Synthetic Ecologies: Design and the Ecological Imagination

HARVARD UNIVERSITY
Graduate School of Design

THESIS ACCEPTANCE CERTIFICATE

The undersigned, appointed by the Doctor of Design Program, have examined a dissertation entitled

Synthetic Ecologies: Design and the Ecological Imagination

Presented by
Daniel Daou Ornelas

candidate for the Doctor of Design degree and hereby certify that it is worthy of acceptance.

Signature _____

Professor Charles Waldheim

Signature _____

Professor Gareth Doherty

Signature _____

Professor Alex Wall

Date: January 26, 2021

Synthetic Ecologies: Design and the Ecological Imagination

A dissertation presented

by

Daniel Daou Ornelas

MCP, SMArchS

to

Harvard University Graduate School of Design

in partial fulfillment of the requirements

for the degree of

Doctor of Design

Harvard University

Cambridge, Massachusetts

January 2021

ABSTRACT

Daniel Daou Ornelas

Advisory committee: Professor Charles Waldheim, Professor Gareth Doherty, Professor Alex Wall.

Synthetic Ecologies: Design and the Ecological Imagination

The present historical condition has been characterized by the impasse between two seemingly opposing narratives, one of modernization, mastery, and progress (usually associated to economic growth), and another of interdependence, precaution, and balance (usually associated to ecological integrity).

In addressing the relationship between design and ecology, this dissertation's aims are threefold.

First, it problematizes the relationship between design and ecology defined by the apparently self-evident discourse of mainstream environmentalism developed since the seventies around the institutional notion of sustainability. The dissertation reveals how ecology, in its different acceptations (as a scientific field, a synonym for environmentalism, and a particular worldview) played a central role in the processes of de-politicization and re-politicization of design discourse, first as a cultural metaphor in the theoretical writings of the late 1990s and early 2000s, then as the result from the maturation of political ecology accelerated by the Global Financial Crash of 2007-9.

Second, drawing from a comparative literature analysis of representative texts from different bodies of ecological scholarship (environmentalism, techno-managerialism, political ecology, and ecological philosophy), the dissertation probes the limits of different instances of the ecological metaphor and the effect these have on the construction of political narratives.

Third, the dissertation rearticulates the relationship between design and ecology (now understood as an aesthetic as much as a political problem) asserting that the current cultural impasse can be overcome if politico-ecologic problems are restated as design problems.

TABLE OF CONTENTS

Page intentionally left blank.

INTRODUCTION

Summary

This dissertation seeks to problematize and rearticulate the relationship between design and ecology. This relationship has been defined by the supposedly self-evident discourse of mainstream environmentalism which, given its existential urgency, has relegated design to an instrumental role.

The dissertation has three objectives. The first is clarifying the role ecology has played in influencing design discourse. To do so, it tracks the development of ecology as a cultural metaphor specially since 1972—the year that marks the birth of environmentalism's planetary phase and contemporary political ecology—and observes the effects these developments have had in terms of de-politicizing and re-politicizing design discourse.[1] It argues that, in the late 1990s

1. Eric Wolf, "Ownership and Political Ecology," *Anthropological Quarterly* 45, no. 3 (July 1972): 201–5. The celebration in 1972 of the first World Conference for the Human Environment in Stockholm set the first

and early 2000s, ecological design theory used ecology as a cultural metaphor to depoliticize design in a "post-critical" moment. Post-criticality in design reflects a broader "post-political" cultural moment where ecology played a central role as well.[2] Surprisingly, in the wake of the Great Financial Crash of 2007-9 (GFC), thanks to the maturation of the field of political ecology, ecology was still the metaphor through which design was re-politicized.

The second objective is to probe the limits of the ecological metaphor and compare the effects these have on the formulation of different ecological discourses. This is done by means of a comparative literature analysis which draws from four main bodies of ecological scholarship: environmentalism, techno-managerialism, political ecology, and ecological philosophy. The dissertation identifies three distinct "sensibilities" or conceptions of nature: a modern, a postmodern, and one more recent, yet to be named, which seeks to combine the strengths and avoid the weaknesses of the previous two.

---

precedent for international environmental legislation. In that same year, Wolf's essay recovers the term "political ecology" directing renewed attention on the subject.

2. Richard Barbrook and Andy Cameron, "The Californian Ideology," *Mute*, September 1995. Barbrook and Cameron refer to the paradoxical convergence of Silicon Valley cybernetics, free market economic, and counter-culture libertarianism, all revolving around the idea of "Spaceship Earth," as the Californian ideology. Its goal was a form of governance without politics.

Third, once ecology is understood as an aesthetic problem as much as a political one, the dissertation rearticulates the relationship between design and ecology. Instead of being instrumentalized to solve problems defined through given frameworks (e.g. environmentalism, techno-managerialism, political ecology), design can contribute by restating the ecological question under its own synthetic—at once critical and projective—terms.

The dissertation has four chapters. “Chapter 1 Ecology and Design” tracks the evolution of ecology from science to metaphor to political problem and the effects each instance has had on design discourse. “Chapter 2 Zeitgeist” discusses the broader cultural context in which debates around ecology and politics have developed in the period after the GFC. “Chapter 3 The Limits of Ecology” identifies three distinct instances of the ecological metaphor found throughout exemplar cases of ecological scholarship including environmentalism, critical theory, and science fiction. It explores the limits of ecology as defined under different terms (or “horizons”) and reveals the role of metaphors in shaping the construction of political narratives through the naturalization of ideologies. “Chapter 4 Conclusions” brings the dissertation full circle back to the relationship between design and ecology now understood as much as an aesthetic problem as a political one. It argues that for design to avoid being instrumentalized, politico-ecologic

problems need to be restated as design problems. Rearticulating the relationship between design and ecology thusly allows design to play a more relevant and meaningful role vis-à-vis the ecological crisis and fulfill its role as a radical, progressive, and transformative cultural practice.

Methodology

The multiplicity of meanings ecology has acquired has given rise to an all-too-common warning: "Ecology is in danger of becoming a shibboleth applied to everything yet meaning almost nothing."[3] But, "the fact that a concept is generally open for revision does not make it vacuous."[4]

1. Christopher Hight, "Designing Ecologies," in *Projective Ecologies*, ed. Chris Reed and Nina-Marie Lister, (New York: Actar, 2010), 84–105.

4. Samuel B. Harris, "Science Can Answer Moral Questions," (Lecture, TED Conference, Long Beach, California, March 22, 2010.)

From its relatively humble mid-nineteenth century origins as a branch of biology studying the relationship between organisms and the environment, "ecology" has come to acquire other meanings which complicate its use. The crucial inclusion of humans presupposed by human and political ecology results in a hybrid discipline which draws equally from social and natural sciences without resolving the theoretical complications implied by such move. It is customary for ecological literature to draw from fields as diverse as "statistics, systems theory, cybernetics, game theory and prediction theory; thermodynamics, biochemistry, biology, oceanography, mineralogy, meteorology, genetics; physiology, medicine, epidemiology, toxicology; agricultural science, urban studies, demography; technologies of all kinds; theories of society, sociology and economics."[5] Obviously no single person can develop the competencies to deal with it all. Any attempt to reach a synthesis of sorts will face enormous methodological challenges. But this does not preclude the possibility for engaging the field meaningfully.

Instead of the Quixotic aspiration of omni sapience, grand unifying meta-fields, or ambitious programs in the philosophy of science aiming to bridge the ontological and

5. Hans Magnus Enzensberger, "A Critique of Political Ecology," *New Left Review* I/84, March–April 1974, no. 84 (April 1974), 4.

epistemological gaps between the natural and social sciences, a more modest approach is taken here. The dissertation looks at what all these wildly diverse works have in common: namely that, in the strictest sense, they are literature. This point of departure allows a comparative literature analysis of areas that are otherwise theoretically irreconcilable. The basic literary aspect compared here is not plot, character, or narrative strategies, but the metaphor.

To understand ecology as a cultural metaphor, the dissertation borrows from Causal Layered Analysis (CLA), a post-structuralist analysis methodology used in the field of future studies.[6] CLA considers four levels of meaning: the litany, social causation, discourse/worldview, and myth/metaphor. The litany refers to the popular, mainstream, or institutional definitions of concepts or framing of issues. Social causation includes the cultural, politico-economic, and historical factors that shape what ultimately becomes the litany or mainstream discourse. The level of worldview refers to the structures and discourses that legitimize and support deeper assumptions. The level of myth and metaphor goes beyond epistemology (how meaning is

6. Sohail Inayatullah, "Causal Layered Analysis: Poststructuralism as Method," *Futures* 30, no. 8 (1998): 815–29.

acquired) and investigates what is meant by certain concepts (ontology). These are the "deep stories, collective archetypes, and unconscious dimensions" of the matter at hand.[7]

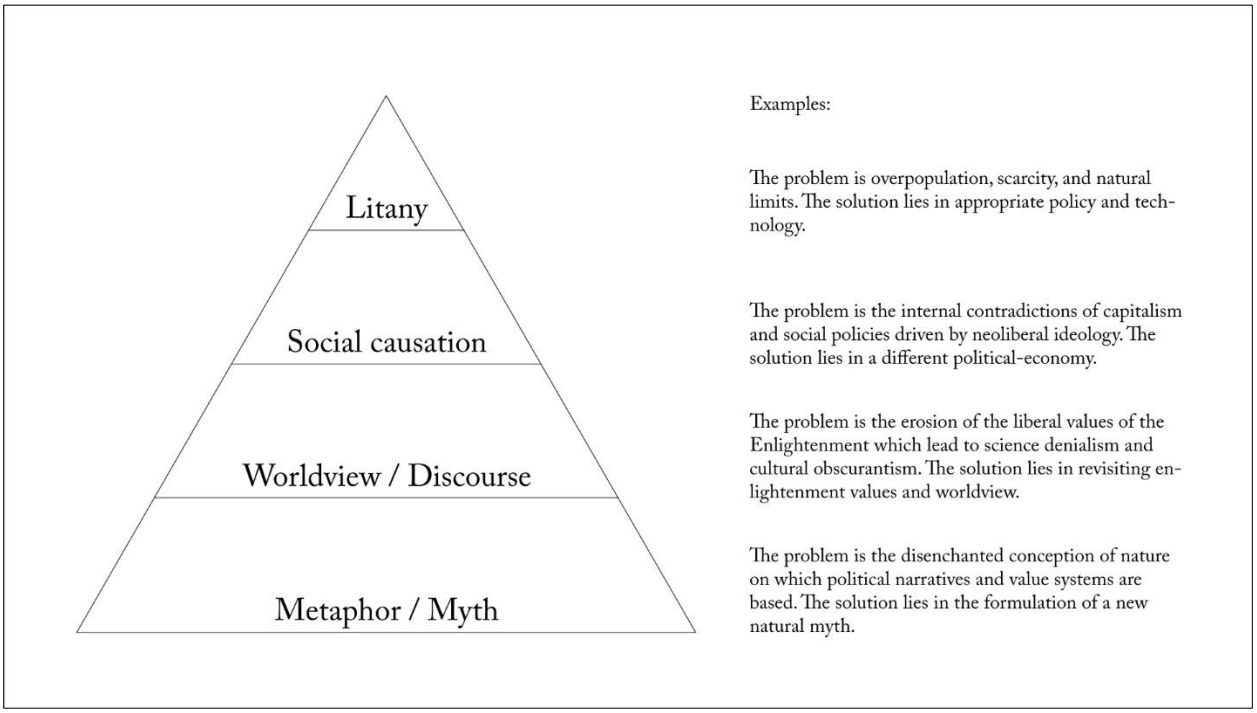


Figure 1. Causal Layered Analysis illustrated with sample arguments from the dissertation's analysis. Depending on the framing, the crisis can be described as environmental, politico-economic, cultural or ontologic.

