Andreas Malm's *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (Verso Books 2016).
6. The series includes: Sunaina Maira's *Boycott!: The Academy and Justice for Palestine* (2017), Jack Halberstam's *Trans: A Quick and Quirky History of Gender Variability* (2017), Roderick A. Ferguson's *We Demand: The University and Student Protests* (2017), Scott Kurashige's *The Fifty-Year Rebellion: How the U.S. Political Crisis Began in Detroit* (2017), Macarena Gomez-Barris's *Beyond the Pink Tide: Art and Politics in the Americas* (2018), and Barbara Ransby's *Making all Black Lives Matter: Reimagining Freedom in the Twenty-First Century* (2018).
7. Jennifer Wenzel. "Salvage and the Accidental Future." *Modern Language Association*. New York, New York. 5 January, 2018.
8. The curriculum was created by the NYC Stands with Standing Rock Committee. The syllabus can be found here: <https://nycstandswithstandingrock.wordpress.com/standingrocksyllabus/>
9. Ramachandra Guha and Joan Martínez Alier. *Varieties of Environmentalism: North and South* (London: Routledge 1997). See also Rob Nixon. *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press 2011).
10. See again Dawson's discussion of "disaster communism" and the ways in which neoliberalism has successfully hijacked theories of evolution so as to cultivate a commitment to the selfish individual (2017).
11. As per my own review of Amitav Ghosh's *The Great Derangement*, the project offers a vital critique of the role of empire in anthropogenic climate change, not to mention a thorough critique of the carbon economy. It would usefully read as a companion to Streeby.

Contributors

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