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## The Ecosystem Is an Apparatus: From Machinic Ecology to the Politics of Resilience

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# The Ecosystem Is an Apparatus: From Machinic Ecology to the Politics of Resilience

Thomas Pringle

More than ever today, nature has become inseparable from culture; and if we are to understand the interactions between ecosystems, the mechanosphere, and the social and individual universes of reference, we have to learn to think “transversally.” As the waters of Venice are invaded by monstrous, mutant algae, so our television screens are peopled and saturated by “degenerate” images and utterances. In the realm of social ecology, Donald Trump and his ilk—another form of algae—are permitted to proliferate unchecked. In the name of renovation, Trump takes over whole districts of New York or Atlantic City, raises rents, and squeezes out tens of thousands of poor families. Those who Trump condemns to homelessness are the social equivalent of the dead fish of environmental ecology.

—Félix Guattari, *The Three Ecologies*

## **Animate | Automate: Machine Components for Current Technopolitical Thought**

*Animate* derives from the Latin *animatus*, in the sense of “giving life to.” *Automate*, from *automation*, originates in the Greek *automatos*, the “acting of itself.” For Gertrud Koch and Bernard Stiegler, these terms of media provide a lens through which to conceive machines

50 as philosophical configurations of culture, technology, aesthetics, and labor.

Both *animate* and *automate* illustrate how “Machine” works as a theoretical concept and help differentiate “Machine” as a term of media from “Technology.” *Machine*, from the Greek *Mākhanā*, denotes a tool, and derivations variously indicate means or strategies (machinations), abilities, instruments of power, or tricks. While technology implements scientific knowledge, machines are specifically tied to labor, work, and power. Animation, from one perspective, concerns the ontology of the machine and the manner by which machines bring matter to life. More precisely, animation describes the machine in its capacity to set matter into movement, whether through mechanism or illusion. Automation, from another perspective, focuses on the machine’s technical procedure, repetition, and dispersal in time. Machines change automatically, whether through formal differentiation, deterioration, reproduction, or self-replication. While these terms are distinct characterizations of the functionality of machines, the animation of life and the repetitive automation of production are not entirely distinct, as illustrated by Stiegler (2015, 16) in a recent interview, in which he explains that the operative properties of machines and life are functionally analogous: “Life is automatic. A Biological cell, for example, is a sequence of instructions and this sequence of instructions is automatic. The reproduction of life is automatic. . . . So automatic repetition is really the basis of life.” What is the work of *animate* and *automate* as each term purports to describe in *technical* terms the operation of an inhuman process, be it organic or technological? What supports the analogous description of organic and technical development? Given the proximity of the animating and automating functions of the machine—whether that is illusion, labor, work, production, reproduction, or self-replication—the machine’s privileged status as a site of conceptual translation between those vital mechanisms that bring-to-life, and the mechanical codes that drive repetition, mark this volume’s field of theoretical inquiry.

Between animate and automate, the concept of the machine answers questions about contemporary media technologies that operate across both great and microscopic scales. When perceived from within a digital paradigm that understands people, nature, and infrastructure in the calculable rubric of information, the magnitude of machines and their mass dispersal becomes a political problem. We get close to machines. Through use, we develop intimate, habitual, and embodied relations with complex machinery and take in the knowledge of the world that they relay. Machines have grown to span continents, like electrical grids, but the digital turn arguably extends the purview of machines to the scale of smart cities, undersea cable networks, or satellite communication systems. Then, we debate the consequences of the embodied sensibilities opened by the knowledge–infrastructure couplings inherent to encounters with machines too large or familiar to see, much less operate on our own. Machines, by magnitude, complexity, availability, or mass production, are inherently social devices. They never leave us alone.

Koch, in “Animation of the Technical and the Quest for Beauty” (chapter 1 of this volume), frames and reframes the human body, and the machine’s animation of the human’s perceptive faculties, against a technoecological drama. Situating the labor, beauty, and practicality of machines within broader patterns of social organization guiding the human use of technology, “machines” become “agents in a field of techniques.” Her theory departs from traditions of media ecology initiated by Marshall McLuhan—wherein technological mediums are extensions of the body’s form—by sharpening the function of illusion and fetish in the animating purpose of the machine. This move accords to a “paradigm change: [when] machines are no longer extensions of organs” but “media that performatively intervene in our action.” Alternatively, Stiegler prepares readers “For a Neganthropology of Automatic Society” (chapter 2 of this volume) by raising automation as a concept illustrating the repetitive production of proletarian knowledge that he distills as the characteristic of work in digital network

52 culture. Referencing Chris Anderson's proclamation that Big Data's processes of automatic calculation render the scientific method obsolete, Stiegler cautions that the production of theoretical knowledge itself is lost to the automation of human thought as it is reticulated within the speed and form of automated machines and their retentive functionality for autonomous computation. Hence, "in today's automated society, all forms of knowledge are being short-circuited by systems of digital tertiary retention operating four million times more quickly than the nervous system of the human noetic body." Koch and Stiegler locate the machine—in its animating and automating capacities—as a primary object for critique in a social environment that is as much technological as it is natural.

With these two functions of the machine in mind—the animation of life and the automation of production—I see the ecosystem as a term of media that helps articulate the machine's particular conceptual value. The ecosystem is a variety of machine that, like *animate* and *automate*, easily slips between operative functions found in both the technical and the organic. As a hybrid term melding the study of the environmental-organic flows of biophysical reality (ecology) and the mechanisms of networked cohesion (system), ecosystem offers a way to theorize how machines mimic the animate and productive forces of life, while accounting for the automatic conversion of natural resources into energy, commodities, and waste through repetition and self-regulation. Ecosystem, as I outline later, is a unique term of media that holds a strategically valuable historical relationship to proximate concepts, including economy, the psyche, apparatus, and digital information. Exploring these relationships provides a way to synthesize the animate qualities of life's cascade—ecology—with the automated patterns of production both defining energy flow in nature and giving the capacity for modes of work in the economy. The ecosystem, I argue, is also a term of media, advantageously positioned as a machine that maps the recursive traffic between animate and automate, ecological and economic systems.

What does analyzing text, or media, as a part of an “ecology” actually mean?<sup>1</sup> Does enlisting the term *ecology* for critical inquiry easily assume an immanent relationship between systems of discourse and the field of nondiscursive actions that constitute the interactivity of both technological and biophysical reality? How does the history of the science of ecology—the study of the flow of natural systems—influence the reception of the ecosystem as the term becomes a critical method in the humanities?

The epistemology outlined by cyberneticist Gregory Bateson (1972) in *Steps to an Ecology of Mind* is exemplary of an ecological methodology, with one of the book’s direct influences in social and political theory being Gilles Deleuze and Félix Guattari’s ([1980] 1987) *A Thousand Plateaus: Capitalism and Schizophrenia*. The marriage of Bateson’s concepts with an explicit environmental political program is expressed most clearly in Guattari’s (1989) later work *The Three Ecologies*. Guattari’s thesis, quoted in the epigraph, forwards an imperative to think *transversally across* the delineated bounds of discursive systems of knowledge, biophysical systems, and systems of technological autonomy. It is in thirty-year retrospect that *The Three Ecologies* appears to reach the status of theoretical clairvoyance, as Guattari’s employment of a general ecological method forecasts the political rise of Donald Trump. For Guattari, the right-wing politician is recast as a form of mutant algae virally invading and expanding amid the posttruth social, technical, and material ecologies of late capitalism.

In looking to the Bateson quote that Guattari selected to open *The Three Ecologies*, an ecology of mind is described as a proscriptive method, which, given how American political history has played out since, could also be described as prophylactic: “There is an ecology of bad ideas, just as there is an ecology of weeds” (Bateson, as quoted in Guattari 1989, 131). Guattari’s argument outlines how to critically diagnose the emergent destructive norms of capitalism’s fixation on growth and overtaxation of the environment as

54 toxic interactions by assuming a philosophical topology linking nature, culture, and technology: “The new ecological praxes,” for Guattari, “articulate themselves across the whole range of these interconnected and heterogeneous fronts” (139). Ecological science is principally about mapping the interconnection of heterogeneous relations between the bounded systems of physical environments and organisms. Ecology, as a generalized critical method offered by Guattari following Bateson, instead recognizes how webs of subjective human thought and technological automation equally function according to models of cascade, succession, bioaccumulation, or the invasion of neighboring communities.

One critical difference lies in how Guattari (1989, 131) locates human thought and its social valence—which doesn’t take the form of “subjects” but of “components of subjectification”—as just one interconnecting “ecology” that crosses and interacts with the two other ecological enclosures: the biophysical environment and the mechanical coevolution of technological forms. For the sake of comparison, the methodology of systemic discourse analysis would be a shallow version of what Guattari has in mind, as discourse privileges only the first ecology—the networked epistemology of minds in their individual and collective linguistic registers—while devaluing the composite influences of the latter two ecologies: operational effects between, and originating within, both the surrounding material environment and the ongoing phylogeny of machines.

*The Three Ecologies* posits a political theory for a world with increasingly visible environmental crises precipitated by the unchecked growth of capitalist economies, the widespread distribution of increasingly powerful technologies—like nuclear power—prone to novel geographical and temporal scales of ecological catastrophe, and those social algal blooms that seek to virally overpower competition to secure scarce resources. “We need to apprehend the world through the interchangeable lenses of the three ecologies,” Guattari (1989, 134) writes,

for there are limits—as Chernobyl and AIDS have savagely demonstrated—to the technico-scientific power of humanity. Nature kicks back. If we are to orient the sciences and technology toward more human goals, we clearly need collective *management* and *control*—not blind reliance on technocrats in the state apparatuses, in the hope they will control developments and minimize risks in fields largely dominated by the pursuit of profit. (emphasis added)

It's worth emphasizing that for Guattari, notwithstanding his attempt to push political analysis past human language and cognition, the human subject is primarily the emancipatory actor. The goal of thinking across the *The Three Ecologies* involves the “re-evaluat[ion] [of] the ultimate goal of work and human activities in terms of criteria other than those of profit and productivity” (Guattari 1989, 142) as the principal political vector for cultivating sustainability across each ecological realm of analysis (semiotic, biophysical, technological). Eschewing liberal individualism, Guattari's ecological politics advocate, in his terms, collective management and collective control—a vision akin to a socially radical and transversal permaculture.

As demonstrated herein, Guattari specifically pivots on these cybernetically inflected terms—*management* and *control*—in what I see as a resigned acceptance of the ineluctability of the historical concepts, and the corresponding institutional apparatuses, made available by information theory, its cybernetic circulation, and technological application. With such advocacy for collectivity, it is *individual* faith in the technocratic and economic state administration of ecology under the superordinate guidance of profit and productivity that proves the problem to be overcome by transversal reasoning across *The Three Ecologies*. Restated, environmental politics become, How to think transversally about the reticulation of the individual within the natural, technological, and social collective? How can collective control and management be achieved



56 apart from the overarching coordinate objectives of profit and streamlined productivity?