The dissertation understands ecology as a "cultural metaphor." The seminal work of philosophers George Lakoff and Mark Johnson on conceptual metaphors gave rise to the field of

7. Inayatullah, 820.

metaphor studies within the larger discipline of cognitive linguistics. In the West, metaphors have been treated traditionally as purely linguistic constructions. Lakoff's reappraisal crucially posits them as conceptual constructions central in the development of thought. In their classic *Metaphors We Live By* (1980), Lakoff and Johnson argue that "the way we think, what we experience, and what we do every day is very much a matter of metaphor."[8] In *Moral Politics* (1996), Lakoff further elaborates on the role of metaphors by asserting they are central to understanding the political process.[9]

On a similar vein, urban planner and architectural educator Donald Schön presented the idea of how metaphors are central to the task of setting the frame in which problems are to be made sense of. For him, "the essential difficulties […] have more to do with problem setting than with problem solving, more to do with ways in which we frame the purposes to be achieved than with the selection of optimal means for achieving them."[10] He develops the concept of

---

8. George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: The University of Chicago Press, 1980), 8.

9. George Lakoff, *Moral Politics,* (Chicago: University of Chicago Press, 1996), 24.

10. David A. Schön, "Generative Metaphor," in *Metaphor and Thought*, ed. Andrew Ortony, (Cambridge: Univ. Press, 1998), 122.

"generative metaphors" to understand the process defined by the selection of certain metaphors over others. Generative metaphors are responsible for the framing of a problem setting the direction of problem solving. In line with a constructivist epistemological inclination, problems are understood not as being given, but socially constructed. However, there is a tendency for metaphors to remain implicit and therefore unquestioned. For Schön, it is when we remain unaware of the metaphors when they can most powerfully influence the way we perceive a situation.

Not all metaphors are generative though. A generative metaphor can carry frameworks from one field to another allowing to restructure given frames. What sets generative metaphors apart is the actual generation of new perceptions or explanations. They render obvious what is wrong in a problematic situation. For Schön,

> it is not that we ought to think metaphorically about social problems, but that we do already think about them in terms of certain pervasive, tacit generative metaphors; and that we ought to become critically aware of these generative metaphors, to increase the rigor and precision of our analysis by examining the analogies and "disanalogies" between the familiar descriptions... and the actual problematic situations that confront us.[11]

11. David Shön, 128.

Building on the work of Lakoff and Johnson, organizational manager Martin Gannon has further elaborated on the concept of the "cultural metaphor." For him, such metaphors are more complex as they are the manifestations of values and worldviews shared by large group of individuals. Concepts like "nature" and "ecology" can be considered cultural metaphors as they play central roles in much of the literature surveyed, particularly political ecology and ecological philosophy. Approaching these concepts as generative or cultural metaphors allows for a deeper and more complete understanding of their effects on political action and discourse including design sensibilities. However, the hope is that an improved understanding will not only make designers more aware of the culturally embedded ideologies of nature, but also better position them to participate in their reshaping.

Literature

In a passage titled "The Discourses of Nature" geographer David Harvey summarizes the broad spectrum of positions found in ecological and environmental literature:

> the environmental and ecological movements are full of competing and cacophonous claims as to the possible future of the human species on planet earth. […] Ecocentrism against naked anthropocentrism. Individualism clashes with collectivism. Cultural, historical, and geographical grounded accounts sit at odds with the universal claims often advanced by the 'natural' sciences. There's a litany of enemies: enlightenment, reason, modernity, materialism, technology, multinationals, the world bank, patriarchy, capitalism, free markets, private property, consumerism, state power, bureaucracy, the military industrial complex, ignorance, indifference, arrogance, shortsightedness, greed… And then there is the added complexities of ontology and epistemology in the debates around these issues. […] To speak of consensus is plainly impossible in such a situation. Yet some common language or form of translation is required if any form of conversation about alternatives is to take place.[12]

Like many others, Harvey identifies a key problem in engaging the literature around ecology: the lack of a "common language." Ecology's fecundity (or promiscuity) has led to a

12. David Harvey, *Spaces of Hope,* (Berkeley: University of California Press, 2000), 84.

proliferation of fields, from industrial ecology to ecological engineering, from systems ecology to human ecology, and from political ecology to ecological urbanism, urban ecology, and urban political ecology. Observers have given this condition different names: prismatic ecology, the ecological turn, ecological encyclopedism or a thousand ecologies [see APPENDIX 1].[13] To make sense of this variegated landscape, the dissertation eschews a taxonomy based on fields or knowledge areas in favor of a historiographic approach based on cultural paradigms. These three paradigms are modernism, postmodernism, and a newer "sensibility" that seeks to recover the best of both. Some refer to it as a planetary turn, some as metamodernism, some as cosmodernism.[14] This dissertation adopts the later term as discussed in Chapter 3.

13. Erich Hörl, "A Thousand Ecologies," in *The Whole Earth: California and the Disappearance of the Outside*, ed. Anselm Franke and Diedrich Diederichsen (Berlin: Sternberg Press, 2013); Jeffrey Jerome Cohen, *Prismatic Ecology: Ecotheory beyond Green*, 2013.

14. Robin van den Akker and Timotheus Vermeulen, "Notes on Metamodernism," *Journal of Aesthetics and Culture* 2 (2010): 1–14; Basarab Nicolescu, *From Modernity to Cosmodernity: Science, Culture, and Spirituality* (Albany: SUNY Press, 2015); Christian Moraru, *Cosmodernism: American Narrative, Late Globalization, and the New Cultural Imaginary* (Ann Arbor: The University of Michigan Press, 2011); Christian Moraru and Amy J. Elias, *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century* (Evanston, Illinois: Northwestern University Press, 2015).

Regardless of the nomenclature, what all formulations of the most recent paradigm have in common is a dissatisfaction with certain (mostly self-imposed) limitations of postmodernism. Some of these shortcomings are: a fixation with localism, a rejection of technology, an indiscriminate use of suspicion as a method for critique, the impossibility of consensus or a common language, the negation of grand narratives, and the wholesale rejection of universalism which leads not to perspectivism but to moral relativism. In contrast, a new sensibility should be, at least, comfortable with abstract, global politics, technologically literate, and rehabilitate new forms of universalism and along with the category of totality.

This approach yields the following bodies of literature: environmentalism, techno-managerialism, political ecology, ecological philosophy, and ecological design theory.

Environmentalism and techno-managerialism are two sides of the same coin. The former favors ecological integrity and is generally pessimistic about economic development; the later favors technological and policy fixes and is optimistic about the prospects of balancing economic growth and ecological change. Political ecology is a heterogeneous field with two main currents

which sometimes overlap.[15] The earlier is a structuralist approach based on a Marxist framework. The more recent is a post-structuralist approach based on postmodern critique. Additionally, after the GFC, a newer crop of scholars seeks to overcome the limitations of postmodern critique while retaining its insights and analytical sharpness. Ecological philosophy overlaps with post-structuralist political ecology but is generally less concerned with politics and more with epistemological and ontological matters concerning ecology.

An exhaustive revision of each body of literature would be not only practically impossible, but unnecessary. Works in each category exist within ranges defined by certain epistemological orientations and ideological positions. Once these become clear, it is easy to infer the general contours of different works within each field. Therefore, the comparative literature analysis is based on exemplar cases from each category.

Environmental literature includes early modern works from the sixties and seventies as well as more recent works. The perceived sense of urgency regarding the environmental crisis foments a sense of gloom and doom often misdirected (pejoratively referred to as "collapse-

15. Darcy Tetreault, "Three Forms of Political Ecology," *Ethics & the Environment* 22, no. 2 (2017): 1–23.

porn").[16] Most of this so-called "doomsterism" is based on neo-Malthusian ideas of over population and resource scarcity. In general, works in this field lack nuanced socio-political analysis. The villains are individuals (overpopulation) or human attributes (consumerism, ignorance, indifference, short-sightedness, greed), but rarely the structural mechanisms behind capitalist political-economy or neoliberal ideology.

Techno-managerial literature proposes solutions to environmental problems based on technology and policy. Works here share a common a mechanist or "cybernetic" worldview. Good examples of this worldview are works on "systems ecology" and "systems dynamics."[17] The former was an approach toward ecological science developed by ecologist Howard Odum heavily influenced by cybernetics, systems theory, and engineering. The latter is a methodology to understanding non-linear behaviors in complex systems developed in the fifties by engineer Jay

16. Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015).

17. Howard T. Odum, *Systems Ecology*, (New York: Wiley, 1983); Jay Wright Forrester, *System Dynamics*. (New York: Elsevier, 1980). Twentieth century cybernetics began as an interdisciplinary field drawing from control systems, electrical network theory, mechanical engineering, logic, evolutionary biology, and neuroscience. Through the work of figures such as ecologist Howard Odum and engineer Jay Forrester, ecology borrowed the methodologies and frameworks from cybernetics, engineering, and systems theory.

Forrester. This cybernetic approach pervades most recent discussions around notions of natural limits. In fact, Forrester was directly involved with the most important book in this category: the all-time best-selling *The Limits to Growth* (1972) published by Dennis and Donella Meadows and Jørgen Randers working at the Massachusetts Institute of Technology under his supervision.[18] The pioneering use of computer models to examine multiple future scenarios lent their publication unprecedented authority deeply influencing environmental discourse at an institutional level.

Like neo-Malthusian literature, techno-managerialism also has an elementary grasp of deeper, structural politico-economic considerations. However, this group does not necessarily share the same pessimistic outlook, the intrinsically anti-humanist ethos, or the Malthusian worldview defined by scarcity and austerity. In fact, if environmentalist literature tends to doomsterism, techno-managerial literature tends to boosterism (sometimes also referred to as "Prometheanism").[19] A good example of this is economist Julian Simon's *The Ultimate Resource*

18. Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972).

19. Barry Commoner, *The Closing Circle*, (New York: Alfred A. Knopf, 1971); Ernst F. Schumacher, *Small Is Beautiful*, (New York: Harper & Row, 1973); Frank J. Tipler, *The Physics of Immortality*, (London: Pan Books,

(1981).[20] Simon argued that a larger population is not necessarily a liability, but, on the contrary, represents a potential boon for scientific progress given the added number of available individuals to apply themselves to any given problem. Famously, Simon made a bet against Ehrlich regarding the future price of ten commodities Julian let Ehrlich handpick.[21] Ehrlich predicted prices would rise due to scarcity, while Simon predicted they would fall thanks to technological innovation and efficiency improvements. Simon's ideas gained notoriety when, against environmental common sense, his predictions panned out and made him the winner of the bet.[22]

Political ecology places greater emphasis in understanding of the social-constructedness of environmental issues. No position is apolitical. For instance, neo-Malthusians and luddites

---

1996); Freeman Dyson, "Time without End: Physics and Biology in an Open Universe," in *Reviews of Modern Physics* 51, no. 3 (July 1979): 447–60; Fuller, Richard B. Fuller, *Operating Manual for Spaceship Earth* (Carbondale: Southern Illinois University Press, 1969). The spectrum of technological optimism in this literature goes from the incremental pragmatists like ecologist Commoner and economist Schumacher to post-scarcity cornucopians like physicists Dyson, Tipler or even designers like Fuller.

20. See: Julian Lincoln Simon, *The Ultimate Resource,* (Princeton: Princeton University Press, 1981).

21. See: Paul Sabin, *The Bet*, (New Haven: Yale University Press, 2014).

22. It has been noted that, had the bet taken place on a different 10-year period, Simon would not have won.

can be associated with paleo-conservatism; techno-managerialism with green capitalism (but also with de-growth anti-capitalists), and neo-Marxism with eco-socialism. The political tends to play a more central role than the ecological in this literature.[23] The field develops in the seventies and eighties with the rise of development geography and cultural ecology at a time when environmental issues started gaining prominence in political agendas worldwide. Political ecology has an almost unavoidable normative character since it develops from the intrinsic belief that there are better, more just, and sustainable ways to organize human and non-human life.

Besides the diversity of intrinsic or explicit political affiliations in environmental positions, the works in political ecology can be differentiated by understanding the evolution of the field. Since its emergence, it has transitioned from a structuralist approach influenced by developments in ecological science in the seventies and eighties to a post-structuralist approach which has shifted the focus toward politics. This results in at least three concurrent strands of epistemological inclinations within political ecology today.[24] The first is a neo-Marxist materialist

23. Peter A. Walker, "Political Ecology: Where Is the Ecology?," *Progress in Human Geography* 29, no. 1 (2005): 73–82.

24. Darcy Tetreault, "Three Forms of Political Ecology," in *Ethics & the Environment* 22, no. 2 (2017): 1–23.

approach which emerges in response to the neo-Malthusian explanations of environmental degradation and seeks to introduce structural and class analysis to environmental concerns.[25] The second is a post-structuralist or postmodern approach focused on discursive deconstruction of prevalent narratives and bringing attention to the social constructedness of the environment and environmental issues. A third "eclectic" approach borrows from both.

