

An Ecology of Nonhuman Modes of Production

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Abstract: What happens if you rework the Marxist idea of a mode of production, extending it to a variety of intersecting, nonhuman processes? Well, perhaps, even more vibrant, volatile, and regionally diverse images of ecology unfold. Key examples of nonhuman-initiated modes of production include species crossings, glacier flows, the planetary ocean conveyor, storm production, hurricanes, photosynthesis, and, perhaps, the origin of time itself. In each case, constituents and products of the mode in question are specified, often involving self-organized consolidation of nonhuman agencies and forces of diverse sorts. The essay closes by exploring what happens when such nonhuman modes coalesce, collude, or collide with human-initiated, neoliberal modes. Results include reduction in the supply of oxygen, accelerating glacier melts, probable closure of the ocean conveyor, intense wildfires, intensifying storms, and the expansion of drought zones, all delivered by impersonal planetary modes (such as El Niños, trade winds, a shifting jet stream, the tilt and wobble of the earth) differentially to diverse parts of the world. Such nonhuman modes both amplify the effects of neoliberal climate triggers, and distribute them asymmetrically to polar and tropical regions. The proposal is to advance further beyond construing nonhuman processes to be primarily receptacles of human practices, or even merely highly sensitive to human climate triggers. Doing so to address dynamic relations across such disparate processes. Appreciation of the grandeur of a world, whose self-organizing powers and products extend beyond both cultural internalism and humanocentric economic theories, may grow with exploration of such conjunctions.

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1.

I am going to try an experiment, partly inspired by one theme in *Anti-Oedipus*, a book composed by Gilles Deleuze and Felix Guattari in the 1970s. Inspired, even more, by recent work in earth sciences such as oceanography, climatology, virology, geology, and glaciology. If it works it may identify a problematic complementarity between (classical) Marxism, Keynesianism and neoliberalism across their significant differences. It may also underline some of the costs paid so far, mostly in nontemperate zones

but in temperate zone states too, for the fact that capitalist state social scientists and humanists remained too long stuck in both sociocentrism—the idea that the basic causes of social change are all internal to society—and secular, Christian singular cosmologies of linear time. The latter are anchored in assumptions of a rather docile nature progressively susceptible to human technical control. The price that nontemperate states and regions pay for the long term sociocentrism of temperate zone capitalist states is tied to the false idea in the west that the only modes of production in the world are human.

The experiment, then, is to redefine a large set of diverse natural processes such as ocean currents, atmospheric vapor absorption, viral species crossings, mosquito disease transmissions, volcanic eruptions, and photosynthesis as self-organized modes of production. Each mode produces outcomes such as planetary temperature variations, rain, drought patterns, monsoon seasons, diseases, and oxygen. Each also interacts both with other nonhuman and human modes, generating novel effects that are traditionally included as isolable parts of the social sciences and humanities. When things are seen this way it now becomes more apparent why the humanities and social sciences need to broaden their scope of inquiry, for the things they think and care about the most are closely interwoven with a variety of nonhuman modes. Moreover, such an experiment eventually calls into question both notions of human mastery and its traditional minor competitor in the west—the human pursuit of organic harmony with the world—though the latter retains elements to be folded into an alternative cosmology. The cosmology to be suggested here, then, is one in which we come to terms with the multiple trajectories and grandeur of a volatile world that is not our oyster—a world neither to master nor with which to slide into organic harmony. So, the topic now is nonhuman, self-organized modes of production, a vast panorama of processes pretty much ignored as themselves productive by economists, Western sciences, and the humanities, at least until recently.

A mode of production in Marx, as I recall, consists of intimate connections between the forces of production of a time and the human relations generated to deploy them. The forces might be forests, soil, fossil fuels, iron ore, wind, waterways, steel, lithium, limestone, etc. The specific relations in, say, capitalism are those between private capital aiming to maximize profit by resources and workers hired and disciplined to produce the product. Feudalism and socialism would establish distinctive relations of production, but often deploy some of the same forces, if differently. All three of these modes, however, are human induced, though Marx after 1868 took hesitant steps that threw his earlier theory of capitalism into doubt. Hayek never did.

2.