This chapter pauses on the notion of information as it shaped the concept of the ecosystem in postwar ecology. I trace the recursive history of the ecosystem as the idea originates in theories describing the mind as a system and subsequently becomes the dominant concept for describing biophysical reality as a cybernetic hybrid of nature and machine, otherwise, as an amalgamation of technological *and* ecological systems.<sup>2</sup> The informational paradigm authorizes Guattari's proposal for an intersystemic analysis of exchanges between mind, biophysical reality, and technology. Information supports a common theoretical ground for strategic conceptual fluidity between fields of study, as epitomized by the postwar appeal by the cybernetic technosciences to become a "universal discipline" through rhetorical strategies of "legitimacy exchange" (Bowker 1993, 116). This alleged universality between bounded disciplines is the epistemological conceit mimicked and exploited by Guattari in *The Three Ecologies*. Transversality is the revaluation of ecology as unnatural and technoecological, otherwise, as the acceptance of the total fusion of organism and machine conjured by the idealized image of the cybernetic ecosystem. Guattari amends the ecosystem with an elevated aim of political transformation as articulated from within a critical position assuming the systemic interactions of individual and collective psyche, natural processes, and the adjacent lives of machines: "The general ecology," as Erich Hörl (2013, 128) succinctly notes, "is an ecology of a natural-technical continuum."

I characterize Guattari's move to study the transversality between ecologies as an *immanent* critique that transgresses the enclosed epistemic boundaries of existing systems and disciplines. This move is *reluctant* insofar as Guattari recognizes that the informational paradigm that makes available and supports such a theoretical move equally enables the antipolitical formations that he argues against. This is evidenced by the ability for bad ideas to proliferate in technonatural media ecologies in a weedlike manner,

as the perceived negative qualities of weeds follows a historical argument as opposed to an evolutionary one. Rhetorically, then, cybernetic universalism is recognized as ineluctable: as axiom, provocation, target, and tool. Guattari's critique confronts a system with systemic reason, which, as I describe throughout this chapter, is a recapitulation of the recursive problem that defines the politics of the ecosystem. Specifically, this chapter hones the efficacy of the ecosystem as a political term of media by highlighting the work the term does beyond its hybrid technonatural metaphorical status. Instead, the ecosystem is a *mechanism* that translates knowledge between two fields caught in the twentieth century's cybernetic fold: ecology and economy. This is most evident in the turn to ecological resilience-thinking in recent American environmental and military policy, as the convenient historical affinity found between ecology and economy under the aegis of the ecosystem is argued to rationalize the entrenched relationship between national security and resource extraction in a form of governance focused on tactical response to unpredictable, yet impending, ecological crisis.

Guattari (1989, 135) prophesized that in a media-informational environment, such as ours, politicians like "Donald Trump and his ilk—another form of algae—are permitted to proliferate unchecked." Despite the apparent prescience of this statement, I don't see value in reading Guattari's text for a preemptive and transversal explanation of the social support in Trump's 2016 election. Instead, I take another route and suggest that, according to the historical calibration of thought encapsulated by the ecosystem's strategic management of intellectual traffic between environmental, technological, and economic modes of organization, Guattari's text opens a theoretical path to understanding the Trump administration's environmental program as a strategy of governance *dependent* on the continuation of ecological crisis conditions. If Guattari highlights the challenge to thought posed by modern ecological crises that are anthropogenically economic and technological in origin, the list of "neoliberal catastrophes" that Nicole Shukin (2016) identifies as that "*to which we are becoming*

58 *accustomed*: Fukushima, Deepwater Horizon, Chernobyl, Exxon Valdez, Bhopal, and so on,” look to provide an ideal habitat for the “unchecked proliferation” of the Trump administration’s mutated conservatism, which manifests in twinned environmental policies of ecological and economic *resilience*.

The following series of events appears heterogeneous but is, I maintain, identifiable as a part of the broader and unified ecosystemic governance embracing *resilience* planning:

On June 6, 2016, President Trump suggested the addition of solar panels to greenwash and help finance the construction of the American border wall with Mexico, dovetailing xenophobia with sustainable energy investment and the Pentagon’s strategic futurological work to forecast climate refugees from Mexico and Central America (Parenti 2011; Garfield 2017). In 2018, Interior Secretary Ryan Zinke launched a complementary initiative by retasking National Park Service officers to patrol the United States–Mexico border, citing migration as an “environmental disaster” (Green, 2018).

On September 13, 2017, President Trump proposed corporate tax cuts via Twitter as the American humanitarian policy par excellence for hurricane-ravaged Puerto Rico (Klein 2017).

On November 2, 2017, the Republican Party passed the Tax Cuts and Jobs Act, permitting Alaskan National Wildlife Refuge land sales to oil and natural gas companies. As a part of a broader policy move transforming environmentally protected reserves into financially active natural resource reserves, the inclusion of extreme energy extraction confirms the speculative efforts advanced by petrochemical corporations toward previously inaccessible arctic oil, which is made increasingly available by conditions consistent with climate change. This act is a clear move to *secure* and *securitize* a future when thawed ice

means both more drilling and less foreign energy dependence (Meiklejohn 2017; Hiltzik 2017; Jerving et al. 2015; Lieberman and Rust 2015).

On February 12, 2018, President Trump's budget request gestured toward realizing his campaign promise of an American coal and nuclear renaissance. The marriage of proposed coal and atomic energy growth confirms an underrecognized alliance between revitalized investment in fossil fuel extraction, national security interest in stockpiled materials for nuclear weapons and petroleum for the military-industrial complex, and the continued endorsement of a nuclear power transition as lauded by neoliberal scientists, all while cutting renewable energy initiatives (Cooper 2008, 42; Natter 2017; Gardner 2018).

Geoengineering is increasingly disseminated as "a technological *deus ex machina*," but the idea originates in neo-conservative think tanks already working to cast doubt on climate change, as Philip Mirowski argues that manufactured ignorance itself is a stopgap measure intended to preserve free market autonomy and economic growth against ecological imperatives to the contrary (Mirowski, Walker, and Abboud 2013; Mirowski 2013).

When considered through the following discussion, each of these cynical prospects gains theoretical clarity with reference to the history and mechanism of the ecosystem: *resilience*, otherwise, how the state and economy adjust toward maintaining systemic multidynamic cohesive stability by increasing financial gain and enhancing national security upon encountering the uncertain, yet imminent, destabilization promised by environmental threats.

Guattari was right: nature *has* become inseparable from culture, but this critical observation is equally legible to those who would exploit the entanglement. As the spokesperson for the Federal Emergency Management Agency summed up the destructive 2017 hurricane season in the United States, "*the only way we*

60 *become resilient as a nation is we have to create the true culture of preparedness among our citizenry*" (Green 2017, emphasis added). As I conclude, cultures of resilience demonstrate why it is a mistake to think that the choreographed dance between neoliberal and neoconservative policies that specify the administration of environmental politics in the United States is a mode of governance ignorant to the imbrication of nature, culture, and technology.

Seeing environmental politics along Guattari's ecological topology, Matteo Pasquinelli (2017) works to expand the programmatic of "*machinic ecology*" to fully describe the historical cleavage of labor into energy (systemic material exchange) and information (energetic control). This series of bifurcations is part of an emerging environmental-governmental strategy that corresponds to three stages of capitalism and their complementary extractive machines. An "*epistemic rift*" forms "between energy and information that was provoked by industrial capitalism [the factory] and then amplified by cybernetics [ergonomic control society] and the digital revolution [planetary computation]" (312–13). He argues that the initial bifurcation was enacted during the onset of industrial capitalism by technologically organizing the productive force of labor into the extraction of natural resources, like coal (labor-become-energy), while the pedagogy of workers in the factory functioned as energetic control (information), as workers could then make use of the mined resources and autonomously operate extractive machines. For Pasquinelli (2017, 313), the large-scale machines of capitalism are diagrams describing how labor is breached into the historical abstractions of energy, or "labor as manual activity," and information, or "labor as a source of information that gives form to energy and matter." This "epistemic rift" replaces John Bellamy Foster's concept of "metabolic rift" recuperated from Karl Marx's study of the ecological fissure grown between humans as occupants of cities in industrial society and the natural soil conditions increasingly depleted by commercial agriculture and the accumulation of resources in large population centers (Foster 1999). Pasquinelli, instead, offers Guattari's "*machinic ecology*" as a method to diagnose the trans-

actions of “*empirical assemblages*” that *link* both nature and society *through* the organized severance of labor into the abstractions of energy and information, as opposed to the traditional Marxian description of nature–society relations as rifting.

Pasquinelli proposes the “*machinic* [a]s indebted to the open framework inaugurated by cybernetics that aimed to dissolve the border between organic systems and technical systems” (324). Then, his advocacy of *machinic ecology* follows Guattari by employing the same informational paradigm that grounds both the potential and the problematic of the system, as the *machinic* rhetorically and strategically employs the openness of cybernetic universality to illuminate: “a mode of governance that attempts to dissolve labor conflicts into the fabric of information and energy, thus mystifying labor into technological forms so as to render it invisible” (313). As demonstrated in this chapter, the conceptual development of the ecosystem is central to the mode of governance implied by Pasquinelli, even, perhaps, going so far as to preempt and disarm Pasquinelli’s ultimate recommendation that “it may be better to try and consolidate the assemblage of energy and information into new systemic notions” (321).

Then, *machinic ecology* highlights the abstraction processes defining three stages of capitalist economic history (industrial, cybernetic, digital) alongside their corresponding machines, technologies, and institutions (factory, ergonomic control, computation) that give informational form to the matter produced by the energy of labor (312–13). As I compile here, there is an emerging set of political strategies centered on the ecosystem that follow the *epistemic rift* between energy and information by grounding conceptual exchanges between ecology and economy. Most dangerously, following Melinda Cooper and Jeremy Walker’s (2012) genealogy of *resilience*, this mode of ecosystemic governance is positioned to gain from uncertain environmental conditions that are temporally and statistically inbound as future ecological crises precipitated by capitalist organization in the present.