The positions illustrated by these three groups are often seen as responses to each other. If technological optimism seeks to counter Malthusianism, political ecology seeks to develop the political and critical aspects missing in these two bodies of work. Demographer Joel Cohen offered a useful analogy to illustrate this in *How Many People Can the Earth Support* (1995).[26] After a thorough overview of the history of responses to the question in the title of his book, Cohen finds they all fall within three positions. To illustrate them, he likens our environmental predicament to a hypothetical dinner party. Experiencing a shortage of food, some guests

25. Early Marxist-informed responses to neo-Malthusian ecological writings in the sixties can be found in the works of North American ecologist Barry Commoner (1972), German writer Hans Magnus Ezensberger (1974), and French social philosopher André Gorz (1975).

26. Joel E. Cohen, *How Many People Can the Earth Support?* (New York: Norton, 1995), 24.

propose to remove a few seats from the table as, clearly, the problem is that there are too many people—this is the neo-Malthusian take. Another group of guests propose putting more food on the table, plenty for everyone—this is the techno-optimist solution. Yet another group suggests a third alternative: teaching everyone better manners—the politico-ecological approach.

Not all metaphors are generative (in Schön's sense), so one should be careful when extrapolating from analogies. The dinner party cannot be upscaled to represent the 10 or 11 billion humans that are expected to inhabit planet Earth at the end of the century. An expanded conceptual arsenal is necessary to address the politico-ecological challenge. Here is where the next body of literature comes in.

Ecological philosophy overlaps with post-structuralist political ecology. However, concrete, local examples illustrating socio-environmental struggles are far less common in these writings. Ecological philosophy focuses more on deeper ontological and epistemological questions regarding what ecology is (as an object of study and as an image of thought) shifting their emphasis away from politics.

Another key trait in this group is a fully postmodern framework characterized by a "hermeneutics of suspicion."[27] In other words, these works aim at deconstructing "grand" or "hegemonic" narratives including, to name some, technological determinism, progress (or "Prometheanism"), "scientism" (a somewhat derogatory term referring to the view that only empirical, positivist science has access to the world as it really is or that natural science can explain all phenomena), and moral universalism. Regarding ecology and the environment, postmodern literature, unlike most works in previous groups, emphasizes the dissolution of discreet natural and cultural categories. Instead, terms such as "networks," "hybrids," or "assemblages" are used to refer to socio-natural instances, in the understanding that they are historically contingent constructs. Within this framework, there is a spectrum of degrees of constructivism that go from an extreme (or Berkeleyan) idealism to common sense realism.[28]

---

27. Christian Moraru and Amy J. Elias. *The Planetary Turn*, (Evanston, Illinois: Northwestern University Press, 2015). Moraru and Elias elaboration hinges on a reaction to the inadequacy of postmodernism to provide the proper framework to understand a new, emergent planetary aesthetic. The "hermeneutics of suspicion" is an important shortcoming of postmodern critique—a *modus operandi* based on skepticism to the point of counterproductivity.

28. David Demeritt, "Science, Social Constructivism, and Nature," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree, (London; New York: Routledge, 1998), 173–93; Roy Bhaskar, *The Possibility of Naturalism:* (Atlantic Highlands, N.J.: Humanities Press, 1979). Demeritt provides a classification

The work of French philosopher Bruno Latour straddles the gap between political ecology and ecological philosophy. Two of his works, *We Have Never Been Modern* (1991) and *Politics of Nature* (1999), have been instrumental in deconstructing hegemonic narratives of science and western society. Further, his work on Actor-Network Theory within Science and Technology Studies (STS) has provided a novel theoretical and methodological approach to understanding the relational ties between human and non-human agents.[29] Besides Latour, other notable examples are philosophers Donna Haraway (1991), Félix Guattari (1989), Isabelle Stengers (2010), and Timothy Morton (2007).[30]

---

scheme based on a spectrum that moves through the following gradient: Common-sense realism, social object constructivism, social institutional constructivism, artefactual constructivism, and Neo-Kantian constructivism. Bhaskar has devoted most of his work since 1979 to the problem of realism proposing "critical realism" as a framework to bridge the incompatibilities between empirical realism (positivism) and transcendental idealism (constructivism).

29. Bruno Latour, *We Have Never Been Modern* (Cambridge, Massachusetts: Harvard University Press, 1993); Bruno Latour, *Politics of Nature* (Harvard University Press, 2009).

30. Félix Guattari, *The Three Ecologies* (London: Athlone Press, 2000); Donna Jeanne Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991); Isabelle Stengers, *Cosmopolitics* (Minneapolis: University of Minnesota Press, 2010); Timothy Morton, *Ecology without Nature: Rethinking Environmental Aesthetics* (Cambridge, Massachusetts: Harvard University Press, 2007).

As the environmental discourse has shifted its attention to global warming, postmodern approaches that challenged the supremacy of positivist science now sit uncomfortably with climate change denialism.[31] As some critics have argued, even the nuance of moderate social constructivism is hard to distinguish in practice from more extreme forms of idealism.[32] Latour himself expressesed his concern regarding his role in the development of a critique of scientific authority vis-a-vis the threat posed by the environmental crisis:

> […] entire Ph.D. programs are still running to make sure that good American kids are learning the hard way that facts are made up, that there is no such thing as natural, unmediated, unbiased access to truth, that we are always prisoners of language, that we always speak from a particular standpoint, and so on, while dangerous extremists are using the very same argument of social construction to destroy hard-won evidence that could save our lives. Was I wrong to participate in the invention of this field known as science studies?[33]

---

31. Murray Bookchin, *Re-Enchanting Humanity: A Defense of the Human Spirit Against Antihumanism, Misanthropy, Mysticism, and Primitivism*, 1st ed. (New York: Cassell, 1995). Bookchin's book is one of the earliest recognitions of the dangers of using a postmodern framework to address the ecological crisis.

32. Andreas Mälm, *The Progress of This Storm*, (London; New York: Verso, 2018).

33. Bruno Latour, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225–48.

What was once a framework to question hegemonic forms, including scientism, in a post-colonial moment that sought to bring back into the fold the voices of those historically excluded (women, racial minorities, LGBTQ+, non-human persons, etc.) was ultimately weaponized against environmental activism. In response to the shortcomings of postmodernism analytical frameworks there are new calls for a so-called "climate realism."[34]

Design theory addressing ecology and environmentalism is a heterogenous group. Besides the subject matter, it is difficult to find a common thread. Works in this group reflect the diversity of the whole of ecological literature since design theory has often reacted by "importing" or "transcoding" (to use Jameson's term) positions from other fields. In this sense, ecological design theory tends to instrumentalize design as yet another tool to solve environmental problems. As Vidler observes, the foundation of an ecological imagination from the seventies onward was "suspended and external to mainstream architectural theory and practice."[35]

---

34. Mälm, 12.

35. Anthony Vidler, "What Happened to Ecology? John McHale and the Bucky Fuller Revival," *Architectural Design* 80, no. 6 (2010): 24–33.

Following the publications of Ian McHarg's *Design with Nature* (1969), Rayner Banham's *The Architecture of Four Ecologies* (1971), Crawford S. Holling's seminal "Ecology and Planning" (1971) and Robert Smithson's "The Dialectical Landscape" (1973), there is a dearth of ecological theorization within design since the seventies.[36]

This is not to say design theory has been exclusively reactive. Not all works are a response to external discourse. Works that constitute original contributions from within the field include revisionist accounts that offer new environmental interpretations of previous design projects. Some examples in this vein are architect Luis Fernández-Galiano's *Fire and Memory* (2000), historian Peder Anker's *From Bauhaus to Ecohouse* (2010), architect Lydia Kallipoliti's *The Architecture of Closed Worlds* (2018), architect Eduardo Prieto's *Historia Medioambiental de la*

36. Ian L McHarg, *Design with Nature* (Garden City, N.Y.: Natural History Press, 1969); Reyner Banham, *Los Angeles: The Architecture of Four Ecologies* (New York: Harper & Row, 1971); C. S. Holling and M. A. Goldber, "Ecology and Planning," *Journal of the American Institute of Planning* 37 (1971): 221–30; Robert Smithson, "Frederick Law Olmsted and the Dialectical Landscape," *Artforum*, February 1973, 62–73. There is little in Banham's analysis that is "ecological" in contemporary terms. In postmodern fashion, he uses ecology as a metaphor to refer to the way in which certain infrastructures promote particular spatial growth patterns and how architectural objects can be better understood in terms of their relation to these broader conditions.

Arquitectura (2019), and architect Fred Scharmen's *Space Settlements* (2019).[37] These works hinge on a strictly cybernetic interpretation of ecology which this dissertation seeks to move beyond.

Within design scholarship, besides historical reinterpretations of architectural examples, a notable body of work engaging ecology comes from the field of landscape.[38] Its robust engagement with ecological and environmental matters comes as no surprise and sometimes even predates similar discussions in other fields. [39] For example, as Ábalos argues, the contemporary concern in ecological literature regarding the nature-culture divide has been a central theme within the landscape tradition since its origins in the sixteenth century European picturesque.

---

37. Luis Fernández-Galiano, *Fire and Memory* (Cambridge, Mass.: MIT Press, 2000); Lydia Kallipoliti, *The Architecture of Closed Worlds, or: What Is the Power of Shit?* (Zürich: Lars Müller Publishers, 2018); Peder Anker, *From Bauhaus to Ecohouse: A History of Ecological Design* (Baton Rouge: Louisiana State University Press, 2010); Fred Scharmen, *Space Settlements* (New York: Columbia Books on Architecture and the City, 2019); Eduardo Prieto, *Historia Medioambiental de la Arquitectura* (Madrid: Cátedra, 2019).

38. James Corner, "Ecology and Landscape as Agents of Creativity," in *Projective Ecologies*, ed. Chris Reed and Nina-Marie E. Lister (New York, New York: Actar Publishers, 2014). Corner observes two common responses to environmental problems in landscape architecture we see two responses to the ecological emergency: conservationism and managerialism. Conservationism is moralistic based on ideas of a 'virgin' nature external to man. Managerialism is technocratic and tends to instrumentalize design. Corner denounces this situation and calls for the exploration of creativity and subjectivity.

39. Iñaki Ábalos, *Natural Metaphor: An Anthology of Essays on Architecture and Nature*, trans. José Luis Mateo (Zürich; Barcelona; New York: ETH; Actar-D, 2008).

Here the work of landscape architects, theorist, and historians such as Ann Spirn, Dennis Cossgrove, James Cormer, and Elizabeth Meyer resonate with the postmodern position of nature as social construct—landscape can be interpreted literally as an embodiment of this notion. However, this literature—with the exception of James Corner—does not engage the post-critical debate which is the focal point in the narrative proposed here. In other words, notwithstanding landscape's contributions to ecological design theory, since the dissertation deals with the maturation of political ecology, it focuses on a particular subset of the ecological design literature that was instrumental in shaping design's relationship to politics in the context of environmentalism.

Lastly, there is a sixth group which could be placed within political ecology but merits special attention. Emerging in the period after the GFC and in response to the perceived failures of the political Left, these works mark an important departure within political ecology. This body of literature responds to a deeper shift in sentiment regarding the nature of environmental issues. What all works here have in common is (a) an unequivocal recognition of capitalism as main cause of current day ecological crisis, (b) that the scope of the crisis is planetary and therefore, from a political action perspective, localism is ineffective, and (c) that post-structuralist

analyses or postmodern critiques have not only failed but actually obfuscate the task of formulating a successful counter-ideology of nature.

Works in this group acknowledge the political nature of environmental problems but go a step further by recognizing that the planetary ecological crisis puts the notion of the political itself in crisis. In other words, this is a political ecology where the crisis has to do as much with the very definition of what constitutes the political as with the ecological. Realizing the ineffectiveness of traditional political frameworks and sensibilities, this literature identifies the need to open new spaces of political possibility as a requisite for developing effective ecological positions.