Deleuze and Guattari, however, insist that nature is also replete with nonhuman, self-organized modes of production. In doing so they contend that nature, human culture, and the relations between them, are neither organic nor mechanistic in character, as those two contending models have usually been understood. In that they agree with a theme Nietzsche developed in *Will to Power* in the 1880s.

The machinic in nonhuman nature (rather than human techno-machines) expresses self-organizing powers; each of its modes produces specific results; and a singular mode may morph into another upon encountering—that is, forging disjunctive syntheses with—new nonhuman agencies or forces. A mechanism, by comparison, is an entity produced by human beings to perform specific functions. Its parts can be pulled out for repair. Watches, hydraulic mechanisms and computers are examples, each in turn also drawn upon by some human-ists (Hobbes, Freud and recently the Churchlands provide exemplars, deploying clocks, hydraulic mechanisms and computers respectively) to comprehend the workings of nature and/or human society. A mechanism, however, does not exhibit the qualities of a multiplicity, that is, a complex formation in which the “parts” simultaneously impinge upon one another and infuse one another to some degree, in ways that may help to foment a new, sometimes more complex formation in response to a new nexus with another protean art.

The organic model, to Deleuze and Guattari, provides another faulty way to grasp animals, plants, and other planetary processes; that model usually promulgates a mode of complex harmonies toward which nature organically tends, especially if human interference with these unfoldings is not too severe.

So, nonhuman modes of production are neither mechanistic nor organic. They are machinic and replete with partially formed pluripotentialities; a new nexus between two different assemblages may thus involve the creative evolution of a new or more complex system, not in the first instance the product of human ingenuity or invention. In fact, without the former, the latter—the human initiated modes—would not occur. The machinic, again, is neither organic nor mechanistic. In relation to other forces, it retains capacities to self-organize and evolve, to connect to other machines, and to become otherwise than it was. It consists of entangled forces with surpluses, with some surpluses pulling upon and infusing others.

3.

Here is one modest example drawn from *Anti-Oedipus*, involving the experimental formation of a mode of production between mother and child in which neither is really in charge of the formation: “It is not true that a baby experiences his mother’s breast as a separate part of her body. It exists, rather, as part of a desiring machine connected to the baby’s mouth, and is experienced as the object providing a nonpersonal flow of milk.” The new nexus between mother and infant invokes vague, unfolding intentions of the infant and sharper intentions joined to developing relational powers of the mother. Out of these uncertain relational experiments a mode of production is formed. Such a formation, organized through the give and take of vague searching operations, becomes a “relation of production as such.”

Indeed, many first-time parents pass through a veritable crisis when the “natural” connection between adult breast, infant sucking, and milk production falters during an early period of mutual stumbling. Mother and infant fumble around. A doctor, nurse, or older mother will say, “be patient”. And usually—but not always—the baby fumbles and experiments more diligently as its hunger grows. And the mother becomes more closely attentive to the infant’s strivings. Until, in one surprising stroke, a new mode of production is organized between mother’s breast, the infant’s sucking, and the production of milk, engendering modes of satisfaction to mother and child as it does so. The success may even push daddy to the sidelines, setting a possible impetus to Freudian theory into motion. But that is not my concern today.

Deleuze & Guattari continue along this line with other examples. The bee and the clover self-organize a mode of production through heterogeneous connections forged across diverse lines, mediated by strange attractions. More famously, in their later work, the machinic connection celebrated is between the wasp and the orchid, with the wasp intending to have sex with the orchid and, as it attempts to do so, absorbing nectar then carried to other plants. A nonhuman mode of production. Or take the tick-mammal relation—borrowed by them from Jacob von Uexküll, with the simple perceptual powers of the tick and the warm blood of a mammal coalescing to produce food for the former and, sometimes, Lyme disease for the latter.

4.

Today we may be in a better position than Deleuze and Guattari to explore even more robust and consequential nonhuman modes of

production, almost endlessly. Neither you nor I, for instance, invented nor controls the mode of production by which pluripotent stem cells migrate to different areas of a mammal body to morph into blood, brain, skin, or kidney cells. That is a self-organized mode of production, involving resonances between protean stem cells and the specific character of the proteins to which they migrate in an egg or embryo. The same could be said about the self-organization of digestion systems, self-organized differently in humans, flytrap plants, cows, and spiders.