## What Is an Ecosystem?

Perhaps unsurprisingly, the concept of the ecosystem has a curious relationship to theories of the mind. As Laura Cameron recounts, British ecologist Arthur George Tansley's (1935) introduction of the term in the famous paper "The Use and Abuse of Vegetational Concepts and Terms" is partially indebted to his time undergoing psychoanalytic treatment with Sigmund Freud, twelve years previously. Tansley remained fascinated with Freud's theory and practice throughout his career, even laying out his own theory of mind in resemblance of his concept of the ecosystem: an "interwoven plexus of moving material . . . a more or less ordered system, or rather a system of systems . . . acting and reacting" (Tansley, quoted in Cameron 2004, 56). Cameron highlights how Tansley's original ecosystem aimed toward equilibrium asymptotically, similarly to Freud's theory of the psyche, which reveals the early ecosystem theory to be both an idealized model limited in application and a theory founded in relation to a constitutive negativity retaining an absence beyond the enclosure of the model.

Tansley's introduction of the term, and its logical proximity to contemporaneous theories of mind, is important for several reasons. As Cameron and Earley (2015, 479, 475) write, quoting Tansley, the ecosystem originally included the agency of human beings as the "most powerful biotic factor" under the banner of "*anthropogenic ecosystems* [which] differ from those developed independently of man." The early recognition and inclusion of human activity within scientific models of biophysical reality is crucial to environmental history because the term was later evacuated of this conceptual qualification in an explicit political application of the theory toward imperial ends during the Conservancy movement, which legitimated ecologists' role as "nature's managers" (Cameron and Earley 2015, 476) over an allegedly "de-peopled" wilderness. In this sense, the anthropocentric frame to the ecosystem—its recursive modeling of mind, agency, and nature—was repressed, as was Tansley's insistence, following Freud, that ecosystems strive toward

equilibrium asymptotically, never to reach the ideal. The ecosystem was founded as a transversal object (physical system, mental, and environmental) in recursive epistemological relation to negativity.

Like many human and social sciences in the postwar period, ecology was an inheritor of the cybernetic program delineating the control exerted by information over energetic exchanges between humans, animals, and machines. In 1948, Yale ecologist G. Evelyn Hutchinson's interest in thinking together ecology and thermodynamic systems would unite Russian biogeochemist V. I. Vernadsky's approach to the "Biosphere," as a physical thermodynamic system composed of interacting living and inert matter, with Tansley's ecosystem through the introduction of the calculation of information as the control mechanism for the flow of energy in natural systems. After attending the interdisciplinary and influential Macy Conferences on cybernetics in 1948, following an invitation from Bateson, Hutchinson drew the "concept of circular causality as a means for describing the mechanisms by which ecological systems regulate themselves" (Bryant 2006, 66–67). In 1953, Eugene Odum synthesized these ideas into *Fundamentals of Ecology* by focusing and articulating a cybernetic ecosystem as a central model for theorizing nature as informational systems. Citing the influence of his brother Howard, who was a student of Hutchinson, the Odums's cybernetic ecology "swiftly became a dominant paradigm within the science, reaching its zenith with the International Biological Program in the late 1960s and early 1970s" (Bryant 2006, 71).

With the support of the Atomic Energy Commission, the Odums first worked to apply their concept of an ecosystem ecology in the 1950s by studying the circulation of radioactive isotopes leftover from U.S. nuclear weapons testing as the radiation passed through coral reef ecosystems.<sup>3</sup> The idea of a "secondary informational network" governing the material energetic exchanges in idealized biophysical systems through mechanisms of feedback linked both nature and technology in the same epistemology: "The grand laws which define the conditions of existence (gravity, conservation,



64 dissipation, limiting factors, etc.) are all part of the informational network” (Odum and Patton, quoted in Bryant 2006, 88). This was one of the first steps in conceptually reconceiving the whole Earth as a whole system (Bryant 2006), but importantly, it is not the only one linked to the geopolitical *urgency* of nuclear weapons development, as Paul Edwards (2012) and Joseph Masco (2010, 2017) have noted regarding the theoretical, technological, and cultural links between atmospheric atomic testing and the computation of climatic complexity. The Odums theory maintained that certain machines and ecosystems were equivalent on the grounds of the cybernetic position that self-regulating systems are universal, but how this term—*ecosystem*—informs an epistemological relationship between economy and ecology within an informational paradigm requires further clarification.

### **Ecosystem as Apparatus**

In effect, as William Harold Bryant (2006, 57) comments on the critical historical reception of the postwar ecosystem, “cybernetics turned ecology into a technoscience.” While Bryant’s project is to recuperate the history of the term as central to then burgeoning twentieth-century environmental political movements and the conceptual distinction between destructive and green technologies, Fred Turner (2006, 2010) has argued that the interdisciplinary import of cybernetic whole-system holism into liberal political movements in California (especially environmentalism) laid the foundations for the individualizing ideology of the network society that drove Silicon Valley commercialism. (This is not to mention the ecologically devastating demattering of hardware from software that drove the emergence of e-waste; Gabrys 2013.) Turner’s critique, by way of Geoffrey Bowker (as cited in Turner 2006, 25), draws out how the “cybernetic rhetoric” of “legitimacy exchange” encapsulates a strategic “process by which experts in one area draw on the authority of experts in another area to justify their activities.” Bernard Geoghegan (2011) has furnished these “politics of knowledge” with an account of how the heterogeneous relation-

ship between the mutability of concepts in the cybernetic sciences accord to a set of nondiscursive “instruments and techniques” accompanying the conceptual development of these fields. For this task, Geoghegan adapts the term Michel Foucault used to describe the set of strategic relations between a discourse and its heterogeneous, generalized material implementation: *dispositif* (96–98).

Geoghegan’s alteration—“the cybernetic apparatus”—is appealing in its deliberate conflation of Foucault’s use of the French words *dispositif*, “a strategic system of relations established among a heterogenous ensemble,” and *appareil*, “which may connote an instrument or tool” (Geoghegan 2011, 99). As he continues, the melding of the two terms in the English “apparatus”

poetically realizes that peculiar *disunity-in-unity* that characterizes Foucault’s use of the term *dispositif*. Moreover, this exploitation of semantic dislocation thematizes a kind of productive terminological slippage between languages and disciplines that was the condition of possibility for the cybernetic apparatus. (99–100, emphasis added)

Geoghegan’s description of the cybernetic apparatus is crucial, especially as the term fully embraces as constitutional the twofold ambiguity of cybernetic history: fool’s errand efforts to find a unified metaphysical logic for the “disunity and heterogeneity . . . that constituted cybernetics’s peculiar strength and attraction” while giving a fuller account for the nondiscursive technologies and institutions that usually “disappears from the historical picture and is replaced by hermeneutics and language” (100–101). As Foucault defined the term’s deployment while defending *The History of Sexuality* (Foucault 1978) from a panel of prominent psychoanalytic theorists, *dispositif* intends “a thoroughly heterogeneous ensemble” that forms “at a given historical moment that of responding to an *urgent need*. . . . Its general form is both discursive and non-discursive” (Foucault 1980, 194–95, 197). For Geoghegan, Cold War geopolitics supplies the *urgent* establishment of strategic heterogeneous relations that form the cybernetic apparatus.

66 The ecosystem—as a cybernetic distributary—also satisfies Foucault’s criteria under similar duress. This is especially the case as a longer etymology of ecosystem gives this particular avenue of the cybernetic apparatus a privileged relationship to the nondiscursive processes of biophysical reality. This privilege—the ecosystem’s purview of environment—is inherited from the translational mechanism founded on the historic conceptual connections between ecology and economy, later repressed and packaged for use by cybernetic universalism.

## **The Ecosystem Apparatus: Why Management?**

Refining the conceptual relationship between ecology and economy—and the ecosystem’s work as a translator between the two—benefits from an etymological detour. In Reinhold Martin’s history identifying how former American president Richard Nixon’s alleged environmental policies—including the establishment of the Environmental Protection Agency—complemented his economic positions in the 1970s, he outlines “the origins of the term *ecology* in the Greek *oikos*, meaning ‘house’ or ‘home,’ which also forms the root of *economy*, with the two terms translating etymologically as the ‘study’ and the ‘management’ of the ‘household’” (Martin 2004, 82). This exchange between ecology and economy is visible in the *urgent* historical context of the increased media visibility of American environmental crises precipitated by Fordist industrial capitalism without ecological regulation. Nixon’s environmental protection assuaged public concerns following the critique enabled by the ecosystem’s use throughout Paul Ehrlich’s (1968) *The Population Bomb*, Barry Commoner’s (1972) *The Closing Circle*, and the Club of Rome’s *The Limits to Growth* (Meadows et al. 1972). This is not to mention the observable deteriorating conditions of the American landscape described in Rachel Carson’s ([1962] 2002) *Silent Spring*, or the novel spectacle of polluted rivers and lakes catching fire in Ohio holding an emblematic visual analogy with the state violence of napalm weaponry use in Vietnam.

As Martin recounts, in 1971, Nixon suspended “the convertibility of the dollar into gold or other reserves” (Nixon, quoted in Martin 2004, 93) and made this full repeal of the gold standard—abstracting capital from materiality—permanent in part due to the 1973 energy crisis precipitated by the OPEC oil embargo. This history cynically betrays those nondiscursive instruments and institutions established in the fluid exchange between economy and ecology: the delinking of currency from materiality enabled new and virtually ungrounded financial practices, including “the speculative exchange of statistical *risk*,” and futures derivative trading, inclusive of environmental risk (Martin 2004, 94). This is clearly a politically strategic action in line with the *epistemic rift* grown between energy and information. Meanwhile, the emergence of the Environmental Protection Agency (EPA) as an institution that corresponds to the identification of “an outer limit to the exploitation of the external physical environment” reveals the same institution as a political smokescreen for the economic “compensat[ion] on the inside, at the semiotic level of capital-as-such” (Martin 2004, 95–96). In other words, the complementary traffic between ecology and economy—protection and abstraction—recapitulates the Greek origins of the management of the household, here conceived as the relation between external (ecological) and internal (economic) management respectively.

In Giorgio Agamben’s pursuit of an etymological definition for Foucault’s *dispositif*, he lands in similar territory: “Now, what is the translation of the fundamental Greek term [*oikonomia*] in the writings of the Latin Fathers? *Dispositio*. The Latin term *dispositio*, from which the French term *dispositif*, or apparatus, derives, comes therefore to take on the complex semantic sphere of the theological *oikonomia*” (Agamben 2009, 11). Agamben continues to define apparatus—which is linked by Martin to the relation between ecology and economy—as a declension of the theological *oikonomia*, otherwise “a set of practices, bodies of knowledge, measures, and institutions that aim to manage, govern, control, and orient—in a way that purports to be useful—the behaviors, gestures, and

68 thoughts of human beings" (12). Through *oikonomia* as *dispositif*, ecology and economy find their way back to the indirect governmental production of the subject.