The ensuing rise in awareness regarding the problems with neoliberal ideology that followed the GFC played a seminal role in the emergence of these new crop of works. Even though they come from an eclectic mix of backgrounds, they all recognize the incompatibility between the current politico-economic regime and the planet's biospheric integrity and, most importantly, the ineffectiveness of traditional Left discourse to produce effective change. Since these works identify capitalism as the main problem, they all share a "post-capitalist" sensibility.

Notable examples would be journalist Paul Mason's *Postcapitalism* (2015), historian Rutger Bregman's *Utopia for Realists* (2016), *Inventing the Future* (2016) by Left accelerationism theorists Nick Srnicek and Alex Williams, environmental scholar Andreas Mälm's *The Progress of this Storm* (2017), political commentator Aaron Bastiani's *Fully Automated Luxury Communism* (2018), and political journalist Leigh Philip's *Austerity Ecology and the Collapse-porn Addicts* (2015) and *The People's Republic of Walmart* (2019).[40]

Structure

"Chapter 1 Ecology and Design" has four parts. "The Politics of Ecology and Design" problematizes the relationship between design and ecology which is generally taken as given and subordinates design to the "ecological imperatives" of environmental agendas. "Ecology: From Science to Metaphor" elaborates on the evolution of the concept of ecology and the ways in

40. Paul Mason, *Postcapitalism* (London: Penguin Books, 2016); Rutger Bregman, *Utopia for Realists* (London: Bloomsbury, 2018); Aaron Bastani, *Fully Automated Luxury Communism,* (New York: Verso, 2020); Nick Srnicek and Alex Williams, *Inventing the Future: Postcapitalism and a World without Work* (London: Verso, 2016); Leigh Phillips and Michal Rozworski, *People's Republic of Walmart: How the World's Biggest Corporations Are Laying the Foundation for Socialism* (New York: Verso, 2019); Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015).

which different acceptations inform design discourse. “Design Ecologies and the Post-political” analyzes how ecology (as a metaphor) helped depoliticize design discourse during the turn of the millennium. “Design Ecologies against the Post-political” continues the previous analysis arguing that the re-politization of design discourse following the GFC was still driven by ecology thanks to the maturing of political ecology.

“Chapter 2 Zeitgeist” places ecological debates within a broader cultural context. “An Uncommon Sense of Urgency” states this dissertation’s position with regards to climate change and the broader ecological crisis. It warns against more insidious and subtle forms of denialism which lead to “placebo activism.” In the case of design, placebo solutions (e.g. green roofs and bike paths) do not correspond to the scale and nature of the crisis at hand. “Counter-sustainability” goes a step further arguing that the mainstream environmental debate, framed in terms of sustainability, limits, and scarcity, obfuscates the questions of redistribution, class struggle, and social and environmental justice. “Anti-enlightenment and Postmodernity” argues that the roots of the politico-ecologic crisis run deeper than the structural level of a capitalist economy and a neoliberal ideology and should also be understood as symptomatic of a cultural climate that is best described as anti-enlightened. “Postcapitalism and Design” brings these

questions back to design arguing that if design is to avoid being instrumentalized as a tool of mainstream environmentalism it should participate in the construction of an aesthetic postcapitalist program.

"Chapter 3 The Limits of Ecology" turns to the comparative literature analysis of ecological and environmental scholarship. It places special attention on the way in which metaphors naturalize (e.g. negate the social and historical contingency) of certain ideologies defining the limits of political possibility. "The Metaphor of the Island" probes instances of ecology as closed, isolated entities. "Gaiapolitics" describes the limitations of the resulting political narrative based on resource scarcity and an idealized isolated or "steady state." "The Metaphor of the Ship" explores figures of ecology as a machine—a Spaceship Earth—closed and regulated by internal combustion or open to external cosmic radiation. "Heliopolitics" compares the effects each reading has over the resulting politics of nature from a modernist notion of "energetic determinism" in ecological economic literature to a postmodern notion of "thermosemiosis." "The Metaphor of the Flag" explores the "de-naturalizing" effects on discourse resulting from liberating nature from its earthly horizon in science fiction. "Cosmopolitics" discusses the politics of a technologically mediated re-enchantment of nature.

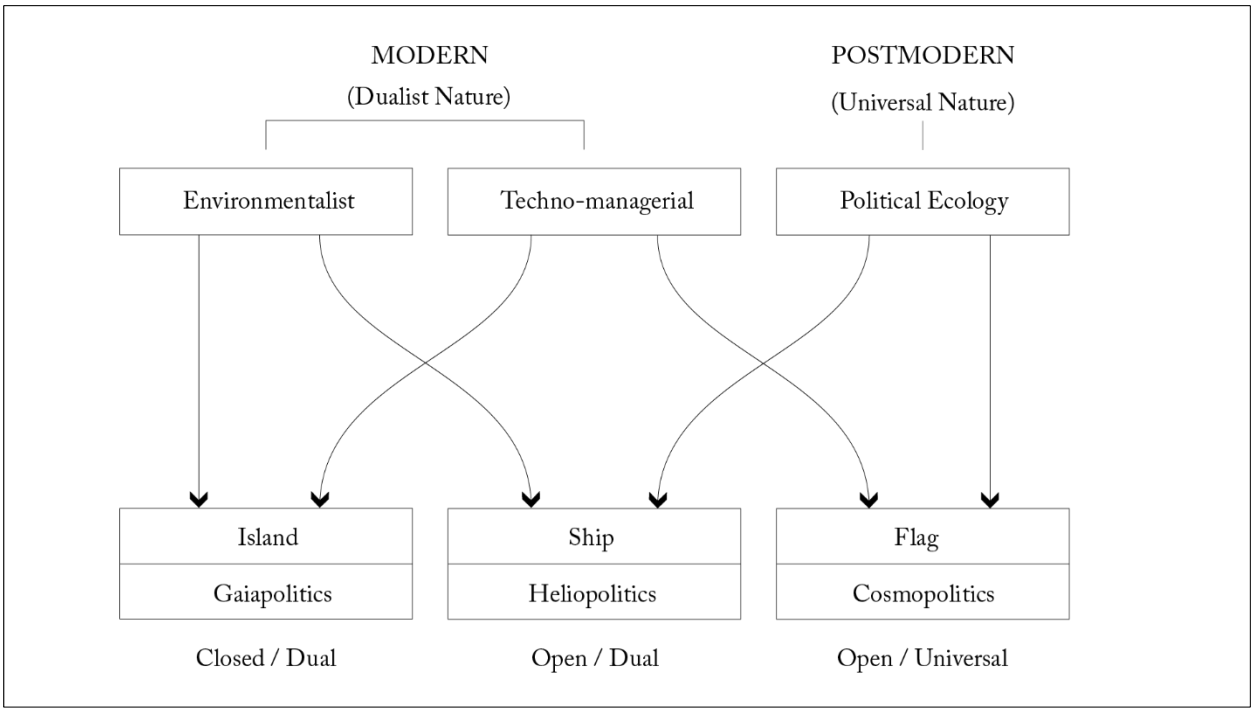


Figure 3. "Chapter 3" structure. The chapter explores different conceptions of nature and their effects on political discourse through a sequence of oppositions.

If political imaginaries are contingent upon our conceptions of nature (and its corollary, human nature), it follows that the necessary expansion of political horizons first requires the reformulation of "an effective counter-ideology of nature." This reformulation is what Smith and others have called the "project of re-enchantment."[41] The need for such a project is underscored

41. Neil Smith, "Nature at the Millennium: Production and Re-Enchantment," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree (London: Routledge, 1998), 271–85; Murray Bookchin, *Re-Enchanting Humanity: A Defense of the Human Spirit Against Antihumanism, Misanthropy, Mysticism, and Primitivism*, 1st ed. (New York: Cassell, 1995); Joshua Landy and Michael T Saler, *The Re-Enchantment of the World: Secular Magic in a Rational Age* (Stanford, Calif.: Stanford University Press, 2009).

by the inability of either modernism or postmodernism to process the practical and theoretical challenges posed by climate change and the planetary ecological crisis. Through a heuristic consisting of a sequence of oppositions, Chapter 3 deducts the necessary traits of a new natural myth.

Chapter 4 brings the dissertation back to the relationship between design and ecology. It presents the conclusions as three syntheses: aesthetics and politics, politics and ecology, and ecology (now expanded to include aesthetics and politics) and design. The aim is to define the conditions and goals for a re-orientation of design practice.

The first synthesis argues that the Left lacks a radical and progressive aesthetic project, and that, given the dialectic between space and political economy, the project for any postcapitalist political economy is by necessity also a spatial and aesthetic (i.e. design) problem. Yet, little is being done in this area.

The second synthesis argues that, if most of the literature in political ecology has been characterized by the politicization of ecology, it is appropriate now to ecologize politics. Here, it is important to distinguish between the cybernetic ecology that sought to take over politics in the

nineties and the more recent ecology understood as a relational (non-dualistic) and re-enchanted image of nature. Ecologizing politics in this manner has two effects. The first, as observed by Latour, acts over the politics of the real and entails the expansion of the sphere of the political to include non-human and extra-human agents.[42] The second acts over the politics of the possible by considering three correspondences between ecology and politics. An ecology cornucopian in (material) scale, cosmic in vision, and re-enchanted in attitude requires a politics futural in (temporal) scale, total in vision, and re-enlightened in attitude. These sets of concepts constitute an emergent manifesto for a "cosmodern" political ecology.

The previous two syntheses are preconditions for the third and final synthesis—design and ecology—which aims to re-define ecological design. For design to avoid being, at best, instrumentalized by or, at worst, complicit with the system responsible for the current crisis, politico-ecologic problems need to be understood as design problems. Only then can design

42. Bruno Latour, *Down to Earth: Politics in the New Climatic Regime*, 1st ed. (Cambridge, UK: Polity Press, 2018), 52.

become "a means to think about, and contribute to, the transition from the hegemony of modernity's one-world ontology" into the next historical chapter.[43]

Synthetic Ecology

A brief historical survey shows that the term "synthetic ecology" first appears in the 1912 Botanical Gazette in a review of Coulter, Barnes, and Cowles' *A Textbook of Botany.*[44] Here, the term is used in opposition to analytical ecology. If analytical ecology focuses on the study of parts that compose a system, synthetic ecology focuses on the emerging "associations, formations, and societies." This is the same use American ecologist Frederic Clements gives the term in his reports appearing on the Carnegie Institution of Washington Yearbook in 1917 and 1918 and in the Bulletin of the Geological Society of America also in 1918. In this later piece, writing on

43. Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (London: Duke University Press, 2018), 17.

44. *Botanical Gazette* volume 54 ,1912; Coulter, Barnes, and Cowles' *A Textbook of Botany.* Vol. II Ecology. New York: American Book Co., 1912.

paleoecology, he argues that the field ought to be primarily synthetic since it must deal with "processes, their development and correlation." His stressing of the differences between analytic and synthetic modes are representative of the shifting approach towards the study of environments from a collection of "detached parts" to a "unit complex." This is precisely what characterized the holistic turn in ecology promoted by Clements since 1916.

The term does not seem to be mentioned again until 1969 in the Transactions of the Thirty-fourth North American Wildlife and Natural Resources Conference where it is referenced once explicitly to mean a "designed" ecology that should accommodate human activity.

In the literature of the eighties, synthetic ecology is used with two different meanings. One is associated with the Biosphere-2 project—a multi-acre enclosed facility in the Arizona dessert to study closed ecologies—planned and built between 1987 and 1991. Here, the term is meant to refer to artificial, man-made, deliberately assembled, and enclosed ecologies. The second meaning is as a synonym of restoration ecology. The earliest appearance of this use is in

John Cairns Jr.'s 1989 *Rehabilitating Damaged Ecosystems* where the terms "synthetic ecology" and "restoration ecology" are used interchangeably.

In the mid-nineties, founding editor of Wired magazine and technologist Kevin Kelly, introduced the term in popular culture in his book *Out of Control: The New Biology of Machines, Social Systems, and the Economic World* (1994). There it was used to reference the work of scientists Walter Adey, Anthony Burgess, and Peter Warshall, designers of the biomes within Biosphere-2.[45] However, notably, the term is also used to refer to the state of California as a whole. "'Bio2 is a synthetic ecosystem, but so is California by now," said Burgess. Warshall agrees: "What you see in California is a symbol of the future. A heavily *synthetic ecology*. It has hundreds of exotic species. A lot of Australia is going this way too. And the redwood/eucalyptus forest is also a new s*ynthetic ecology*.'"[46]

This acceptation of synthetic ecology is the same that was adopted in systems ecology to refer, in the work of ecologists like Howard Beyers and Howard Odum, to micro and

45. In his 2004 book *Ecological Engineering,* environmental engineer Patrick Kangas attributes this use of the term to geologist Walter Adey in 1995.