You can say that these modes often mingle means (or forces) and relations together, encouraging us to think about how nonhuman modes disrupt any neat Marxist separation between means and relations and, moreover, to explore further how the human microbiome, fleas, forests, soils, viruses, fungi, bacteria, bats and mosquitos scramble those two terms when they coalesce to form both means and relations of production. The mosquito, for instance, having emerged into being during the age of dinosaurs, strives to find warm blood upon which to gorge; the female can see, fly, smell, sense heat, and flee danger. It also numbs the skin of its target before inserting its proboscis to draw blood. One of the unintended products of gorging on blood can be malaria or Yellow Fever for humans. None of the above entities is thus reducible to “labor,” as Marx understood that exploitative concept in capitalism, though human workers, cattle, pigs, and tomatoes are now reduced to that standing in agribusiness.

These examples may still seem rather marginal. Nonhuman-organized modes, to be sure, but not that large, consequential, or pervasive—even though some of these diseases are nothing to sneeze at. Nonetheless, larger, more pervasive nonhuman modes proliferate on the face of the earth too. Take the disparate elements that eventually coalesced to forge the ocean conveyor system. The heat of the sun, the heat absorptive capacity of oceans, differential temperature gradients between tropical and polar zones, the orbit and tilt of the earth, and the current geography of continents, have all conjoined to manufacture the planetary ocean conveyor as a mode of production. Its products? A worldwide conveyor system that carries heat and food from tropical zones to polar zones and stabilizes temperature variations between polar and tropical zones. Neither you, nor I, nor Elon Musk invented it; indeed, we have a difficult time ascertaining how it became self-organized and how it works now. The very discovery of it in Western (until so recently anthropocentric) earth sciences was delayed until the

1970s, suggesting again how the long temporal lag in Western societies between the development of physics and the other earth sciences has been highly consequential. It would be much colder on the east coast of

the US and Western Europe if this nonhuman mode of production became inoperative and much hotter in the tropics. A vast, nonhuman mode of production with profound global consequences for species life of multiple sorts.

Similarly, a glacier system, once formed through interminably slow, seasonal self-accretions of ice, contains self-organizing powers that maintain the cold temperature level that sustains it. These include reflection of light rays back into the sky (rather than the much higher rates of absorption by water) and the cold air secreted by the huge block of ice. The more massive it becomes, the more self-sustaining is a glacier system. Ice cold polar temperatures, the planetary distribution of diverse temperatures, specific global wind patterns, diverse soil types, and planetary rock distributions are among the products here.

Viral species crossings set modes of self-production into operation, too. It seems that resonances (or vibrations) emerge between a virion and the potential host blocking its entry until, sometimes, both change enough for the latter to become a host. SARS, COVID, and AIDS are three recent products of such crossings and the nonhuman modes of production they set into motion. A compromise formation is forged, which changes both the virus and the emergent host. A self-organized mode of production. Here I note in passing a stray sentence from D

& G: "Process as the metaphysical production of the demoniacal in nature."⁹ Sometimes, however, such a nonhuman mode of production is beneficial to humans, as the viral formation of placenta has been to them. It should be noted, too, that such viral modes also foster horizontal gene transfers that have, among other things, improved the suppleness of human brain processes.

We could also focus on those potent processes by which weathering was introduced to the rocky earth. Once oxygen was secreted into the atmosphere by cyanobacteria starting about 2.7 billion years ago, the earth became blessed with more rich and fecund soils. And, only millions of years ago there was the self-production of lignin, firming tree trunks in a way that allowed them to grow much higher than heretofore. This product—enabled trees to grow much higher, apparently creating a short, 90-million-year window within which future fossil fuels were produced. That window closed when fungi evolved into being, encouraging us to speculate what might have happened if the first species' fateful window had never opened. And species evolution itself, with its massive alterations and developments of diverse species, is pretty much a self-organized mode of production. We are products more than authors of it, even if there are now significant human interventions into it.

5.