Then, recalling one of the questions that opened this chapter—what is ecological inquiry's distinct relationship to the nondiscursive realms of technological and biophysical reality?—Agamben gives us the sketch of an answer via his interpretation of Foucault's *dispositif*. This is to say that Agamben (2009) responds by linking *dispositif* to a much older philosophical question regarding the establishment of positive governance through theological institutions: "the set of beliefs, rules, and rites that in a certain society and at a certain historical moment are externally imposed on individuals . . . the administration of the *oikos* (the home) and, more generally, management" (4, 8). This gives a partial explanation for why Foucault offers a secular version of technological and institutional governance through power's mediation of historical knowledge formations, however, Foucault's terms are more specific: "the *episteme* is a specifically *discursive* apparatus, whereas the apparatus in its general form is both discursive and non-discursive" (Foucault 1978, 197). Like the ecosystem's theoretical blend of natural, technical, and anthropogenic activity, for Foucault, the *dispositif* is an operational description of both *discursive and nondiscursive* factors. Then, when Agamben reasons that *dispositif* comes to occupy a more general and developed mechanism analogous to *positivité* in Foucault's (as cited in Agamben 2009, 3) archaeological theories of the 1960s, he mistakenly sells the role of the nondiscursive (biology, ecology, technology, institutional, etc.) short. So far, then, governance through the positive, strategically urgent, and ancillary managerial strategies of *oikonomia* becomes *dispositif* for Agamben. For Foucault, however, the association between *oikonomia* and *dispositif* produces a more complex theorization of governance than what is glossed by Agamben. Given the etymological proximity of both *economy* and *ecology* (*oikonomia*) to *dispositif*, a fuller consideration of how nondiscursive activity factors into Foucault's terminology will demonstrate why Agamben's reading falters in this regard.

Agamben misses a crucial part of this picture that proves central to my argument that the ecosystem is an apparatus. In an essay titled “What an Apparatus Is Not,” Pasquinelli (2015) provides a compelling counterhistory to Agamben’s question while moving beyond etymological convenience to give a complete account of the emergence of the *dispositif* concept. By looking to Foucault’s first use of the term during the lectures on the abnormal at the Collège de France in 1975, Pasquinelli discovers the term’s genesis in the holistic organicism of German *Naturphilosophie*. This is, not coincidentally, the intellectual environment within which the word *ecology* emerges in 1866, according to Ernst Haeckel’s development of Charles Darwin’s phrase “economy of nature—the investigation of the total relations of the animal both to its inorganic and its organic environment” (Haeckel, quoted in Golley 1993, 2, 207).

Pasquinelli argues that Foucault’s term can be traced to a constellation of sources that gives *dispositif* a renewed political interpretation in its possibility to recuperate the autonomy of the organic subject. The primary source for *dispositif* is not a theological tradition but Foucault’s doctoral advisor, Georges Canguilhem, who drew the term into sharp relief across three texts: *Essai sur quelques problèmes concernant le normal et le pathologique* (Canguilhem 1943); “Machine and Organism” (Canguilhem [1952] 2008); and the second edition of *The Normal and the Pathological* with an appended section titled “augmenté de Nouvelles réflexions concernant le normal et le pathologique” (Canguilhem [1966] 1991), which significantly adds reflection to the relationship between organicism and social theory, critiquing the concepts of organic unity that drove nationalist ideologies during World War II.

In sum, Canguilhem develops his definition of *normativity* from neurologist Kurt Goldstein’s theory of the organism, for which

*normative power* is the ability of each organism (and specifically of the human brain) to invent, modify and destroy its own norms, internal and external habits, rules and

behaviors, in order to adapt better to its own *Umwelt* (or surrounding environment), particularly in cases of illness and traumatic incidents and in those conditions that challenge the survival and unity of the organism. (Pasquinelli 2015, 7)

Canguilhem's admiration for Goldstein lies in the observation that the organism is a system of internal systems aiming toward dynamic equilibria all while in constant antagonism with the external environment. (In the revised portion of *The Normal and the Pathological* that regards social theory, equilibria of systems becomes "homeostasis"; Canguilhem 1991, 253, 260.)

In this sense, when the organism experiences a shock, it is able to amplify existing, or develop entirely new, norms (perceived retroactively as abnormal symptoms of illness) to compensate for disruption and correct the system. Canguilhem, following Goldstein, views the "abnormal as a manifestation of a positive normative process itself" (Pasquinelli 2015, 7). It is in this light that Pasquinelli sees Canguilhem's enduring thesis as a description of an organic "*normative dispositif*" (13):

it is the historical anteriority of the future abnormal which gives rise to a normative intention. The normal is the effect obtained by the execution of the normative project, it is the norm exhibited after the fact. . . . Consequently it is not paradoxical to say that the abnormal, while logically second, is existentially first. (Canguilhem 1991, 243)

Organic life is the autonomous biological development of new norms in response to externally encountered conditions rocking a normal state. New norms are perceived as abnormal due to the a posteriori effect of normalization: a process that spurs diagnostic response according to the normative intention that counterintuitively follows the perception of abnormality. The subsequent redefinition of the normal—through the categorical pathologization of the abnormal—returns the system to homeostasis from the shock delivered via encounter with the changing external environment,

now with difference: “Thus, the organism is always *in-becoming*. Truly ‘sick’ is instead the organism that is incapable of invention and experimentation of new norms: the organism that is, paradoxically, not capable of making mistakes” (Pasquinelli 2015, 7). As I imply later, it is precisely such a “true sickness” that plagues the adaptation-oriented policies of ecological resilience.

Pasquinelli, then, mines Canguilhem’s influence to give a clearer account of two distinct, yet interdependent, definitions of *dispositif* in Foucault: one nondiscursive in its distribution through the technological and institutional operations of indirect power, or “the ‘organic’ incarnation of power into an impersonal infrastructure of procedures, standards, and norms,” and a second corresponding *dispositif* guiding the “power of normalization” that characterizes “the autonomous production of the categories of the normal and the pathological by state apparatuses” (Pasquinelli 2015, 10). This dynamic interplay is, in fact, easily identified in an ecological reading of Foucault.

Normalization is a crucial process in *Discipline and Punish* (Foucault 1977). The *origins* of disciplinary power—often attributed to Jeremy Bentham’s diagram of the Panopticon—are instead more loosely identified as a distribution of social institutions and technologies established during the onset of plague management in European cities:

the plague as a form, at once real and imaginary, of *disorder* had as its *medical and political correlative discipline* . . . the functioning of an extensive power that bears in a distinct way over all individual bodies—this is the Utopia of a perfectly governed city. The plague (envisaged as a possibility at least) is the trial in the course of which one may define ideally the exercise of disciplinary power. (Foucault 1977, 198, emphasis added)

As Foucault scales the normative operation of Canguilhem’s autonomous organism to that of disciplinary power as a plasm finely distributed throughout individuals and institutions within a



72 society, the plague as external, environmental, and at-the-time-illegible threat of unperceivable disease gave rise to a new set of responsive disciplinary norms: quarantine, confinement, visible enclosure, and, most importantly, the beginning of statistical population censuses. For Foucault, it was plague that occasioned “surveillance . . . based on a system of permanent registration. . . . The registration of the pathological must be constantly centralized” (Foucault 1977, 196).

These new norms established in response to plague were initially abnormal social projections *through which* a new order of normal was subsequently defined as pathology. The social organism encountering disease *as disorder* returns to homeostasis with the *medical and political correlative of discipline*. Now, an immunitary social is better prepared for future shock with both a sense of normality via the pathological and those normalizing institutions prepared for subsequent encounters with environmental instability. Pasquinelli argues that this disunity-in-unity passing *between* individuals, technology, and the social whole discloses the returned specter of organicism: “As in the nightmares of the worst German *Staatsbiologie*, Foucault’s power apparatuses appear to cast the shadow of a gigantic macro-organism of which we would not dare to think” (Pasquinelli 2015, 14). It is Foucault’s social *interpretation* of Canguilhem’s organic *dispositif*—and Foucault’s consequential hint of superorganic social unity—that sets up the terms for Pasquinelli’s ecological–political intervention.

First, to recap, this chapter has traced the concept of the ecosystem from its proximal origins to a psychoanalytic theory of mind, through to its cybernetic reinvention in the postwar period, and its contiguity with Foucault’s notion of *dispositif*—both etymologically (*oikonomia*, alongside ecology and economy) and in terms of intellectual heritage (Canguilhem’s encounter with German biophilosophy). Then, I have demonstrated how *dispositif* contains an ecological dimension through both a relationship to the nondiscursive (generalized governance through institutions and technologies) and a relationship to environment specifically (ecology as the study

of management between interior economy and exterior environment, and, strategies of normative organic autonomy responding to external disturbance acting on internal systems of organization that aim toward homeostasis). When Pasquinelli (2017, 318–19) states that “cybernetics was the *normative project* of power in the age of information machines—a shift that Michel Foucault . . . failed to record in his epistemology of power” (emphasis added), he implicitly recognizes the descriptive limits of *dispositif* as it holds a twofold definition (positive governance and organic social normalization). This clears ground to pursue *dispositif* as more fully in line with Geoghegan’s English reformulation of the word: the disunity-in-unity functionality of *the cybernetic apparatus*.

Pasquinelli’s provocative statement about the twentieth-century cybernetic control society being the archive enclosing Foucault’s analysis is an argument supported by two compatible studies. First, one year before his full articulation of the “Postscript on Control Societies” (Deleuze [1990] 1995), Deleuze ([1989] 1995, 344–45) remarked in “What Is a *Dispositif*?” that “the disciplines Foucault described are the history of what we are slowly ceasing to be and our current *apparatus* is taking shape in attitudes of open and constant *control*” (emphasis added). Second, Céline Lafontaine (2007, 36) more explicitly sees Foucault’s thought as implicitly reflective of the contemporaneous “*Zeitgeist*” of informational control: “In defining power as a system of relations and emphasizing its discursive nature, Foucault is well and truly in line with the cybernetic rupture. . . . Depoliticized, decentralized and totalized, the concept of power as developed by Foucault is strangely similar to cybernetic control.” The implications of Pasquinelli, Deleuze, and Lafontaine, taken together, substantiate Pasquinelli’s (2017, 314) imperative for “a new critique of cybernetics [that] should help to remind us of the role of information in the growth of the old industrial apparatus.” It is at this precise point between the dislocation of energy and information, economy and ecology, that I situate the ecosystem as a term describing the historical normative apparatuses critically taken up by Guattari’s call for collective management and control.

- 74 The ecosystem as apparatus is a heterogeneous coordination of relations between mind, environment, and machine that respond to conditions of historical urgency, as is evident in nondiscursive governmental institutions, techniques, technologies, and the normalizing position of the adaptive social whole disposed toward future environmental crisis. This reading of ecosystem is further supported by one major historical outcome of the concept and its institutional application through ecological and economic *resilience*.