46. Kevin Kelly, *Out of Control: The New Biology of Machines, Social Systems, and the Economic World.* (Reading, Mass.: Perseus Books, 1994), 130.

mesocosmos—miniaturized closed system ecologies which were the object of research of so-called "capsule ecologies," first during the cold war for nuclear submarines, and then, during the space race for deep space exploration.[47] It is in this space-age sense in which the term has penetrated the collective imagination the deepest: the controlled ecologies of space colonies and planetary engineering iconically illustrated by artist Don Davis for the NASA Ames Space Center.[48]

In the 2000s with the development of synthetic biology—an interdisciplinary branch of biology and engineering developed at MIT—synthetic ecology has been adopted by engineers to refer to bacterial colonies assembled in labs to produce useful chemicals, particularly biofuels.[49] This approach presents itself as a less technologically intensive alternative to synthetic biology which requires the manipulation of organisms at the genetic level. There is a modest body of

47. Robert J. Beyers and Howard Thomas Odum. *Ecological Microcosms.* (New York: Springer-Verlag, 1993).

48. Fred Scharmen, *Space Settlements* (New York: Columbia Books on Architecture and the City, 2019); Peder Anker, "Ouroboros Architecture," in *The Routledge Companion to Biology in Art and Architecture*, ed. Charissan N. Terranova and Meredith Tromble, 1st ed. (New York: Routledge, 2017), 112–35.

49. Sophia Roosth, *Synthetic: How Life Got Made* (Chicago and London: University of Chicago Press, 2017).

literature, comprised mostly of loose scientific papers, employing the term in this very narrow sense.

Since Marc Antoine Laugier's account of the primitive hut, designed spaces have stood in relation to nature—either through contrast, mimicry, or complement. As such, ponderations regarding the place of design in the world are ineluctably ponderations about the relationship of the manmade and the natural and the place of humans in the universe. Therefore, if yet another term to refer to the relationship between the natural and the manmade is to be introduced, it ought to be understood in its historical specificity so as to be distinguished from previous investigations.

The field of design is filled with terms that allude to the crossover between the natural and the manmade such as second, artificial, synthetic, and hyper natures, ecologies, or landscapes. In his introduction to *The Natural Metaphor* (2008), architect Iñaki Ábalos explains how the "contemporary condition" in architecture can be understood by a new environmental sensibility and a growing questioning of the dialectical relationship between nature and artifice

inherited from modernism.[50] But this interest can be extended back at least to the picturesque tradition of the eighteenth century. Examples old and new abound in urbanism from, Angkor Wat and Teotihuacan's cosmic layouts to the early 19th century urban designs by Patrick Geddes and Ebenezer Howard.

Beyond architecture or urbanism, the dialectic between the natural and the manmade is nowhere more explicit and mature than in the field of landscape. Indeed, hybridity is a constitutive trait of the concept of landscape. Landscape historian J. B. Jackson defined landscape as "not a natural feature of the environment, but a *synthetic* space, a manmade system of spaces superimposed on the face of the land, functioning and evolving not according to natural laws but in order to serve a community."[51] In the essay "Frederick Law Olmsted and the Dialectical Landscape" (1972), land artist Robert Smithson envisions landscape as synthesis between the beautiful and the sublime (or the soft and the horrific in the picturesque tradition following eighteenth century landscapers Uvedale Price and William Gilpin).

---

50. Iñaki Abalos, *Natural Metaphor: An Anthology of Essays on Architecture and Nature*, trans. José Luis Mateo (Zürich; Barcelona; New York: ETH; Actar-D, 2008).

51. Jackson, John B. 1986. "The Word Itself" in *Discovering the Vernacular Landscape* (New Haven, Yale University Press), p. 8. Emphasis mine.

Even recent proposals coming from geology and chemistry such as the "Anthropocene"—the recognition of a new geological epoch defined by the impact of human activity on the planet—or the emergence of synthetic biology—a nascent branch of engineering that blurs the line between technology and biology—have only increased the interest in hybrid formulations in the collective imaginary. It is somewhat surprising then that instances of the specific term 'synthetic ecology' did not appear in the context of design debates until the second half of the first decade of the millennium.

In 2007, a panel discussion titled "Synthetic Ecologies" was organized by the architects Matias del Campo and Sandra Manninger at the MAK Center of the Arts in Los Angeles. The panel included architects Hernan Díaz-Alonso, Benjamin Bratton, Marcelyn Gow, Neil Leach, and Jason Payne.[52] The discussion sought to explore how evolutionary systems and emergent behaviors engender new possibilities for architecture. There are no proceedings nor recordings from this event except for a short article titled "Synthetic Ecologies" on the Frieze web portal.[53]

52. http://makcenter.org/programming/synthetic-ecologies/

53. https://frieze.com/article/synthetic-ecologies

According to the article, the panel framed the emergence ecology as a potential new field for the development of design intelligence in the wake of the so-called "post-critical" debate (more on that later).

Architects Philip Beesley and Rachel Armstrong used the term in 2011 to describe the "Hylozoic Ground" installation at the Canadian pavilion at the Venice Biennale.[54] This work of public architecture aimed at offering a model for an evolutionary synthetic ecology. A series of physical units called "protocells" consisting of hanging geo-textile meshes, scaffolding, mechanical valves, sensors, and chemical vials meant to respond to environmental feedbacks through chemical reactions that would ultimately produce a synthetic soil. The structure mimicked the functions of a living system through a rudimentary assembly of valves, tubes, sensors, flasks, membranes, and bladders responding to changes in light, movement, temperature, and humidity. The installation explored the ecological concepts of complexity, adaptiveness, evolution, metabolism, symbiosis, and feedback loops and tried to blur the lines between biology and technology. Instead of imitating natural forms, it sought to recreate

54. Philip Bessley and Rachel Armstrong. "Soil and Protoplasm: The Hylozoic Ground Project." Architectural Design 81 (2): 78–89.

biological processes which resulted in novel formations that otherwise would not occur spontaneously in nature.

In a 2014 essay titled, "Architecture and Synthetic Ecologies," Armstrong argued ecology had become the operational metaphor in systems theory. The result is an understanding of ecology (i.e. nature) in the image of cybernetics and systems theory. In other words, nature not as pastoral images of pristine landscapes or metaphysical notions of order and balance, but as virtual, non-linear, adaptive, recursive, and evolutionary series of processes actualized in matter. This conception of nature makes no distinction between biological and technological material systems. Later, in her 2015 book *Vibrant Architecture*, Armstrong defines synthetic ecology as "the rational design and engineering of environmental networks that can be thought as the system version of synthetic biology."[55]

In a 2012 essay titled "Synthetic Ecology: Recomputing Nature," architects Alisa Andrasek and Jose Cadilhe argue for a retooling of architecture given the enormous

55. Armstrong, Rachel. 2015. Vibrant Architecture: Matter as a CoDesigner of Living Structures. Walter de Gruyter GmbH & Co KG. p. 35. See also: Armstrong, Rachel. 2014. "Architecture and Synthetic Ecologies." Conditions 23.

environmental pressures of climate change.[56] Following architecture theorist David Gissen, they suggest that beyond efficiency certifications and the internal control systems of architecture be it vernacular, green, or high-tech, there is an opportunity to rethink buildings themselves as producers of nature.[57]

In Andrasek's formulation, synthetic ecology stands for designed ecologies that merge natural and artificial elements. Through her work at Biothing and at the Design Research Laboratory at the Architectural Association School of Architecture in London, Andrasek has pursued design speculations engaged with notions of synthetic or designed ecologies. This translates into speculative design work aided by computational algorithms which intend to replicate biological processes (i.e. complex, non-linear, recursive, adaptive, evolutionary) and informed by material science research that allow control at the microscopic scale.

Landscape architect Bradley Cantrell has also pursued synthetic ecology as a consistent research program since 2012 in numerous projects, lectures, and taught courses. In his

---

56. Andrasek, Alisa, and Jose Cadilhe. 2012. "Synthetic Ecology: Recomputing Nature." In *Tarp Architecture Manual*, 45–50. New York: Pratt Institute.

57. David Gissen, "Nature's Historical Crises," *Journal of Architectural Education* 69, no. 1 (March 6, 2015): 5–7.

formulation, synthetic ecologies blur the lines between biology and technology and analog and digital realms. He operates at the scale of landscape deploying responsive systems to improve management regimes. His 2017 book *Responsive Landscapes*, edited along with architect Justine Holzman, compiles a series of examples of landscape architecture projects that attempt to augment the biophysical environment through the deployment of responsive technologies enabled through drones and robotics, remote sensing, actuators, big data powered computer simulations and even artificial intelligence.[58]

In 2013, the 101st ACSA National Conference celebrated at the California College of the Arts under the title "New Constellations, New Ecologies," featured a session dedicated to "artificial ecologies" presided by Marcelyn Gow. Individual contributions by architects Nicole Koltick and Bradley Cantrell referenced the term "synthetic ecology."[59] Gow, principal of Servo in Los Angeles, has included synthetic ecologies as part of her office's research interests at least

58. Cantrell, Bradley, and Justine Holzman, eds. 2017. Responsive Landscapes: Strategies for Responsive Technologies in Landscape Architecture. Routledge; Cantrell, Bradley, Laura J. Martin, and Erle C. Ellis. 2017. "Designing Autonomy: Opportunities for New Wildness in the Anthropocene." *Trends in Ecology & Evolution* 32 (3): 156–66.

59. Berman, Ila, and Edward Mitchell, eds. 2013. *New Constellations, New Ecologies: Proceedings of the 101st Annual Meeting of the Association of Collegiate Schools of Architecture (ACSA)*. Washington, D.C.: ACSA Press.

since 2012 when she taught a studio at the Southern California Institute of Architecture (SCIArc) named "The Imbalancing Act of Entropic Architecture."[60] The studio sought to develop new understandings about the relationship between architecture, technology, and materiality so as to produce novel natures understood as synthetic systems. In 2012, she was the recipient of a grant from the Graham Foundation for her *Aqueotrope* installation at SCIArc as an illustration on her take on synthetic ecologies. In her participation as chair of the Energy Circuits and Artificial Ecologies session at the ACSA National Conference titled *Synthetic Ecologies*, she invoked architect Kisho Kurokawa's understanding of architecture in metabolic and entropic terms in his 1969 *Capsule Declaration.* She suggested that, moving along similar lines, new technological advances in material and computational sciences were resulting in a paradigm shift in architecture's approach to matter from an attitude of control to one of complicity.

Koltick, as director of the Design Futures Lab at Drexel University, Pennsylvania, has explored synthetic ecologies and material agency with a multidisciplinary approach that focuses less on real life applications than on material and aesthetic speculations informed as much by

60. http://www.suckerpunchdaily.com/2014/04/07/the-imbalancing-act-of-entropic-architecture-2/

science, design, and engineering as by philosophy and the arts. Her formulation of synthetic ecology refers to the transformative potential fields such as artificial intelligence, synthetic biology, neuroscience, robotics, materials science, and biomedical engineering have for design. Her paper, titled "Tomorrow's Ecologies: A Synthetic Approach" warns against the hubris of modernist Prometheanism and its aspirations of total control. She proposes a "speculative realist" philosophical attitude to navigate the fuzzy landscape left behind after the dissolution of the discreet categories of nature and culture.

In addition to these, there are several minor other instances in which the term synthetic ecology appears in recent design literature including a number of student theses at schools where the teaching faculty pursues the subject such as the Architectural Association in London, SCIArc in Los Angeles, and Pratt Institute in New York. Mentions in recent literature include architect Evan Douglis's contribution to the 2013 volume *Architecture In Formation,* architect

Lydia Kallipoliti's essay "Return to Earth" appearing in Cornell's Journal of Architecture in 2011 as well as casual mentions in Benjamin Bratton's many lectures.[61]

Different meanings of the term can be surmised from these appearances. In the case of Cantrell, the image conjured by synthetic ecology is that of a cybernetic landscape reminiscent of poet Richard Braughtigan's 1967 "All Watched Over by Machines of Loving Grace."[62]

---

61. Evan Douglis "Ten Exaltations for an Excitable Planet." In *Architecture in Formation on the Nature of Information in Digital Architecture*, edited by Pablo Lorenzo-Eiroa and Aaron Sprecher, (London: Routledge, 2003), 77–84.