People like Deleuze & Guattari, nonetheless, in focusing so much attention on species/earth modes, may have given too little attention to earth/sky modes of production. For perhaps the most pervasive and fateful nonhuman mode of production—having evolved into being of its own accord—is photosynthesis. I am trying to grasp this pervasive mode, though to date my best efforts are incomplete. Some scientists think it involves quantum processes; others deny that it does. Here is one version of the former claim, from a site devoted to quantum studies: “Quantum superposition applies to any number of states. In the case of photosynthesis, the exciton can take all the possible paths to the reaction center at the same time. Quantum superposition offers a valid explanation as to why photosynthesis is highly efficient at converting sunlight into energy.” Other scientists call these acausal coherence/non-coherence relations, acausal because the correlation between a and b does not involve a difference in time, in which the causal force precedes its effect. A kind of finding, I am told, that creates considerable “discomfort” among many physicists.

The language through which photosynthesis is presented often seems rather metaphorical to me. It portrays the incoming light and the products formed, but seems to remain rather vague on how the transduction of heat into energy nourishing to the plant is done. The language of absorption, electronic vibrations, storage, and so on may suggest that this mode is not well grasped through the current human categories designed to “capture” it.

Anyway, this self-organized mode of planetary production probably evolved into being in some form as early as a billion years after the earth was formed. It involves absorption of light rays by pigment molecules or chlorophylls, a process which transducts light into carbon as plant food. In this mode, we are advised to appreciate two kinds of energy: “The electronic energy and the vibrational energy, and both are changed when the photon is absorbed.” Again, “vibronic energy is a combination of two kinds of energy of the molecule here: the electronic energy and the vibration of both electronic and nuclear vibrational energy.”

Setting current technical discussions of how it works aside, what does this self-organized mode of production do, as light is absorbed and transformed into plant food by chlorophyll?

Well, it “transducts” photons from the sun into energy that the plant, phytoplankton or diatoms then absorb as food. It pulls out CO₂ from the atmosphere. And it releases oxygen, as a “waste” product. The gradual accumulation of oxygen in the atmosphere, in turn, eventually allowed

the formation of animal life, life that depends on atmospheric oxygen to breathe. "If plankton had not infused the sea and air with oxygen..., there would never have been forests, grasslands or wild flowers, nor dinosaurs, mammoths and whales..." Moreover: "If methane had not been removed by its oxidation produced by photosynthesis, and if CO₂ had not been removed by photosynthetic assimilation at the appropriate rate, the present earth would have been too hot for survival, because both methane and CO₂ are greenhouse gases."

Additionally, the release of silica and calcium eventually allowed the evolution of multi-celled animals with vertebra to hold them up.

6.

One more thing about photosynthesis. Its primary carriers are massive supplies of phytoplankton in the sea, sea kelp, and forests and other land plants, all organisms that absorb CO₂ to produce food—and thereby helping to retain the carbon balance—and then release the oxygen and other products animals need to absorb. Here is what one recent naturalist says about the role of phytoplankton: "Scientists have estimated that if phytoplankton vanished, the amount of carbon dioxide in the atmosphere would double, reaching levels the planet has not experienced since the early Eocene Epoch, 50 million years ago, when the average global temperature was about 14.4 degrees F. higher than today and crocodiles swam in the Arctic." The latter being only one of several earlier periods of planetary volatility.

I feel confident I have merely scratched the surface of nonhuman modes of production. We could, for instance, study how hurricanes and tornadoes self-organize. To note another example, it is now widely thought by evolutionary biologists that life itself self-organized deep within the interior of the earth after diverse molecules of then considerable complexity encountered one another through chancy conjunctions, melding together in a heated setting. For yet another, self-organized cloud systems are more apt to spawn rain if bacteria have been blown upward into them, providing seeds for formation of drops of rain. Rain as a self-organized mode of production. Hence the phrase, "It rains." Moreover, a molecule in a salt water sea absorbs energy from the sun until a vibrational threshold is attained. It then "escapes into the atmosphere, leaving all the salt behind." Making the interface between ocean and atmosphere another planetary, self-organized mode of production. And suggesting, perhaps, that we might seek to become ever more alert to how contrasting vibrations and rhythms, often operating below the threshold of regular human perception, help to make the world go round.

7.