### **Autonomy in the Organicist Ecosystem**

It is worth recalling that Tansley's introduction of the ecosystem concept was a direct response to the primacy of organicism in ecology. The "superorganism" and "complex organism" were the dominant metaphors in the 1930s, when "plants that comprised the superorganism worked together as interacting parts, and the community as a whole maintained itself in dynamic equilibrium within the shifting conditions of its environment by means of physiological processes" (Bryant 2006, 44–45). Tansley identified a problem within the field that the ecosystem redressed: on one hand, "superorganism" and "complex organism" evangelized holism and emergence "that created for ecology the same problems as did vitalism: an orientation toward untestable, unempirical explanations for idealized constructs" (46), while on the other hand, previous models reducing organic complexity to "the mechanistic actions of molecules" missed the functionality of how many parts "worked together to maintain the integrity of the whole" (33). Then, the utility of the ecosystem concept was located within how

living things lost their privileged status and became, along with non-living matter, mutually formative components of a larger, encompassing entity. The ecosystem concept oriented ecology toward process and dynamics and away from taxonomy and natural history; toward the particular and the material, and away from the ideal and unverifi-

able. In so doing, it circumvented the mechanist-vitalist binary by providing a rigorously materialist, empirical way to address wholes without reducing their complexity. (48)

By 1942, Raymond Lindeman had published a quantifiable study of solar energy passing through a lake ecosystem as physicochemically processed by “producers,” “consumers,” and “decomposers” (Bryant 2006, 48). It was this conceptual movement toward the quantifiable study of energy within a thermodynamically modeled physical–natural system, constituted by interacting “biotic and abiotic components” (48), that primed the ecosystem for its reception in the cybernetic sciences. The introduction of information feedback, as the control mechanism for energy transfer, gave a theoretical framework that accounted for self-regulation in a given idealized biophysical system.

Just as Tansley appeared suspicious of organicism in ecology, so is Pasquinelli of this impulse in Foucault. Canguilhem’s theory of the abnormal—and its critical social application to normative French institutions—crystallized specifically within postwar France due to heightened recognition of the “dangers of *organicism*” that Pasquinelli (2015, 11–12) defines as “the metaphors that were born in the biological sciences and then clumsily transplanted into the political sciences.” This is the case, he maintains, because Canguilhem was at the time fully aware of how “German *Naturphilosophie*, from Kant to Goethe, from Humboldt to Haeckel, from Driesch to Uexküll, is built up around the organic unity of the living, which is then delivered ‘hands tied’ to political philosophy and legal theory” (12). Implied here is an intellectual mistranslation bluntly shuttled from *Naturphilosophie*—including Haeckel’s ecology—directly into social theorization, contributing toward the “organicist paradigm [that] led German society to drift, eventually, into the catastrophe of Nazism” (13).

Canguilhem, for Pasquinelli, offered a careful philosophical distinction that challenged the organicist perspective maintaining an easy application of the procedure of the normative to social

76 happenings and institutions. "The organism is formed around an *internal environment* of organs that can grow but not significantly change their configuration," yet "society [i]s an *external disposition* of machine-organs that often extend and accumulate against each other," meaning that the individual and the technological/institutional implementation of the social "evolve in a completely different way" (12). The organism and social technologies/institutions evolve *in completely different ways*. Pasquinelli concludes that Foucault's inheritance of the *dispositif* loses Canguilhem's insistence that "the social organization is able to *invent new organs* that are no longer an imitation of nature but follow its sense of production," as Foucault instead reversed: "the normative autonomy of the subject and, specifically, technology as a potentiality of the living" (12, 11). Foucault's alteration of his advisor's thesis formulates "knowledge as an *expression of power upon life*" rather than "knowledge as an *expression of life*," thereby withdrawing the "normative *potentia*" (13) of the organism to articulate the full theorization of power found in the dual (nondiscursive and normative) *dispositif*. Hence Foucault maintains a hint of the superorganic unity in the *dispositif* that Canguilhem so carefully sought to avoid. It is Pasquinelli's intervention to imply critical value in the conceptual distinction between the organic autonomy of the subject and the organic autonomy of the machine—a crucial difference easily effaced in the dynamics of the theorization of power as circulating and accumulating in populations, institutions, and technologies.

This intellectual history is important because it runs parallel to a series of conceptual movements coupling the organic to the political as filtered through the twentieth-century cybernetic ecosystem. In the 1960s and 1970s, James Lovelock was studying the possibility of life on Mars while working for NASA. Drawing knowledge from cybernetic ecosystem theory that maintained that biophysical reality worked as a materially closed, energetically open whole system governed by informational self-regulation, Lovelock reasoned that since "Earth's air was full of reactive gases of biological origin," then "the composition of the atmosphere in fact depended upon the

life on its surface" (Bryant 2006, 229). Following a xenobiological line of inquiry, Lovelock determined that NASA didn't need to visit Mars to ascertain whether the planet hosted organic life. He could deduct that answer based on observing the Martian atmosphere by telescope from Earth, as theoretically understanding the composition of an atmosphere as being part of a system composed of interacting biotic (if present) and abiotic factors supported the inference that a planet's lifeless character would be reflected in spectral analysis of the chemical makeup of the given atmosphere. If Mars had organic life, you should be able to see its effects on a planetary scale.

Lovelock (1995, 10) returned this observation to the planet Earth in his durable thesis, the "Biocybernetic Universal System Tendency/ Homeostasis," which maintained,

Life on Earth shaped and determined the physical composition of the planet, just as the physical planet shaped and determined that character of life. . . . Life exists planet-wide or not at all. . . . The quantity and distribution of organisms would need to be sufficient to regulate the planetary environment and keep it comfortable for living things. . . . Species do not merely adapt, through evolution, to the environment they find themselves in. They continually change their physical and chemical environment. Species and environment co-evolve in an indivisible process. . . . Viewed as a whole integrated system, *the Earth could be considered a single living organism in its own right*. . . . It was self-organizing and self-regulating; through cybernetic circuits of negative feedback, the planet maintained itself in dynamic equilibrium, just as an individual organism maintains homeostasis. (Bryant 2006, 229–30, emphasis added)

After receiving the advice of his friend and neighbor, author William Golding, Lovelock (1995, vii) renamed his idea of a self-regulating and complex unity "Gaia."

78 Then, what makes a planetary-scale Gaian superorganism different from more traditional organicist notions? Complexity and disequilibrium. Beginning in the late 1970s and building momentum through the 1980s, the idea of complexity had profound implications for both the ecological and economic sciences. Looking at Gaia, what Lovelock made clear was that Earth's history of life did not diminish in biological difference according to an entropic propulsion toward the heat death of equilibria. Rather, life responds to thresholds of disequilibria by progressing toward an increasingly complex diversity of forms that regulate the abiotic and material imbalances that support the conditions for the phenomenon of life itself. As Melinda Cooper (2008, 35) explains regarding Lovelock's conceptual move from the thermodynamic planetary evolutionary model of the biosphere to one of complexity, as illustrated by Gaia, "life, in this view, is intrinsically expansive—its field of stability is neither rigorously determined nor constant. . . . Its law of evolution is one of increasing complexity rather than entropic decline, and its specific creativity is autopoietic rather than adaptive." Biospheric self-regulation was located within the regenerative capacities of life in its interrelating variety, and more specifically, microbial life was highlighted as the most crucial component in the system given its ability to reanimate in the most extreme geographies.

Cooper argues that Gaia theory is a part of a broader and, again, disunified-yet-unified *ecological* response that folded alongside an *economic* cooptation. She locates the traffic of this ecosystemic apparatus in the reaction to the restrictive theoretical and political challenges posed by environmental steady-state advocacy, like the Club of Rome's *Limits to Growth* (Meadows et al. 1972) and *Beyond the Limits: Global Collapse or a Sustainable Future* (Meadows et al. 1992). Upon comprehending the consequences of how 97 percent of industrial production was dependent on nonrenewable fossil fuel extraction, the imperative offered by then-nascent degrowth environmental perspectives maintained that "the earth is finite. . . . Limits to growth . . . were time-like rather than space-like. This meant that we might have already gone beyond the threshold at

which an essential resource such as oil could be sustainably consumed, long before we would notice its actual depletion" (Cooper 2008, 17). The Club of Rome had concluded after two studies that capitalist economic growth could not outstrip the material ecological equilibria of the planet without encountering catastrophe. It followed that solid-state economies were mandatory to stave off collapse, as plans to continue neglecting the limits operated in ignorance that "we were already living beyond the limit, in a state of suspended crisis, innocently waiting for the future to boomerang back in our faces" (Cooper 2008, 17). Rather than act on the Club of Rome's prescription, and in accordance with the ecosystemic drive of "capitalist delirium" (Cooper 2008, 21) that reestablishes the ordinates of growth and accumulation in the bald-faced reality of scarcity, the entwined limits to both life (ecology) and capital (economy) needed to be invented and reinvented so as to *promise* a future both livable *and* returnable. The promise, of course, was not offered to everyone.

Cooper (2008) uses the term *bioeconomy* to describe the codevelopment of the twentieth-century turn in economic, earth-system, and life sciences toward complexity, as each field responded to theories proposing limits to growth as though in concert. For Lovelock, Lynn Margulis, and Dorion Sagan, "their rereading of evolution thus concludes with certitude that microbial life will outsurvive all limits to growth—certainly it will outsurvive the human race and quite possibly the end of the earth" (Cooper 2008, 39). In a political indictment of how the coherent philosophy of Lovelock's Gaia hypothesis was mistranslated into a series of neoliberal economic policies and institutions, the idea that the planet was an autopoietic living system capable of self-regulation and autonomous sustainability gave ground to rationalize strategies of financial biospeculation intended to stave off a meaningful divestment from oil. Cooper writes,

[Biosphere science, complexity science, and related theories] may well have their origins in essentially revolutionary histories of the earth . . . , but in the current context



they are more likely to lend themselves to distinctly neoliberal antienvironmentalism. . . . Whether this is a misinterpretation of complexity theory, at odds with the intentions of the theorists themselves, is in a sense beside the point, since in the absence of any substantive critique of political economy, any philosophy of *life as such* runs the risk of celebrating *life as it is*. And the danger is only exacerbated in a context such as ours, where capitalist relations have so intensively invested in the realm of biological reproduction. . . . It is because life is neguentropic, it seems, that economic growth is without end. And it is because life is self-organizing that we should reject all state regulation of markets. This is a vitalism that comes dangerously close to equating the evolution of life with capital. (41–42)

On one side of the mistranslation, contradictory theories of ecological modernization and green capitalism introduced the imperative to grow capitalist economies to the tune of sustainability, only to end up making unachievable promises beyond the limits. On another side, environmental regulation was repudiated with the charge of anthropomorphism, as Cooper identifies Lovelock's continued endorsement of nuclear power as a symptom of the anti-humanism present in the most drastic interpretation of Gaia: does Earth truly need humans—or all humans—to survive? Probably not, as long as the microbes will.