62. Richard Brautigan, *All Watched Over by Machines of Loving Grace.* (San Francisco: Communication Company, 1967).

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now, please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computers
as if they were flowers
with spinning blossoms.

Indeed, the introduction to his book *Responsive Landscapes* is a direct allusion to the imaginary conjured by Braugtigan with an essay titled "Towards a Robotic Ecology." This territorial scale vignette of a technologically augmented landscape might be the most literal interpretation of the term and relies on stereotypical notions of what constitutes technology and what constitutes nature.

Armstrong formulates synthetic ecology as a corollary to synthetic biology: it is the result of placing engineered biological components into an environment as is the case with her Venice lagoon project. Meanwhile, for Andrasek, the understanding of the term is more metaphorical where 'synthetic' stands for 'digital' and 'ecology' for a system consisting of interrelated parts

---

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

displaying biological behaviors such as adaptiveness thanks to generative and recursive computer algorithms in a sort of biomimicry of process more than form. Lastly, in the case of designers such as Koltick, Beesley, or Gow, synthetic ecology shares less of the problem-solving preoccupation typical of engineering and more of the speculative or exploratory approach of art in the form of installations that emphasize materiality and relationality.

This brief account of the appearances of synthetic ecology reveals different readings associated with the different acceptations of each term. "Ecology" is meant in the scientific sense and in the metaphoric sense and sometimes both.[63] "Synthetic" is meant as a methodological opposition to the analytic, as the third movement in a dialectical process between thesis and antithesis, and as a categorial synonym for the artificial. Additionally, the history of the term reveals associations with different fields: restoration ecology, environmental engineering, design, and the philosophy of science.

As for design, regardless of the forms different instances of synthetic ecology suggest (augmented landscapes, generative algorithms, or responsive art installations), all share the same

63. In a conversation with professor and McArthur grantee Marc Shell, upon making this distinction to him, he responded: "Isn't science a metaphor?"

acceptation for the terms synthetic, as a synonym of manmade, artificial, or designed, and ecology, as a synonym for nature or (eco)systems.

This dissertation claims and expands the term giving it a "strong" formulation consisting of three simultaneous definitions. The first refers to a synthesis of ecological scholarship achieved through the comparative analysis of the particular effects to which ecology is deployed in different bodies of literature ranging from environmentalism to critical theory to science fiction. This definition results in a richer and more nuanced definition of ecology as a cultural metaphor. The second definition refers to the theory and praxis of world-building in the broadest sense. This definition helps recover a notion of design as simultaneously critical and projective field. These two synthetic ecologies, plural, but not fragmented, allow to reframe the question of the relationship between ecology and design as a dialectic that redefines each in term in the process of searching for an answer.

Page left intentionally blank.

CHAPTER 1: ECOLOGY AND DESIGN

The Politics of Design and Ecology

In the last twenty years, ecology has exerted an important influence on architecture from at least on two fronts. First, as synonym of environmentalism, the "ecological imperative" has called for architecture to seek strategies that align with the putative principles of ecology as a science.[1] On the other, ecology has played the role of a broad-spectrum "cultural metaphor" to introduce concepts from the new paradigm of complexity science, systems theory, and cybernetics into the social and political arenas. Notions such as resilience, adaptability, indeterminacy, interconnectedness, and flows have permeated design theory and practice promoting discourses that privilege process over object, strategy over composition, and adaptability over permanence and legibility. Though the adoption of ecology in both its

1. Even when more than a unified science, ecology is better described as a meta-field.

acceptations has had problematic consequences for architectural agency and discourse, ecology remains a powerful metaphor to describe the zeitgeist and frame the challenge of our times.

To understand the relationship between architecture and ecology, it is necessary to provide some historical context due to the different meanings "ecology" has acquired since it was coined by the German biologist Ernst Haeckel in 1866.

The Kyoto protocol—the first international treaty that sought to curb greenhouse gas emissions (GHG)—was signed in 1997 almost a hundred years after the first paper by German chemist Svante Arrhenius recognized the effects of CO_2 in the atmosphere.[2] In 2017, the United States announced it would withdraw the Paris agreement—a GHG emissions treaty that sought to keep the increase of global temperature below two degrees Celsius. According to the National Oceanic and Atmospheric Administration, nineteen out of the top twenty warmest years have

2. Svante Arrhenius, "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground," *Philosophical Magazine and Journal of Science*, 5, 41 (April 1896): 237–76.

occurred since 2000. In the words of philosopher Timothy Morton, witnessing the environmental crisis is "like witnessing the detonation of a nuclear bomb in slow motion."[3]

At the same time, the design profession was undergoing an existential crisis in the mid-nineties. Neoliberal state policies in the eighties reduced dramatically architecture's public role affecting its cultural relevance a decade later. Worried, academics and professionals alike debated whether the attitude of resistance held by critical theory should yield to a pragmatism aligned with the reality of the market.[4] Inspired by the new paradigms of systems theory, cybernetics, and ecology, some proposed flexible practices that imitated "life itself" just like the market did.[5] This is what came to be known as the "post-critical" period.

---

3. Timothy Morton, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: University of Minnesota Press, 2013).

4. Rem Koolhaas, "Whatever Happened to Urbanism?," in *S, M, L, XL*, ed. Bruce Mau and Jennifer Sigler (Rotterdam: 010 Publ., 1995); Michael Speaks, "Design Intelligence: Or Thinking After the End of Metaphysics," in *Versioning: Evolutionary Techniques in Architecture*, ed. Sharples Holden Pasquarelli SHOP (Chichester: Wiley-Academy, 2002).

5. James Corner, "Not Unlike Life Itself," in *The Landscape Imagination: Collected Essays of James Corner, 1990-2010*, ed. Alison Bick Hirsch (New York, New York: Princeton Architectural Press, 2014). A crucial text where Corner makes three problematic assumptions when referring to the relationship between architecture and design. All fall within the bounds of what is known as the appeal to nature logical fallacy. First, he equates

The new strategy seemed to bear fruits. The period from 1997 to 2007 marked one of the most prolific moments in architectural history. However, the Global Financial Crisis (GFC) of 2007-9, triggered by real estate speculation no less, bought this period to an end. Architecture was back into soul searching mode.

Meanwhile, the ecological crisis had only aggravated. The GFC and the sentiment of repudiation toward neoliberalism it awakened lead to a new wave of politico-economic critiques including literature in the rapidly developing field of political ecology. As design searched for a new social role, it latched onto ecology once more. But if ecology in the nineties had the effect of depoliticizing design discourse, now it had the opposite effect.

This brief historical recount serves to illustrate three modalities of the relationship between ecology and design—what we call the Politics of Design and Ecology. First of these is

---

ecology—as described by the processes of adaptation, flexibility, and auto-organization, among others—to "life itself" (whatever this may be). Second, he equates the logic of the markets to ecology as if the laws of the markets were as inexorable as the laws of nature. The last instance of Corner's appeal to nature is when he suggests design practice ought to imitate nature—again, understood as flexibility, adaptation, and so on—if it is to succeed (in the market). The appeal to nature fallacy occurs when something is deemed good because it is assumed "natural." An example of the quandaries of such thinking is political theorist Herbert Spencer's notion of social Darwinism where social competition is justified on evolutionary selection processes.

the way in which design has fulfilled a utilitarian role as a problem-solving tool within a techno-managerial framing of the environmental crisis. Second is the one where design has drawn inspiration from a putatively scientific conception of ecology both as a form-finding heuristic and as a model for practice more aligned with the flexibility of the market's logic and fluidity of capital flows. Lastly, there is a third moment where design has regained its political awareness and vocation at a time when the debates around environmental and social justice call for a reconstruction where the political expands to include entities beyond the human—in other words, political ecology in the Latourian sense.[6]

The question of the relationship between ecology and design is usually taken for granted. But first, it is necessary to problematize it if it is to be clarified. A crucial step in this process is recognizing its historical contingency. Only then can it be meaningfully reformulated. In what

6. Bruno Latour, "To Modernize or to Ecologize," ed. N. Castree and B. Willems-Braun, Remaking Reality: Nature at the Millennium (London and New York: Routledge, 1998), 224; Bruno Latour, *Down to Earth: Politics in the New Climatic Regime*, 1st ed. (Cambridge, UK: Polity Press, 2018), 52; Albena Yaneva and Alejandro Zaera, eds., *What Is Cosmopolitical Design?: Design, Nature and the Built Environment* (Burlington, Vermont: Ashgate, 2015), 10.

follows, this chapter elaborates on the evolution of ecology and the effects its different acceptations had over design discourse.

Ecology: From Science to Cultural Metaphor

The year 1968 is a favorite when it comes to recounts of our recent historical arch. Its worldwide protests were symptomatic of a deeper political rift. But as a new decade began and social unrest settled, another picture started to emerge—one where environmental concerns took center stage and became part of a shared planetary narrative. In the first historical recount of ecology, historian Donald Worster referred to this period as the "Age of Ecology."[7] The year 1972 was to ecological concerns what 1968 was to social unrest.

Today, "ecology" is synonymous with "environment," and, due to the nature of the climate crisis, environmentalism has become a fiercely contested political and ideological arena of

7. Donald Worster, *Nature's Economy: The Roots of Ecology* (San Francisco: Sierra Club Books, 1977), 12.

planetary scale that transgresses cultures, political affiliations, and national borders. This was not always the case.

The concept of ecology (*oekologie*) is relatively recent. It was coined in 1866 by German biologist Ernst Haeckel as "the comprehensive science of the relationship of the organism and the environment."[8] Chemist Ellen Swallow Richards—the first woman admitted at the Massachusetts Institute of Technology—ported the term to the English language as oekology for the first time in 1892 and subsequently developed the notion of "human ecology."[9] Including humans in its studies proved to be a controversial move which precipitated ecology into a crisis of which no end is yet in sight.[10]

It took a little over half a century, but thanks to the pioneering efforts of ecologists Eugene and Howard Odum, who wrote the first textbook—*Fundamentals of Ecology* (1953)—,

---

8. Carl von Linné, *Specimen Academicum de Oeconomia Naturæ* (Upsaliæ, 1749); Ernst Haeckel, *Generelle Morphologie der Organismen* (Berlin: De Gruyter, 1866). Haeckel chose the etymology in direct reference to the "economy of nature" borrowing the terminology from Linnaeus.

9. Carolyn Merchant, *American Environmental History* (New York: Columbia Univ. Press, 2007), 181.

10. Hans Magnus Enzensberger, "A Critique of Political Ecology," *New Left Review* I/84, March–April 1974, no. 84 (April 1974).

ecology was formally recognized as an independent field in American academia. Less than a decade later, environmental activist and marine biologist Rachel Carson's *Silent Spring* (1962) is widely credited with detonating the modern environmental movement in the US.[11] The book reported on the negative effects of the use of pesticides and their spread in food chains suggesting "we all live downstream." According to Worster, by this point, the science of ecology had matured to the point where its observations could be used to conduct empirical research. The post-war economic boom responsible for cementing the middle class also represented an accelerated rate of environmental degradation. Environmentally aware groups turned to ecology for guidance. This is when ecology became synonymous with environmentalism in popular culture.

The watershed moment that marks the turning of environmentalism into a concern of planetary scale came in 1972. At least three concurrent events illustrate this turn: the celebration

11. Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962); Murray Bookchin, *Our Synthetic Environment* (New York: Knopf, 1962). Carson's book was not the first to call attention to the effects of using synthetic pesticides in ecosystems, but thanks to her lobbying efforts, the book was endorsed by several high-profile figures and went on to sell two million copies. Eco-anarchist Murray Bookchin had published his just a few months before the publication of Carson's book seeking to raise awareness on similar environmental maladies.

of the first United Nations Conference on the Human Environment in Stockholm, Sweden, the publication of the environmental all-time best-seller *The Limits to Growth* (1972), and the iconic "Blue Marble" photograph shot by the crew of National Aeronautics and Space Administration's (NASA) Apollo 17 mission. These events represent a zeitgeist characterized by the awakening of a planetary environmental consciousness. At this early stage, this awareness still lacked the conceptual and political apparatus to properly frame its new concerns.