In Thomas Hertog's recent account of how Stephen Hawking, late in life, conceived the origin of time, he reports that a chancy trajectory shot out of the Big Bang that could have proceeded in other directions. Time itself, on this rendering, was a nonhuman mode of production; its formation involved elements of chance, at least as interpreted by us when the event is processed through current human capacities and lures of reception. This finding, indeed, underlines how any account of the modes discussed here points to a never fully transparent conjunction between the processes and our evolving capacities of responding to and addressing them. Human perspectives can be stretched in this way or that in response to our own strivings and powers of world responsiveness. But we never perceive or organize the world from a godlike perspective. We still don't know the limits of our own capacities of understanding, nor are we perhaps sufficiently reflective about how resilient lures to protect embedded images of time and belonging continue to lurk inside contemporary understandings of culture and nature.

The examples cited here are nonhuman instituted modes of production. They issue in products with radical effects on the carbon cycle, and they set the stage of possibility for yet new formations. As the photosynthetic production of oxygen and calcium did for the explosion of multiple forms of life in seas and on land. Or as the conveyor enables broad areas of the planet to house diverse modes of life. This suggests that each nonhuman mode of production organizes some forces while retaining reserves and surpluses that might later, through a new chancy conjunction, issue in new modes.

8.

If there are as many consequential nonhuman-initiated modes of production as I suspect, and if their self-organization is fateful for human and other species life, then it must be said that the middle-aged Marx and Hayek—not to say by far most of their contemporary followers—were all way too econo-centric and humano-centric in their grand understandings of modes of production, exchange processes, and consumption. They have downplayed not only the importance of ethos in every human mode of production—those variable spiritual orientations within production, exchange, consumption and regulation that create the context for different types of capitalism such as the democratic, social democratic, neoliberal and fascistic. They also were inattentive to nonhuman modes of production.

Let's look a bit more closely at Marx and Hayek. Marx, according to Kohei Saito in *Marx in the Anthropocene*, embraced a mode of socialist Prometheanism until late in the day.¹⁷ To state the issue in the terms of this essay he played down the significance of autonomous nonhuman modes of production that both enable some forms of human production and can recoil back on them to promote climate wreckage. But Marx, Kohei shows, went through a significant shift in his thinking after 1868, as revealed in notebooks yet to be fully published. Now he started to worry about how fertile soil, which is full of micro-life and produces itself up over long periods of development, is regularly depleted by capitalist production. Same with forests. And he studied other, non-capitalist civilizations in the past which had undermined their own earthy conditions of being. He now began to see how multiple civilizations have forged self-destructive relations with nature. To make a long story short, he did not explore nonhuman modes of production, but his late retreat from Prometheanism did set a stage to do so.

Friedrich Hayek is another story. In *Law, Legislation and Liberty* he presents an entire social philosophy.¹⁸ The goal is to forge a nation of regular individuals who have internalized market norms, to provide state support for market expansion into numerous zones of locality, family life, churches and unions, and to deploy the state as a subsidizer of private capital expansion that also supports the decisions and priorities of capitalist profit. That is why, for instance, Hayek enunciates a robust neoliberal jurisprudence in which courts take challenges to capital off the register of democratic politics. He even thinks about how to regulate corporate production of smoke. Nowhere, however, does Hayek encounter multiple nonhuman modes of production that might support, interfere with, or recoil autonomously back on capital expansion. His political economy is grounded both in human exceptionalism and a benign history of natural evolution compatible with long term capital expansion.

The sky/earth relation, however, is neither reducible to a deposit of resources for human use nor smoothly susceptible to human modes of production aimed at maximum abundance for dominant human civilizations. The sky/earth complex is replete with multiple nonhuman modes that intersect with one another and, often fatefully, periodically unsettle the practices, perceptions and dreamscapes of Western modernity. In the late-modern world, too many theorists who concentrate on human modes of production and even humanists who imagine human cultures to be tied to mostly passive nonhuman "environments," continue to dream with their eyes wide open. The planetary scale and complexity of the problems surveyed here continue to exceed the reach of the theories invoked.

I take the recent acceleration and evolution of neoliberalism after Hayek to consist of growing state priorities to support corporate domination of nature, to protect and augment private profits, to expand radically class inequality and job insecurity for low- and middle-class workers, to plunder regions outside the centers of capitalist production, to promote a plutocracy that finances ruthless electoral campaigns, and to enact campaigns to translate real white working- and middle-class grievances into cultural rage against minority races, feminists, gender plurality, religious diversity and collective climate action.