Cooper's theory poses a difficult problem: while complexity and its various incarnations yield a refined image of the planet's mechanisms, history shows us that there are those who deliberately exploit that knowledge in bad faith of the stated aspirations of good science. By acknowledging the philosophical coherence of Earth as a complex system, the question gets turned around: rather than hold a theory of life responsible for its inheritors, what instead is required of critique to meet *the life of ideas* on political grounds? As a methodological inspiration, I advance the ecosystem as the conceptual ground supporting exchanges between natural

and economic science. The ecosystem is a mechanism for such exchanges as facilitated by the disunity-in-unity inherited from the cybernetic apparatus.

Economists and policy makers from the Carter and Reagan administrations through to the Clinton and Bush governments formulated responsive positions to the determination of limits to growth by proposing speculative economies drawn from knowledge in the life sciences. In one compelling example, citing George W. Bush's "notoriously antienvironmental" regime, Cooper (2008, 47) illustrates how his Department of Energy's Office of Science in 2004 "adopt[ed] a language that recalls the Gaia hypothesis as much as the more economic calculations of ecological modernization [by looking] to the history of microbial and biospheric evolution as a source of future solutions to the looming energy crisis [and] plac[ing] special emphasis on the potential industrial applications of extremophiles." Gaia's foundational interest in life's capacity for regeneration in the most extreme geographies begins to look like some of the promised fallback fantasies intended to move economic development past limits projected regarding the scarcity of nonrenewable resources. After years of implementing and institutionalizing such strategies, Cooper argues that we're now well beyond the limits and waiting for the boomerang. But this isn't the most frightening prospect. The indirect consequence of such avid assurance of growth-past-the-limits is the preparation of a new set of cynical strategies: the imagination of the production of surplus value from an industrially scorched earth. Otherwise, how can surplus be extracted from a future that assumes that life will continue to grow in the ruins of capitalism?

## **Financing the Whole Earth as a Whole System**

Truth is stranger than fiction, as one such financial imaginary emerges in the evolving transactions of the cybernetic apparatus-become-ecosystem. In 1984, during fears of nuclear apocalypse

82 and the emergent dream of escaping the planet to off-world colonies in preservation of growing populations and industry, the private research corporation Space Biospheres Ventures started to consolidate an experimentally sustainable commune into a series of tests. These were outwardly capitalist endeavors to develop patents for space habitats in the isolation of the Arizona desert. The tests led to the establishment of Biosphere 2: an enclosed, self-regulating ecosystem designed to support human, animal, and plant life without any material exchange with, or external reliance upon, Biosphere 1—planet Earth.

The experiment took cues from Princeton physicist Gerard O'Neill's proposal that self-regulating space colonies were a viable technoecological solution to the perceived global population crisis and the apparent limit to an expanding society's dependence on oil and accordingly turbulent geopolitics. The three-acre enclosure cost \$200 million and is the world's largest ecological experiment, funded by a Texan oil magnate named Ed Bass. While Biosphere 2, over the various experiments it ran, ended up producing a large amount of valuable climate change research since its beginnings in the early 1990s, Peder Anker (2017, 125) recounts that the project had less utopian motivations than its stated goal of simulating a space colony: "The aim of the Biosphere 2 was also to build a shelter in which Bass and his friends could survive in co-evolution with thousands of other species in case the eco-crisis turned Biosphere 1 into a dead planet like Mars [and t]hey believed that 'Glass Ark' could secure their personal survival while at the same time rescue some of the world's biodiversity."

The history of this project is well covered elsewhere,<sup>4</sup> but recent political events have shaped the importance of Biosphere 2. The presence of Alt-right spokesman and former advisor to President Trump Steve Bannon as an intermittent financial administrator for the project between 1991 and 1994 merits a brief consideration in light of how Cooper sees the mistranslation of Gaia's ecosystemic vitalism as key to understanding emergent strategies of speculative investment. As recently reported, part of Bannon's interest in

the project was premised on its failure. After the second wave of scientists were evacuated from the enclosure, Bannon used the heightened CO<sub>2</sub> levels that were consistent with modeled expectations of a world undergoing anthropogenic climate change “to measure how quickly commercially harvested trees would grow in a carbon dioxide-rich atmosphere” (Niiler 2016). “[The trees] shot right up” (Niiler 2016), said Tony Burgess, a botanist working there at the time. In Bannon’s eyes, Biosphere 2 became commercially viable as a pilot plant for how to make money from climate change. This is a glimpse of an economic investment strategy literally banking on the failure of planet Earth. Once visible as the whole system of Biosphere 1, the Earth’s anthropogenic climate also enters the financial system. Dipesh Chakrabarty (2009, 22) has influentially argued that “climate change, refracted through global capital, will no doubt accentuate the logic of inequality that runs through the rule of capital,” yet “there are no lifeboats here for the rich and the privileged.”<sup>5</sup> In final recognition that the limits of growth come with a price, Chakrabarty’s thesis is challenged by Bannon’s Biosphere and those who seek to finance the time that remains.<sup>6</sup>

In their shared perspective on the dangers posed by theories of life articulated in the absence of a critique of political economy, I see Pasquinelli and Cooper as compatible in diagnosing such ecological–political problems that result from the ecosystem apparatus’s merger of ecology and economy. As Cooper (2008, 49) suggests, responding to such historical interdisciplinary translations involves an “effective ecological counterpolitics” that attends to the delirious drive to model future worlds while destroying them in the present under the assumption of maintaining the deleterious status quo—the delirium that characterizes “[our] living on the cusp between petrochemical and biospheric modes of accumulation, the foregone conclusion of oil depletion and the promise of bioregeneration.” This counterpolitics requires “work in the prospective mode, to detect and preempt the new forms of scarcity that are being built into the promise of a bioregenerative economy” (49–50). In the case of Bannon’s Biosphere modeling the surplus

84 profit to be gained from a world undergoing slow but predictable anthropogenic change, the prospect of serious climate mitigation appears forgone as the continuation of fossil fuel denominated industrial production is assumed. Critique needs to continue with Cooper's temporal position in mind: who is lining up to finance the conditions of continued growth in an anthropogenic future?

In a complementary position, Pasquinelli offers a philosophical account for the renewed potential of social technologies by way of Canguilhem's careful positioning toward organicism, a concept that appears alongside the prospective surplus value exposed by a Gaian planet. Pasquinelli (2015, 12) sees political possibility, like Guattari, in technology as developed aside from capitalism, but technology must be considered as clearly distinct from the patterns of organic autonomy: "I propose to call *biomorphism* that mode in which *life does not imitate itself*, but is projected into the *ab-normal* social relations, mutant relations of production and further planes of consistency without looking back." His conceptual distinction most clearly illustrates the need to divorce the ecological study of life from the economic study of material governance, coordinated as they are within the ecosystem apparatus.

While subjective organic autonomy remains crucial, danger appears in uniting sociality, machines, and environments under the simple and immanent ontological banner of holistic organization. Thus, when Guattari (1989, 142) states that "the ultimate goal of work and human activities in terms of criteria other than those of profit and productivity," it is in line with Pasquinelli's (2015, 1) renewed mandate to think through "the normative autonomy of the subject and its constituent *abnormality*" as *distinct* from those modal properties of institutional and technological forms.<sup>7</sup> The nondiscursive operations of social institutions and machines require their functionality to be recalibrated outside the parameters of economic growth. *Biomorphism* is a useful term to orient this challenging reconsideration. From the ecosystemic fold of ecology and economy, institutional and technological developments that do not directly mimic the automated production of life for the purpose

of growth are urgently required. Machines need recalibration toward an autonomous acting capacity that is truly ecological in the sense of technical individuation without capitalist coordinates. From Cooper and Pasquinelli, politics requires an autonomous human subject organizing against the delirious pattern of growth and its deferred limits. Equally, this program calls for room for the potential of social technologies to be articulated outside the easy translation of life into industry, as growth is mistakenly conceived as the equivalent purpose of both organism and machine.

As Philip Mirowski concurs, it is with such sustained confluences of economy and ecology that the shadow of geoengineering responses to climate change appears not as true salvation but as the ultimate backup plan for the eventualities of disaster capitalism: “The neoliberal fallback after the ‘cap-and-trade’ model inevitably fails will be geoengineering, which derives from the core neoliberal doctrine that entrepreneurs will innovate market solutions to address dire environmental problems” (Mirowski, Walker, and Abboud 2013). The promise of continued economic growth is made in bad faith, carved from a burgeoning financial imagination reconceiving a wrecked Earth as one prospectively terraformed, primed as it is for the continued extraction of surplus. This imaginary is already prototyped, and in the patenting phase, as of Bannion’s Biosphere.

## **Trump’s Ecosystem and the Problem of Resilience**

Following a highly active hurricane season, CNN ran the headline “Trump Administration Swaps ‘Climate Change’ for ‘Resilience’” (Green 2017). The reporter, Miranda Green, highlights the semiotic shifts that followed the transition from Barack Obama’s administration to Trump’s environmental policy:

In the wake of Hurricane Irma, both Federal Emergency Management Agency (FEMA) Administrator Brock Long and acting Homeland Security Secretary Elaine Duke avoided explicitly answering whether the government

needs to be more focused on climate change because of hurricanes. Instead, they both said the focus should be on resiliency.

Long's response is particularly striking: "*Regardless of what causes disasters, it's our job within the Department of Homeland Security [DHS] and FEMA to manage the consequences. . . . The only way we become resilient as a nation is we have to create the true culture of preparedness among our citizenry*" (Green 2017, emphasis added). The report continues by tracking a wide range of similar linguistic slippages occurring throughout various departments developing environmental perspectives under Trump. Elsewhere, the Natural Resources Defense Council (NRDC) appeared completely baffled by Trump's announcement of a \$12 billion competition "to increase resilience to future flood and hurricane disasters," which the NRDC expert highlighted as "an unexpected proposal" given Trump's outright antagonism toward climate science: "NRDC has floated a similar idea with Congress" (Moore 2017). What logic brings Trump and the NRDC together under the same sign?