The Stockholm conference represented the very first global "taking stock of the human impact on the environment, an attempt at forging a basic common outlook on how to address the challenge of preserving and enhancing the human environment."[12] Its ensuing Declaration constitutes a milestone in international law being the first document to recognize the right to a healthy environment. It set the stage for the all other international summits on the environment including the UN General Assembly's 1982 World Charter for Nature, the 1987 Brundtland Report (which provided for the first time an institutional definition for the term "sustainable

12. Günther Handl, "Declaration of the United Nations Conference on the Human Environment," Audiovisual Library of International Law, n.d., https://legal.un.org/avl/ha/dunche/dunche.html.

development"), the 1992 Rio Declaration on Environment and Development, the 1997 Kyoto Protocol (which set to curb greenhouse emissions), and the 2015 Paris Accord (where signatory countries agreed to keep emissions to levels that would prevent a raise in global temperatures above two degrees Celsius).

The Limits to Growth (1972) was presented on the same year.[13] The project toward the publication began with a report titled *The Predicament of Mankind* (1970) published by The Club of Rome—a group of industrialists founded in 1968 by the Italian philanthropist Aurelio Peccei. The Club then commissioned a team of MIT researchers led by engineer Jay Forrester, the founder of system dynamics, to further develop the report leading to the publication of *The Limits to Growth* to coincide with the UN conference two years later.[14]

13. Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972).

14. The field of systems dynamics is closely related to cybernetics but was developed independently. Forrester had a stint as an engineer working to fix the navy's radar system. He realized the closed navigational system was feeding data into itself recursively creating "feedback loops." This was the crucial insight that lead to the development of the systems dynamics non-linear methodology. After developing the initial framework, Forrester went on to apply his approach in several fields including industrial processes, environmental systems, and urban planning.

The story goes that, on his trip back from Switzerland, Forrester sketched the basic framework for what later became the blueprint of the "World System model" used in the MIT computer simulations. The book's impact cannot be understated. It went on to become the top environmental best-seller in history and was responsible to a large extent of setting the tone and framing for much of the institutional environmental debates that followed. Besides its seemingly common-sensical core argument—growth cannot be infinite in a finite world—its aura of authority stemmed from its novel use of supercomputer simulations to predict multiple, dynamic, and non-linear future scenarios. Notwithstanding its unprecedented methodology, the book was subject of strong criticism. Some critics said the World-3 model did not take into consideration the game changing potential of technological innovation. Others accused it of environmental determinism.

The most serious challenge, however, came from the emerging field of political ecology.[15] As a multidisciplinary field, political ecology coalesced from human geography and social

15. Eric Wolf, "Ownership and Political Ecology," *Anthropological Quarterly* 45, no. 3 (July 1972): 201–5; Peter A. Walker, "Political Ecology: Where Is the Ecology?," *Progress in Human Geography* 29, no. 1 (2005): 73–82. The term political ecology was recovered by anthropologist Eric Wolf in a 1972. In article titled "Ownership and Political Ecology," he speculated on the need to integrate social and political history to geographical insights in

ecology. As it matured, it became informed, first, by neo-Marxist literature and, later, by post-structural critical theory. In the eighties and nineties, the rise of a postmodern cultural sensibility—characterized by an impetus to deconstruct gran narratives and a skepticism toward technology and "scientism"—permeated political ecology through critical theory. Consequently, *The Limits to Growth* was called-out for its techno-managerial approach and its rudimentary grasp regarding the social constructedness of environmental problems.

The third event taking place in 1972 was the end of the Apollo space program which marks the last time any human has gone beyond Low Earth Orbit. During the Apollo 17 mission, among the several pictures shot with the onboard Hasselblad camera during re-entry, a crew member captured what became the famous "Blue Marble" photograph.[16] Environmentalist

---

order to understand the emergence of different forms of land ownership structures across a region. The field is broad in scope and complex in its goals. Its multidisciplinarity means it is subject to different understandings and interpretations. Geographer Peter Walker observes a change from a "structuralist" approach which put the emphasis on ecology to a poststructuralist approach which shifted the focus to politics in later decades. Whereas structuralist approaches highlight the principles of adaptation, homeostasis, and resilience, poststructuralist approaches to political ecology focus on a critique on political economy as the source of maladaptation and instability. It is mostly this second moment in the development of political ecology which concerns this dissertation.

16. Attempts to determine which individual was responsible for the shot have been inconclusive. NASA officials credit the entire crew.

and editor of the *Whole Earth Catalog* Steward Brand had asked just a few years before, "Why haven't we seen a picture of the whole Earth?"[17] When Apollo 17 crew delivered the image, it helped produce a sort of collective "overview effect" catalyzing a new, shared planetary consciousness.[18] The historic sight of planet Earth floating in the unfathomable depths of space replaced what arguably had been until then the most iconic image of the twentieth century: the mushroom cloud resulting from the detonation of an atomic bomb.[19] From the specter of the Cold War with its intercontinental ballistic missiles (ICMBs) carrying nuclear war heads, to putting a human on the moon, to remote satellite sensing, to the resource depletion models simulated in *Limits to Growth*, the story of ecology is tightly interwoven with cybernetics.

---

17. Stewart Brand, *Whole Earth Catalog: Access to Tools*, vol. 1 (Menlo Park, California: Stewart Brand, 1968).

18. Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Boston: Houghton Mifflin, 1987). The "overview effect" is a cognitive shift experienced by some astronauts during space flight. Different accounts of the experience share similarities: invisible political boundaries become trivial, and Earth is perceived as fragile and small.

19. Anselm Franke and Diedrich Diederichsen, *The Whole Earth: California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013). Anselm and Diederichsen offer a detailed account of the cultural significance of the Blue Marble photo and its multiple connections to other cultural artifacts from the seventies.

Design Ecologies and the Post-Political

In the design arena, 1972 was also a year of milestones. Perhaps the most significant was memorialized by architecture historian Charles Jencks. According to him, the modernist movement died on "July 15th at 3: 32 pm" with the controlled implosion of the Pruitt-Igoe housing development in St. Louis, Missouri designed by architect Minoru Yamasaki's (better known for designing New York's World Trade Center twin towers in New York).[20] However, that same year, the Nakagin Capsule Tower designed by architect Kisho Kurokawa was being completed in Tokyo. The building is perhaps the most famous representative of the Japanese Metabolist movement in architecture which, according to architect Rem Koolhaas, was "the last cohesive 20th century modernist avantgarde."[21]

20. Rowan Moore, "Pruitt-Igoe: Death of an American Housing Dream," *The Observer*, February 26, 2012, sec. Art and design, http://www.theguardian.com/artanddesign/2012/feb/26/pruitt-igoe-myth-film-review.

21. Rem Koolhaas and Hans-Ulrich Obrist, eds., *Project Japan: Metabolism Talks* (Köln: Taschen, 2011).

Japanese metabolism was a postwar architectural movement that sought to merge ideas from biology and technology for the improvement of society through architectural design. It owes its name to the architectural critic Noburu Kawazoe who used the Japanese word *shinchintaisha* to refer to the flows of matter and energy that take place between organisms and the environment. The 1960 manifesto, *Metabolism: The Proposals for a New Urbanism*, opened with the following note:

> We regard human society as a vital process—a continuous development from atom to nebula. The reason why we use such a biological word, metabolism, is that we believe design and technology should be a denotation of human society. We are not going to accept metabolism as a natural process but try to encourage active metabolic development of our society through our proposals.[22]

The Nakagin Capsule tower was completed in 30 days. The tower had a total of 140 modules each containing all the necessary living gadgets and accommodations in a two and a half by two and half by four-meter volume. They were prefabricated at a shipping container factory

22. *Metabolism: The Proposals for a New Urbanism* (Tokyo: Bitjutu Syuppan Sha, 1960).

with mass production in mind—the idea being that they would be constantly replaced like cells in a living organism or that the building could grow as needed, like a tree.[23]

Perhaps' Jencks claim to the end of modernism would not have been as convincing if 1972 had not produced what is arguably the first postmodern manifesto: *Learning from Las Vegas* (1972) by architects Denise Scott Brown, Robert Venturi, and Steven Izenour.[24] As we move on to discuss the crisis that architecture was experiencing in the nineties, it is important to keep in mind the repercussions from this book. Shortly before its publication, Denis Scott Brown had penned an essay titled "Learning from Pop" where she argued for the importance of looking at "low art" or pop culture with unprejudiced eyes.[25] She wrote:

---

23. In 1972, the Institute of Biophysics in Krasnoyarsk had its most successful run of the BIOS-3 closed ecology experiment where a crew of two scientists were sealed off in a 300 square feet facility vaguely resembling the metabolist capsules at Nakagin.

24. Robert Venturi, Denise Scott Brown, and Steven Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (Cambridge, Massachusetts: The MIT Press, 1972).

25. Denise Scott Brown, "Learning from Pop," in *Architecture Theory since 1968*, ed. K. Michael Hays (Cambridge, Mass: The MIT Press, 1998), 69-74; Raymond Williams, "On High and Popular Culture," *The New Republic*, November 22, 1974. Brown's essay predates Williams' where he writes:

> The meanings and values of all particular peoples and cultures have to be respected, with no prior selection of universal values, if the next necessary stage, of contact, interaction and the dynamic processes of agreement and disagreement, intellectual conflict as well as consensus are to be reasonably conducted under conditions of equality.

> In the movement from low art to high art was an element of the deferral of judgment. Judgment is withheld in the interest of understanding and receptivity. This is an exciting heuristic technique but also a dangerous one since liking the whole of pop culture is as irrational as hating the whole of it, and it calls for the vision of a general and indiscriminate hoping on the pop band wagon where everything is good, and judgment is abandoned rather than deferred."[26]

She added an important caveat which tends to be forgotten. The last line of her essay reads: "After a decent interval, suitable criteria must grow out of the new source. Judgment is merely deferred to make a subsequent judgment more sensitive."[27]

Brown's notion of judgment will become relevant when we discuss the notion of criticality, a highly contested topic during architecture's disciplinary crisis in the mid-nineties. Before moving on, it is relevant to note her essay predated Raymond Williams' 1974 "On High and Popular Culture" where he equated high culture to the universal and pop culture to the local. Reflecting a postmodern sensibility, he wrote:

> "The meanings and values of all particular peoples and cultures have to be respected, with no prior selection of universal values, if the next necessary stage, of

---

26. Brown, 73.

27. Brown, 74.

> contact, interaction and the dynamic processes of agreement and disagreement, intellectual conflict as well as consensus are to be reasonably conducted under conditions of equality."

Williams' was a call, among other things, to bring down the walls of hegemonic high culture into the fold the voices of the suppressed, neglected, or ignored. But inclusivity as a pop-cultural program was, in his eyes, not enough, and, in a similar fashion to Brown, he too warned that this could "decline into mere antiquarianism and folklorism if the real present is not connected to the recovered past."[28]

Coincidentally, at the same time *Learning from Las Vegas* made a call to consider the lessons from every day or "prosaic" architecture, Rem Koolhaas was graduating from the Architectural Association in London with a thesis titled, almost perversely, "The Berlin Wall as Architecture" (later presented as Exodus: Voluntary Prisoners of Architecture). It stood out sorely at a moment when the avantgarde was fascinated with the playful, utopian works of

28. Raymond Williams, "On High and Popular Culture," *The New Republic*, November 22, 1974.

Archizoom and Superstudio.[29] Its motifs of enclosure and confrontation pushed architectural discourse further into an arena of political and ideological contestation. In this sense, the work foreshadowed another 1972 project "The City of the Captive Globe"—developed with his wife, painter Madelon Vriesendorp, and partners Zoe and Elia Zenghelis.

Side by side, *The City of the Captive Globe* painting and the *Blue Marble* photo, vividly illustrate the transition from a modernist to a postmodern ecological sensibility. Modernist ecology, like positivist science, has a realist, empirical approach to knowledge. Under this worldview, hardly any other mode of depiction can be more accurate than an actual photograph, shot from a capsule put in outer space by a rocket designed based on our understanding of the laws of physics (as scientist and vocal atheist Richard Dawkins put it once, "science works, bitches!"). This is science that claims to be neutral, objective, and factual.