This more belligerent, fascistic mode of neoliberalism therefore also reshapes and reconfigures numerous nonhuman modes with which it enters into multiple transversal exchanges and upon which it depends. Bees, helping to germinate crops, are getting scarce, as their habitats are increasingly destroyed by dominant human modes of production and consumption. Lyme disease has become pandemic, as animal habitats become contracted. And viral disease crossings expand for the same reasons. Polar and mountain glacier systems now melt down at an accelerating pace as enhanced fossil fuel emissions, deforestation, glacier melt self-amplification spirals, glacier crevice formations pulling water down to the bottom of the glacier, and expansion in the number of earthquakes produced by rapid ground level rising all combine to create cascading causalities that accelerate the melting pace. That is, a variety of nonhuman systems amplify the pace of glacier melts and then distribute the brunt of their initial effects to nontemperate zones through enlarged El Nino effects, trade wind shifts, and slowing of the ocean conveyor. The latter all being impersonal, planetary amplifiers and distributors of human modes of production. And phytoplankton in the oceans, essential to oxygen production, are now being severely depleted by ocean heating, acidification and algae blooms.

Photosynthesis, which operates at an optimal temperature of 64 degrees Fahrenheit, now self-organizes less efficiently than heretofore in several zones of the planet. That carries numerous effects for species life, including probable reductions in the planetary supply of oxygen from its current 23% of the atmosphere.

The multifaceted modes of connection between human and nonhuman modes thus now spawn rapid atmospheric heating, spiraling glacier melts, expanding drought zones, ocean acidification, more extreme atmospheric rivers, more intense, long lasting storms, self-spiraling wildfires, rapid coral reef bleaching, declining farmlands, explosive house insurance rates, and, yes, even more volcanic eruptions. The percentage of oxygen

in the oceans has declined by 2% in the last few decades, with severe effects on sea life.

The multifaceted connections between human and nonhuman modes now take the following form: dominant human modes—most particularly neoliberal modes of capitalism—flood the atmosphere with CO₂ and methane, and a host of impersonal planetary processes first amplify these effects and then distribute much of the initial results to tropical and polar regions. The planetary distributors from temperate to nontemperate zones include El Niños, ocean currents, migrating mosquitos, trade wind patterns, and the passive distributors of territorial variations in height above sea level.

Finally, let us focus on human migration patterns set into motion by these bumpy conjunctions between human and nonhuman modes, as growing waves of people face declining farming opportunities in enlarging southern hotspots, and as ever-growing numbers desperately pursue migration from southern to northern zones and from low-lying to higher plateaus. Such burgeoning pressures, besides the crime and civil unrest they help to produce within zones under stress, also foment fascist responses in temperate zone capital states to growing migrant incursions. Temperate zone capitalist states thus spew out climate heating gases and then react violently to the painful migrations from south to north they help to activate. The United States, above all, governed by an unfettered neoliberal regime with fascist tendencies, increases poverty and job security for so many, and spews out massive amounts of carbon and methane, helps to produce the proliferating and painful migration drives it now turns back by more and more violent means.

None of the classical socio-economic theories with which Westerners are most familiar—that is, those that set modes of production and exchange within the compass of human cultures alone and circumvent attention to nonhuman modes of production—are well enough attuned to this emerging situation. Perhaps they are waiting until the oxygen level declines well below 23% of the current atmosphere, as hotbeds of photosynthesis and heat absorption—such as oceans, swamps, and rainforests—function less efficiently?

Even Gilles Deleuze, who wrote his last book as late as 1991, failed to apply his vital concepts to the world of accelerating climate wreckage. The smooth space of oceans and atmospheres, yes. Nonhuman modes of production, yes. Planetary war machines, yes. Capitalism as a system of deterritorialization in some ways and capture in others, yes. But insufficient attention to multiple, intersecting planetary modes of production that, in response to human modes, foster climate wreckage

congruent with several concepts he and Guattari introduced. Viveiros Castro, on the other hand—a follower of Deleuze & Guattari who studies Amazonian nonhuman subjectivities and cosmology—soon pursued these issues with his collaborator, Deborah Danowski.

9.