Brian Massumi (2009, 155) has excavated Foucault's preliminary theory of *environmentalité*—environmental governance—within handwritten manuscript notes from the lectures on *The Birth of Biopolitics*: "[*Environmentalité*] asserts its own normality, of crisis: the anywhere, anytime potential for the emergence of the abnormal. . . . Environmentality as a mode of power is left no choice but to make do with the abnormally productive 'autonomy.'" The theory, sketched out on the horizon of Foucault's thinking, is incomplete at best but proves immensely generative for Massumi's description of a "war-weather continuum" (158) visible in the shared and preemptory relationship maintained between the military preparedness for and neoliberal economic financing of ecological crisis. This gives a partial explanatory framework for the interplay between "neoconservative war power" (Massumi 2009, 179) and "disaster capitalism" (Klein 2007) most apparent in George W. Bush's waffling between Hurricane Katrina as a natural disaster and as a national economic emergency. Instead,

[Bush] dubbed it a “national *enterprise* emergency.” Neo-conservatism’s naturalization of national security activity is one half of a double movement. As power moves into the bare-active realm of emergence to bring life back, life’s induced return is met by an economic expansionism that wraps life’s re-arising into its own global unfolding. (Massumi 2009, 174)

In response to Hurricane Katrina, Bush redeployed the allegedly domestic National Guard, recently returned from Iraq, in New Orleans. The U.S. military, which was legally reserved for foreign incursion, also circulated throughout Louisiana, collapsing domestic security and foreign invasion within the same local environment. Again, the ecological/economic management of the interior and exterior of the household seems at play. With the Pentagon’s re-mapping of civilian and military space came a heinously oppressive program of economic exploitation in the broad implementation of what Naomi Klein (2007) has termed the *shock doctrine*. This doctrine amounts to having free market policies lying in wait for a crisis opportunity, as crisis etymologically indicates the provoked need for swift decision and implementation. This strategy plays out more closely to political elites employing government to further consolidate power, with the banner of “free market” being an ideological tool employed in name alone to otherwise secure profits. Most cynical might be Milton Friedman, aged ninety-three, who saw Katrina as an *opportunity* to privatize the Louisiana school system—a process prepared for and completed before most of New Orleans’s poor were able to return to their homes.

As Massumi writes, such events betray a specific strategy to the emerging form of environmental power that normalizes potential exposure to state and environmental violence while using those same conditions to further economize life. Environmental threats are described as indiscriminate, so the military’s response must be equally ubiquitous and primed like an atmosphere on the verge of precipitation. “The enterprise aspect of Bush’s Katrina response was represented by his strategy of replacing government



88 assistance with outsourcing to the private sector and shunning the shelter of government-planned and government-regulated redevelopment for the gale winds of enterprising investment, following eagerly upon those of Katrina" (Massumi 2009, 174). Bush didn't want to return a sense of safety to Louisiana; he wanted to instill a (false) sense of prosperity. Rather than restoration to the homeostatic norms, a new systemic positionality toward the future emerged as the city was reconceived as a resilient one according to the inputs of neoconservative security and neoliberal economics. This is, so far, a familiar reading for how Bush's response to a hurricane melded neoconservative militarism with neoliberal economic strategies. It is more difficult to trace how this doctrine has remained in place through succeeding political administrations.

What makes Massumi's text such a compelling theoretical framework is his insistence that Bush's "national enterprise emergency" was transformed into a fully fledged "*natural* security" (159) for Obama's national security transition team: "the Obama administration's defense of the Bush era rules of exception, which came as a cruel surprise to many hopers, indicates a trans-administration tendency to hold the potential for preemption and its economic coupling in ready reserve" (180). Throughout Massumi's essay, one cannot shake the image of two semiotically distinct yet continuous political regimes—Bush then Obama—reacting to natural and military threats uniformly through the same terms of ubiquitous yet aleatory environmental disruptions. At times, it almost reads as though Massumi describes the state *as an organism*: adapting to a changing external environment through internal renovations (elections, policies, and infrastructure) while retaining the same outward compulsive position toward preparedness for disequilibrium. Is this an example of statecraft responding to the ecosystemic fold of ecology and economy?

It's most clear in Obama's government, I argue, in the translation of the "War on Terror" to what the *Economist* termed in 2014 the "War on Ebola."<sup>8</sup> On October 23, 2014, Craig Spencer returned to New York from Guinea after treating Ebola victims. He contracted

the disease and didn't show symptoms for two days, making his way around the city in the time being. Russel Brandom recounts just how totally surveilled Spencer's life was *before* learning he had the disease and how publicly those details traveled after diagnosis to help subdue panic: "Once he was back in New York, nearly everything he did left a trail. There's a reason for the obsessive attention: staying ahead of the virus" (Brandom 2014). A culture of resilience was propagated as an immunitary move: New Yorkers learned every minute detail of Spencer's two days to both assure the population of their public health and prepare them in case of an outbreak.

It is surprisingly easy to switch in a terrorist suspect in the above scenario, as, after all, to find out who Spencer contacted in those two days while moving through the New York public, all the DHS needed to do was interpret data from the already up-and-running post-9/11 security apparatus. Implied is a certain conceptual equivalence of external threat from the perspective of the state, spanning the human (terrorist) and nonhuman (virus). Institutional response to the externality of environmental threat, whether natural or national security, is a functionality maintained from one administration to the next. My reading of the incident is further supported by Obama's 2015 speech on the deployment of the Public Health Service Commissioned Corps to combat Ebola in West Africa:

Last year, as Ebola spread in West Africa and I said that fighting this disease was more than a national security priority . . . , understand that this corps of public health professionals are on the frontlines all the time. And when you think of some of the most difficult, challenging tragedies or public health challenges that we've experienced over the last several decades, these are the folks who have been there from the start. After 9/11, after hurricanes, after Sandy Hook, after Deepwater Horizon or the Boston Marathon bombing, they come in to help support, advise and oftentimes provide direct treatment in some

of the most difficult situations imaginable. . . . They not only helped to keep the American people safe; they led a global response. (Obama 2015)

Most notable about this speech is the equivalence and conflation of domestic threats with crises abroad; terrorism with disease, infrastructural failure, and natural disaster; and international health with national security. This is not to mention the semiotic re-inscription of health workers in explicitly militarized terms, or what the development of “public health infrastructure in many of these countries” (Obama 2015) might entail in imperial-economic terms. In the Ebola crisis, the dangers of external threats (environmental or otherwise) are topologically fed directly inward toward domestic cultures of preparedness and civic security. As Massumi (2009, 155) inquires, “What systematicity is this?”

Cooper (2010) has concretely identified this system of governance as appearing in the ecosystem apparatus. In her study of the booming market of American investment in weather derivative financing—second-order speculative futures trading that hedges environmental risk—she explains how the financing of the conditions consistent with climate change were first enabled by Richard Nixon’s removal of the gold standard: “We cannot predict the unfolding of climate change and its effects on prices, even in the short term. Its parameters of variation are unknowable. Yet we can create a derivatives contract allowing us to wager on this very uncertainty. . . . What is at stake in the circulation of capital today is . . . the event of turbulence itself that becomes tradable” (178, 179–80). Her broader argument focuses on the magnetic denomination of debt issuance in global financial markets by the U.S. dollar—“the world’s de facto reserve currency” (168)—and the accordingly distinct American “privilege of paying its foreign debts in its own currency” (169) as a topological ordering of “world imperial power” (181) supported by unrivaled military dominance. “The problem confronting [centrist American think tank] strategists is how to navigate the US-dollar denominated world through the extreme turbulence of financial, climate and energy crisis” (169). By

responding to this problem in strategic planning, in effect, global climate change is viewed as legible according to increasingly volatile conditions of future turbulence marked by uncertain weather as (priceable) environmental risk, uncertain geopolitics rendered as destabilized states (environmental refugees, the testing of critical infrastructure, etc.), and resource scarcity (especially oil depletion). (Nearly beside the point are the new avenues of dethawed access to militarily contested and valuable Arctic territory made increasingly available by global warming.) With turbulent climates of finance and geopolitics looming within the strategic planning of economic and military policy, Cooper charts designs being drawn up not only to *survive* the turbulence but to profit and securitize in its wake. This logical position toward the future perversely underwrites the continued manufacture of said turbulent conditions by maintaining fossil fuel-based growth economies. Then, the integrated response to the reticulation of future financial, ecological, and energy crisis assumes that

turbulence cannot be averted then. . . . Rather the aim will be that of maintaining the topological cohesion of a world in and through the most extreme periods of turbulence. In complex systems theory, this property of topological cohesion is referred to as “resilience” (the term, which was first used in its contemporary scientific understanding in ecosystems theory, is now ubiquitous in strategic thinking). (183)

The shift to resilience relies on the hedge against serious global warming mitigation or climate stabilization. For Cooper, resilience is the working strategy to strengthen American national security (neoconservatism) and economic dominance (neoliberalism) through impending crises while maintaining the topology of American geopolitical supremacy defined along the axes of debt imperialism and military strength. By pivoting toward a future-oriented system best suited to take advantage of inbound turbulent conditions, material acts in prevention are functionally discouraged.

92 In a subsequent study, Cooper and Jeremy Walker have described in depth the genealogy of resilience that, unsurprisingly, follows from the ecosystem apparatus. They highlight the symmetry between ecologist C. S. Holling and his introduction of complexity science to ecosystem theory, with the late neoliberal economic philosophy of Friedrich Hayek. Cooper and Walker (2012, 145–46) illustrate the disunity-in-unity characterizing the conceptual application of complexity to economy and ecology as such:

The key image of science that propelled the formalisation of economics (in the 1870s) and ecology (in the 1950s), was of smooth and continuous returns to equilibrium after shock, an image derived from different vintages of mechanics and thermodynamics. Holling's widely cited paper "Resilience and Stability of Ecological Systems" (1973) represents the destabilisation of the notion of "equilibrium" as the core of the ecosystem concept and the normal terminus of ecosystem trajectory. . . . What Holling seeks to define instead, is a complex notion of resilience which can account for the ability of an ecosystem to remain cohesive even while undergoing extreme perturbations. If stability refers to the familiar notion of a return to equilibrium, "ecological" resilience designates the complex biotic interactions that determine "the persistence of relationships within a system," thus resilience is "a measure of the ability of these systems to absorb changes of state variables . . . and still persist."

Cooper and Walker proceed by mapping how Holling's concepts guide environmental policy development in several prominent think tanks, most notably the Resilience Alliance. Holling's later ecological theories transition toward figuring capital accumulation away from linear models of political economy and into the "crisis tendencies of complex adaptive systems" (147) giving foundation for resource management theories advocating the financing, securitizing, and militarization of the biosphere. While Holling and Hayek did not cite one another, the two have structural similarities

in their respective citations and rhetorical embrace of complex systems theory. Walker and Cooper imply a mutual conceptual foundation, which is by now familiar to the disunity-in-unity strategies of the cybernetic apparatus and its ecosystemic by-product.