I have not here explored the complex relations between nonhuman modes of production and new processes of becoming, nor have I addressed fecund zones of indiscernibility between them. That is, to me at least, a difficult topic. The task now is to render more intelligible how these nonhuman modes, often forged through unexpected encounters between processes of diverse type, periodically usher new novelties into the world, novelties—for good and bad—that are neither fully reducible to human explanation in advance nor reliably oriented to human interests or current modes of protection. The self-organization of a hurricane out of warming ocean water, air currents, and trade winds provides a familiar example of the latter; its new intensities draw upon warmer water and shifts in the pace of trade winds, both influenced by extensive capitalist carbon and methane emissions.

As you digest what is now knowable about numerous nonhuman modes of production, it soon becomes clear that today we not only face a crisis of productive capitalism, a crisis that sets into motion planetary distributions from temperate zone, luxurious states to nontemperate, previously colonized regions of the world. Additionally, northern states not only face migration pressures from south to north they have helped to produce. We are also in the midst of a crisis of Western civilization itself, reflected in the intersections it promotes between the primacy of private profit, anthropocentrism, assumptions of sociocentrism embedded in several institutions, super-entitled multibillionaires, institutions based upon secular and Christian linear cosmologies of progress, the struggles of everyday people to get ahead within the established frames, widespread existential resentments against undertaking massive responses to the mess capitalist civilizations have initiated, and relative blindness toward how nonhuman modes of planetary production cascade into one another and capitalist processes. We still do not sufficiently respect the grandeur of a volatile and multifarious planet predesigned neither to be mastered by any civilization nor to form an organic cocoon within which human beings hover.

Notes

1. This summary of Marx precedes the turn he took late in life—after 1868— when he started to explore earlier civilizations in which soil depletion and deforestation undermined their capacities to flourish, or even survive. For an excellent rendering of Marx’s late Notebooks, see Kohei Saito, *Marx in the Anthropocene* (Cambridge University Press, 2022). I will discuss that later in this essay.

2. For a thoughtful account of how human induced machinic controls work differentially upon a human populace, see Maurizio Lazzarato, *The Making of The Indebted Man* (Semiotext, 2012). Roughly speaking, sovereign orders take the shape of commands and obedience, while machinic controls assume the form of habitual responses to things like credit cards, phone trees, street cameras, computer codes, home security systems, and cash machines. Many of the latter today help to install unconscious prompts to conform.

3. A disjunctive synthesis arises when two entities, very unlike one another, nevertheless exchange energy, helping to make each different from what it was. The formation of granite out of different kinds of rock, melted down by extreme heat, provides a good example. A thoughtful exploration of these processes in living beings occurs in Deleuze and Guattari, *A Thousand Plateaus*, trans by Brian Massumi (University of Minnesota Press, 1987) in Plateau, “Becoming Intense, Becoming Animal, Becoming Imperceptible.”

4. Gilles Deleuze and Felix Guattari, *Anti-Oedipus*, trans. Robert Hurley (University of Minnesota Press, 2000), 47. Two questions are pertinent here. First, why did Deleuze & Guattari drop the idea of nonhuman modes of production for the machinic in their later work? And, second, why did they not come to terms with the advent of climate wreckage, even though their categories could have helped them to address it and it was well underway during the time of their later writings? I have asked other Deleuzians the second question, and neither they nor I have a good answer to it. With respect to the first, I think they lost something when they folded nonhuman modes of production into the machinic. The machinic is more easily misunderstood to be the mechanistic. And it may not convey so dramatically how diverse nonhuman modes both interact and intersect creatively and secrete indispensable products without which humans could not themselves fashion their own modes. Finally, the notion of a multiplicity of modes of production helps to lay the seedbed to think time itself as a multiplicity composed of temporalities of diverse sorts. Additionally, the recent explosion in the earth sciences provides the materials from which more acute attention to nonhuman modes of production can proceed.

5. See Jacob von Uexküll, *A Foray into the Worlds of Animals and Humans* (University of Minnesota Press, 2010). von Uexküll revolutionized ethology by showing how ticks, spiders, flies and numerous other animals express disparate modes of subjectivity set into the bubble-like worlds available to each of them. However, as he transcended mechanistic readings of these beings he then fell into readings of them as set in a world of natural harmonies. Deleuze and Guattari reject the latter reading of these subjectivities, too, offering much more dynamic readings.