Intuitively, Massumi's question—what systematicity is this?—suggests a common logic preempting a future defined by an increasingly turbulent set of atmospheric, financial, and insurgent conditions, which appears satisfied by Cooper and Walker's description of resilience. Resilience policies semiotically absorb the concerns of varied administrations, including Bush's consolidation of FEMA and the EPA under the guidance of the Department of Homeland Security's 2007 mandate to use natural disasters "as opportunities for the selective transformation of urban space" (Cooper and Walker 2012, 154). Or, resilience is visible in the Obama administration's couching of Deepwater Horizon in terms of a terrorist attack, wherein the linguistic shifts along the war-weather continuum serve to justify the unavoidable dependence of the security state upon the petrochemical industry (and its reserves) to fuel its war machine both domestically and abroad (McClintock 2012, 4). In words that portend the Trump administration's call for a "true culture of preparedness among our citizenry" (Green 2017), Cooper and Walker (2012, 155) discern in resilience a "general systems theory of 'socio-ecological governance'" forming a completely normalized sensibility oriented toward maintaining multidynamic stability as though a coherent program of civic defense: "Within this optic, preparedness would seem to demand the generic ability to adapt to unknowable contingencies rather than actual prevention or indeed adaptation to future events of known probability" (153). Correspondingly, they continue, Hayek's late theories posit the equivalence of catastrophes "(natural, social or economic)" as an inevitable failure inherent to the limits of socialized management and control, as though catastrophe is the teleological consequence of governmental intervention (Cooper and Walker 2012, 154). Then, from Hayek's perspective, this means that the failure to mitigate climate change is not itself the problem.

94 Instead, Cooper and Walker see in Hayek's resilience theory an economic philosophy with contempt for political strategies of social governance: "what is called for instead is a 'culture' of resilience that turns crisis response into a strategy of permanent, open-ended responsiveness, integrating emergency preparedness into the infrastructures of everyday life and the psychology of citizens" (153–54). These are nearly the same terms adopted by Trump's FEMA. Within this optic, addressing climate change is not about moving society off oil, as there is no society. Cultures of resilience provide an alternate solution. From the perspective of resilience, it's about deregulation and encouraging individuals toward cultures of disaster preparation.

As in the integrated whole of the organicist state and Guattari's three ecologies, ecological resilience and its prepared security infrastructure imagines its environmental subjects as a "culture" in the bacterial sense: growth from a nourishing medium that rhetorically enlists the agency of the full political spectrum. An allegedly environmentalist program, resilience proves deeply neoliberal in its discount of mitigation strategies. Individuals are positioned as ecosystemic effects without any autonomous potential to re-form environmental relations outside the twinned concerns of national security and petrochemical industrial growth, otherwise, ecology and economy. Collectivity is effectively written out in advance by the preemptory position seeking to maintain cohesive adaptation of individual survivors during inbound turbulence.

It would be irresponsible to discuss resilience without pointing to the deep strain of eugenics that the discourse cultivates, especially with regard to climate migration and refugees. Resilience "reiterates and modifies the Darwinian law of natural selection" by recalibrating social norms toward the turbulent conditions of nonequilibrium: "in this context, the appeal to ecological security is often invoked as a means of distinguishing those who are sufficiently resilient to survive as dignified participants in a globally integrated world from those who are either too resilient or not resilient enough" (Cooper and Walker 2012, 156). Orit Halpern, in





96 the relationship between organic unity and normative potentiality, the proximity of the ecosystem to theories of organicism is better understood for its full political implications: “the perception of the whole earth as ecosystem (as in the Gaia hypothesis)” (Pasquinelli 2017, 320) requires a critique of political economy.

Not unlike the “recursive irony” defining the technonatural hybridity of the ecosystem, to use Bryant’s (2006) phrase, Pasquinelli (2017) implies it is more than a coincidence that the outcome of the industrial division of energy and information as an abstraction of labor is climate change driven by accelerated capitalism, as global warming is made visible by the same epistemological tools that power the problem. Such is the recursive trap of planetary computation:

With almost identical techniques, global data centers accumulate information and intelligence, not just about the world’s climate but also about financial markets, logistical chains, international terrorism, and, more importantly, social networks of billions of individuals. Is the similarity of climate science and control apparatuses just a coincidence, or does it point to a more general form of governance? The vast network of climate science appears like an extended cybernetic loop with big institutions taking the role of the nervous system of a pretty large organism—planet earth. (320)

Pasquinelli’s provocation here regarding large-scale forms of environmental governance is important and, as highlighted earlier, in line with a longer set of historical transactions that can be traced through to questions placing the organic individual in relation to the social and technological whole. Indeed, as the history of the ecosystem shows, this form of governance is already identifiable in policy as resilience.

Yet, there is still the problem of the ecosystem as fashioned by economy and ecology. As prophetic as Guattari’s text appears while regarding his admittedly uncanny forecasting of Donald Trump’s

invasive ecology, Pasquinelli's (2017, 321) insistence on reuniting "the civilizations of Silicon and Carbon, the lineages of Information and Energy" as the "*carbosilicon machine*," requires additional commentary, especially as he maintains that "it may be better to try and consolidate the assemblage of energy and information into new systemic notions." I find his position *toward* new systems intriguing, given the emphasis on "autonomy" as articulated across both of his arguments reviewed here: normative social autonomy as "self-governing and able to invent new laws, rules, and habits. . . . To rethink social autonomy today one has to see what the autonomy of energy and the autonomy of information mean together in an expanded (and technified) notion of labor" (323). This proposition is certainly in line with Guattari's programmatic for collective management and control of the three ecologies, as steered away from profit and productivity. However, I draw this point out in caution because, given the danger of holism, I believe renewed focus on the assumed progressiveness of the system needs qualification.

Resilience proves a particularly thorny concept. As Cooper and Walker (2012, 157) demonstrate, referencing the influence of complex systems theory on social science, it is the complex social system itself that "thrives upon disruptions to its own state of equilibrium. . . . By metabolizing critique into its internal dynamic, the complex adaptive system remains self-referential even when it encounters the most violent of shocks." The risk, here, is that adaptive complex systems are defiant to critique insofar as commentators who employ "the system they set out to challenge" ultimately find their challenge self-referential and systemically enclosed, effectively cannibalized. The target of criticism "reabsorb[s] critique into the workings of systems theory itself" (Cooper and Walker 2012, 157). This is best illustrated by the easy movement of Holling's resilient ecosystem from a position of ecological critique to paradigmatic complicity with neoliberal finance, neoconservative militarization, and environmental governance. Cooper and Walker stress that to confront a system that "transform[s] perturbation

98 into an endogenous feature of the system [a]s a catalyst to further self-differentiation" (157), what is required are "completely different terms" and "a movement of thought that is truly counter-systemic" (157). Guattari's ecological theory—its celebrated utility, inspiration, and prescience—needs to be carefully considered in this cautionary regard, given *The Three Ecologies's* reluctant embrace of cybernetic systems and the immanent critique they afford. Then, at the limit of the problem of resilience is the imperative for flights of thought beyond the system.

As Pasquinelli (2017, 321) reminds us, the "incestuous relation between planetary control and planetary disequilibrium" is a complication located in the abstraction between "civilizations of Silicon and Carbon." His emphasis on historically repairing the separation of energy and information as they bear on contemporary political formations is crucial, and the forms of struggle the implied historical cleavage might call for remain a site for future study. As I have illustrated here, the ecosystem is one such chimeric concept that provides a platform with which to describe and test the appositeness of existing socioecological theories. Insofar as it provides a common ground upon which economy and ecology do play, the ecosystem concept remains a productive term of media in its conceptual relay of energy and information; ecology and economy; and its description of the recursive epistemological lens of the system that nests environment, technology, and mind.

To close, Cooper (2008, 20) argues while regarding the "bioeconomy" that the "capitalist delirium" driving the repeated reinvention of the limits to growth follows from Freud: "the psychotic delirium, as opposed to the neurotic fantasy, is crucially concerned with the breakdown and recreation of whole worlds. Delirium is systemic, not representative. It seeks to refashion the world rather than interpret it." Then, as with Tansley's grafting of psychoanalysis, the ecosystem is perhaps best viewed as one such delirious mechanism recursively derived from an underlining systemic logic: ecosystem as a cognitive machine raising and destroying worlds with the privileged machination of shuffling and sorting the reticulation

of the psyche, environment, and technology between the poles of economic growth and the promise of renewable life. It is equally important to recall that Tansley formed the ecosystem with specific reference to its environmental negativity—a constitutional absence that the concept itself is driven toward. Exploring this forgotten exterior to the ecosystem might prove rewarding as we chart steps outside the ecology of mind.

## Notes

- 1 I would like to express my gratitude to Wendy Hui Kyong Chun, Derek Woods, and Florian Sprenger for their invaluable feedback and vital commentary in responding to drafts of this chapter.
- 2 Donna Haraway highlighted the “ecosystem” as a primary example of the hybrid cybernetic organism, or cyborg, figuration in both “A Cyborg Manifesto” (Haraway 1991) and *Modest\_Witness*: “the cyborg live[s] without innocence in the regime of technobiopower, where literacy is about the joining of informatics, biologics, and economics—about the kinship of the . . . ecosystem” (Haraway 1997, 2).
- 3 For more on the Cold War militarized context driving the Odums’ conceptual development of the cybernetic ecosystem, see Laura Martin’s (2018) “Proving Grounds: Ecological Fieldwork in the Pacific and the Materialization of Ecosystems.”
- 4 Besides Anker’s account, see Sagan (1991), Luke (1995), Bryant (2006), and Steyerl (2017). See also Sagan and Margulis’s (1989) publication *Biospheres: From Earth to Space*, where they make the case for extraterrestrial technoeological biospheres as self-regulating colonies.
- 5 I am grateful to Lukas Rieppel for pointing me toward Bannon’s work on Biosphere 2 and how this ideology contradicts the “no lifeboats” argument.
- 6 Hito Steyerl has initiated a conversation about Bannon’s administration of Biosphere II as “a great metaphor for technofascism” (Steyerl and Vidokle 2017).
- 7 Henning Schmidgen (2005) also sees this distinction as made by Canguilhem in 1952. Schmidgen locates the careful distinction between the mode of existence of organic and technical objects as an early critical response to American cybernetics, and it is worth pointing out that this position on the potential “organology” (Hörl 2015, 4) of institutions and technology deeply influenced another of Canguilhem’s students, Gilbert Simondon, who made a sustained point about the distinct evolutionary patterns of organic and technical individuals.
- 8 For more on this analogy, see also Karen Greenberg’s (2014) perspective.

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