6. Perhaps this is the point to note the magisterial book by Kyle Harper, *Plagues Upon the Earth* (Princeton University Press, 2021). This book charts the history of human contact diseases from the Pleistocene to today, paying close attention to nonhuman vectors of numerous sorts. The discussion of the mosquito is on pages 93-97.

7. For a book by Wally Broecker, the oceanographer who brought news about the world-wide conveyor to contemporary western oceanography, see *The Great Conveyor* (Princeton University Press, 2010).

8. *Anti-Oedipus*, 49.

9. AZoQuantum.com (January, 2022).

10. Dmitri Shevela, Larst Olog Bjorn, Govindjee, *Photosynthesis* (World Scientific Press, 2018), 31. <https://doi.org/10.1142/10522>.

11. Ferris Jabr, "Strange and Wonderful Creatures: Plankton and the Origins of Life on Earth," *The Guardian*, August 20, 2024, <https://www.theguardian.com/news/article/2024/aug/20/strange-and-wondrous-creatures-plankton-and-the-origins-of-life-on-earth>.

12. *Photosynthesis*, 111.

13. See Ferris Jabr, *Becoming Earth: How Our Planet Came to Life* (Random House, 2024), 97 and 91 respectively. Jabr also plays up the role ocean kelp plays in planetary photosynthesis.

14. Helen Czerski, *The Blue Machine* (W.W. Norton, 2023), 132. Indeed, Czerski's book inserts manifold modes of life into the conveyor of Broecker, enlivening it in several ways.

15. See Thomas Hertog, *On the Origin of Time* (Bantam Books, 2023).

16. *In Process and Reality* (The Free Press, 1978), Whitehead explores some lures that have pulled western philosophers toward the objectivist philosophies of Descartes, Newton, Kant, Mill, and Einstein. The book, written in 1927, was not prepared to explore sufficiently how the lure of linear time, pulling upon those philosophies, led them to neglect nonhuman modes of production. Perhaps we are in a better position to do that today.

For one exploration of the cosmological issues posed by conjunctions between climate wreckage and western traditions of time see William E. Connolly, *Stormy Weather: Pagan Cosmologies*, Christian Times, Climate Wreckage (Fordham University Press, 2024).

17. The key text here is Saito, *Marx and the Anthropocene*, noted earlier. But see also Kohei Saito, *SlowDown: The DeGrowth Manifesto*, trans. Brian Bergstrom (Astra House, 2024).

18. See Friedrich Hayek, *Law, Legislation, and Liberty: A New Statement of Justice and Political Economy* (Chicago: University of Chicago Press, 1976) A longer engagement with Hayek can be found in William E. Connolly, *The Fragility of Things* (Duke University Press, 2013), ch. 2, though I was not quite ready yet to discuss nonhuman modes of production.

19. I take this essay to speak to another which is now in production with *Democratic Theory*: “The New Prometheanism: Rescripting the Dreamscapes of the Tech-Bros” explores what happens to the older neoliberal/evangelical resonance machine once multibillionaire tech bros join the assemblage and pull it in specific directions.

20. For a volcanologist who shows how volcanic eruptions increase in number and sometimes intensity during a period of rapid climate heating, see Bill McGuire, *Waking the Giant* (Oxford University Press, 2011).

21. For one invaluable account of migration patterns produced by the conjunction of rapid climate changes in semitropical regimes with the plagues of heat, drought, crime, and violence see Abrahm Lustgarten, *On the Move* (Farrar, Straus, and Giroux, 2024). Lustgarten starts by exploring drives into the US from the heating south and then considers the probable trajectory of growing migrations within the US itself. He sets an abbreviated timetable between now and 2050, thereby perhaps bringing the accelerations home to more people who might well be alive in 2050.

22. Deborah Danowski and Eduardo Viveiros de Castro, *The Ends of the Earth* (Polity Press, 2016). In general, Danowski and de Castro find Amazonian cosmologies of god-infused world processes not highly predisposed to human dominance to be superior to the Western cosmologies of figures such as Augustine, Tocqueville, Kant, Mill, Hayek and, more recently, accelerationists on both the left and right. Thinkers in the west have often thought either that the world is predisposed to human mastery or—the minor report—that it is well designed so that we can harmonize with it. But it is, to Amazonians, a more volatile and self-organized planet than acknowledged in either of these two Western images.