In contrast, *The City of the Captive Globe* painting foregrounds the human role in the production of the representational medium (not a photo—an allegedly unmediated technological

29. Rem Koolhaas et al., "Exodus or The Voluntary Prisoners of Architecture," in *S, M, L, XL* (Rotterdam: 010 Publ., 1995).

artifact, but a painting, a handmade image with a human author). In Vriesendorp's rendition, the world is not a singular island suspended in the emptiness of space, but rather becomes part of an archipelagic grid. The city represents an isomorphic, but pluralistic and contested field where every block represents an ideology (paraphrasing architect Wes Jones: "Every good building is the seed of a city"). Together, they participate in the social construction—the incubation—of the world. As a suggestion that the world (as a stand-in for nature or the environment) reflects human values and ideologies, *The City of the Captive Globe* is the strongest visual representation of a postmodern understanding of ecology. As writer Anais Nin once said, "We do not see things as they are, we see them as we are."[30]

Fast forward to the nineties, design found itself amid a profound disciplinary and professional crisis. Koolhaas was one of the most eloquent commentators. "Architecture is this toxic mixture between power and impotence," he wrote in the biblical *S, M, L, XL* (1996).[31] For someone proud of never revealing his moral positions, nowhere are his convictions clearer than in

30. Anaïs Nin, *Seduction of the Minotaur* (Chicago: Swallow Press, 1961).

31. Rem Koolhaas et al., *S, M, L, XL* (Rotterdam: 010 Publ., 1995), 10.

his 1995 essay "What Ever Happened to Urbanism."[32] In it, he decries the powerlessness and cultural irrelevance of design in the face of unparalleled planetary urbanization. His words proved to be prescient. China was witnessing the beginning of the biggest period of urbanization in history with unprecedented sustained double-digit growth rates.[33] It is right during this urban apotheosis when the urban finds itself least theorized, according to Koolhaas. He blames architecture's irrelevance on its fixation with negative critique: "according to Derrida we cannot be Whole, according to Baudrillard we cannot be Real, according to Virilio we cannot be There."[34] Instead he dares architects to be "radically uncritical," suggesting that urbanism must transcend professional boundaries and become an ideology: "to accept what exists."[35]

---

32. Rem Koolhaas, "Whatever Happened to Urbanism?," in *S, M, L, XL*, ed. Bruce Mau and Jennifer Sigler (Rotterdam: 010 Publ., 1995), 958-71; "Rem Koolhaas im Gespräch mit Nikolaus Kuhnert, Anh-Linh Ngo und Stephan Becker," in *Arch+*, no. 175/2005, 17.

33. Rem Koolhaas et al., eds., *Great Leap Forward*, Harvard Design School Project on the City (Köln: Taschen, 2002); Vaclav Smil, *Making the Modern World: Materials and Dematerialization*, 1st ed. (New York: Wiley, 2013). Koolhaas went on to study this in his first collaboration with Harvard University Graduate School of Design. Environmental historian Vaclav Smil points out that China used more concrete than the United States did in the entire 20th century from 2011 to 2013, a period well after Koolhaas' study of China.

34. Koolhaas, "Whatever Happened to Urbanism?," 960.

35. Koolhaas, 969.

At a conference at the Canadian Center for Architecture held in 1994, Koolhaas foreshadowed similar feelings when he declared that "the problem with the prevailing discourse of architectural criticism is [the] inability to recognize there is in the deepest motivations of architecture something that cannot be critical."[36] Koolhaas argument places the blame squarely on the profession. There are no attempts to historicize urbanization. He fails to recognize that the "generic city" is really the "neoliberal city." If his invitation to "find optimism in the inevitable" succeeded, it was through sheer rhetorical persuasion. The political and the economic are conspicuously absent in his diagnosis.[37]

Published a decade before, geographer David Harvey's book *The Urbanization of Capital* (1985) was one of the earliest attempts to fill the theory gap between political economy and (urban) geography. Harvey provides a framework to comprehend the city as the historically contingent result of a politico-economic process. In his view, the uneven geographies of

---

36. Baird, George. "'Criticality' and Its Discontents." Harvard Design Magazine, Fall 2004.

37. Nicolai Ouroussoff, "City on the Gulf: Koolhaas Lays Out a Grand Urban Experiment in Dubai," *The New York Times*, March 3, 2008, sec. Art & Design, https://www.nytimes.com/2008/03/03/arts/design/03kool.html.

neoliberal urbanization are not mere after-effects, but the very spatial and material reality that enables capitalism to sustain itself. Up until then, most accounts of the urbanization process were descriptive or functionalist. Urbanization was considered a natural or transhistorical phenomenon. City growth was described by physical laws that likened it to the organic growth of an organism—the concentric circles of tree rings, for instance.[38] In those accounts, the city is just a passive reflection of society. Harvey's work set to change that understanding by furthering a Marxist analysis of social and natural production and reproduction under capitalism. As Harvey points out, Marx never provided a full account of the role of space in capitalist production. As he and others argue, urbanization is crucial to capitalist growth and in fact replaces industry in the late part of the twentieth century.[39]

Harvey's contribution is that urbanization is a fundamental process in the reproduction of capital. Specifically, he characterizes urbanization as a spatial fix to the problem of

38. Mumford, Lewis, "The Natural History of Urbanization," in *Man's Role in Changing the Face of the Earth*, ed. William L. Thomas Jr. (Chicago: University of Chicago Press, 1956), 382–98.

39. Henri Lefebvre, *The Urban Revolution* (Minneapolis: University of Minnesota Press, 1970); Neil Smith, *Uneven Development: Nature, Capital, and the Production of Space* (New York, NY: Blackwell, 1984).

overaccumulation. Considering that economics are dominated by a narrative of scarcity, the suggestion that capitalist crisis stems from overaccumulation seems counterintuitive. But ever since the world escaped the so-called "Malthusian trap," roughly around the industrial revolution, the world economy has grown at an average annual rate of 3%. Since capitalism seeks to generate a surplus, its biggest challenge lies in finding new profitable investments. Geographic expansion and the military industrial complex are two fixes. Urbanization is yet another.

Indeed, Harvey's insights help us make sense of the tumultuous last decades from the bursting bubble of real estate speculation in South East Asia in 1998, to the bursting of the subprime mortgage bubble in the US roughly ten years later. As many have pointed out, this newest late mode of capitalist urbanization began in the eighties under the administrations of prime minister Margaret Thatcher in the United Kingdom and President Ronald Reagan in the United States.[40] Under their neoliberal programs, the social welfare state began saw the beginning of its dismantling. Public services were privatized, unions were busted, and social

40. George Monbiot, "Neoliberalism: The Ideology at the Root of All Our Problems," *The Guardian*, April 15, 2016, sec. Books, http://www.theguardian.com/books/2016/apr/15/neoliberalism-ideology-problem-george-monbiot.

spending was cut down. Architects, who had historically seen their professions tied to public commissions, suddenly found themselves without the government's patronage. Speculation bubbles driven by deregulation had not kickstarted a period of economic boom yet. Architecture, mostly tangled in the reactionary politics of the neo-avantgardes, was culturally irrelevant and, increasingly, professionally unviable. This led to intellectual unrest within the profession and led architects to scramble to find new models for thought and professional organization.

Then it happened: the Bilbao effect—named after the impact the Guggenheim museum designed by architect Frank Gehry had on the economy of Bilbao, a former industrial hub in Spain. The effect can also be understood as the commodification of innovative architectural formalism. It transformed architecture into an appendage of global real estate and financial capital, to paraphrase sociologist David Graeber.[41] The museum opened in 1997, a couple years after the publication of *S, M, L, XL* and Netscape's IPO which accelerated the speed at which information circled the globe by making internet access available to the public. Paired with

41. Gean Moreno, "Editorial—'Accelerationist Aesthetics,'" *EFlux* 46, no. 6 (2013), http://www.e-flux.com/journal/editorial%e2%80%94%e2%80%9cacceleration ist-aesthetics%e2%80%9d/.

accelerating global urban growth rates, the Bilbao effect marked the beginning of the most feverish period of architectural production.

One after another, so-called "paper architects" saw their work validated by the establishment.[42] Cities around the world wanted to repeat Bilbao's luck.[43] Big names helped legitimize speculative design projects worldwide. The figure of the "starchitect" was born. There was a global race to build bigger and taller. Headlines of record-breaking projects from the Middle East to South East Asia came every week. "Anything goes," seemed to be the mantra. Architecture seemed to have found its calling.[44] The profession was safe.

Following Koolhaas vocal discontent with the state of architectural discourse in the mid-nineties, theorist Michael Speaks's 2002 essay "Design Intelligence" triggered what could be

42. Koolhaas himself in 2000, the Swiss duo of Jacques Herzog and Pierre de Meuron in 2001, Iraqi Zaha Hadid in 2004, American Thom Mayne in 2005, and French Jean Nouvel in 2008.

43. Even the animated show The Simpsons (s16 e14 The Seven Beer Snitch) featured Frank Gehry in a throwaway gag about city wanting to position itself on the map with one of his buildings.

44. Ellen Dunham-Jones, "The Irrational Exuberance of Rem Koolhaas," *Places Journal*, April 2, 2013, https://placesjournal.org/article/the-irrational-exuberance-of-rem-koolhaas/.

considered a watershed moment which came to be known as the "post-critical" debate in architecture. It was a scathing indictment of architectural theory, history, and criticism (ironic considering Speaks was in the process of finishing his PhD under the supervision of Marxist cultural critic Frederic Jameson).

> If philosophy was the intellectual dominant of early 20th century vanguards and theory the intellectual dominant of late 20th century vanguards, then intelligence has become the intellectual dominant of early 21st century post-vanguards. While vanguard practices are reliant on ideas, theories and concepts given in advance, intelligence-based practices are instead entrepreneurial in seeking opportunities for innovation that cannot be predicted by any idea, theory, or concept. Indeed, it is their unique design intelligence that enables them to innovate by learning from and adapting to instability.[45]

Speaks unabashedly stated that if architecture was to get on with the times, it should ditch theory and adopt instead a model based on "intelligence"—very much like intelligence agencies or business managers do.[46] Intelligence, he explained, is contingent and bottom up; it emerges from the chatter of little truths circulating in mainstream culture.

---

45. Michael Speaks, "Intelligence after Theory," *Perspecta* 38 (April 2006), 106.

46. Douglas Spencer, *The Architecture of Neoliberalism: How Contemporary Architecture Became an Instrument of Control and Compliance*, 1st edition (London; New York: Bloomsbury, 2016).

> Accustomed in ways that their vanguard predecessors can never be to open-source intelligence (OSINT as it is called by the CIA) gathered from the little truths published on the web, found in popular culture, and gleaned from other professions and design disciplines, these practices are adaptable to almost any circumstance almost anywhere.[47]

With its rejection of the high culture of academic theory and its embrace of small truths bubbling up from popular culture, Speaks's ideas are reminiscent of Brown's "Learning from Pop." But he takes it a step further: the process of "emergence" is not to be understood as collective social construction, but as a pseudo-biological metaphor imported from cybernetics and systems theory.[48]

Speaks was an advocate of the "New Economy" which represented the idea that technology was profoundly altering the way finance and business work.[49] He quoted often from figures such as Silicon Valley wonk and founding editor of Wired magazine Kevin Kelly and

---

47. Michael Speaks, "Design Intelligence: Part 1, Introduction," in *A+U* (December 2002): 10–18.

48. Steven Johnson, *Emergence: The Connected Lives of Ants, Brains, Cities, and Software* (New York: Scribner, 2001).

49. Kevin Kelly, *New Rules for the New Economy: 10 Ways the Network Economy Is Changing Everything* (London: Fourth Estate, 1999).

management guru Peter Druker. Architecture, subordinated to theory, becomes mere problem solving, according to Speaks. He wanted architectural practices to evolve and professionalize by embracing the potential for innovation brought upon by technology. He extolled the ways in which, for instance, spreadsheets revolutionized the world of business and finance by allowing multiple scenario forecasting. He drew a parallelism with CAD technologies suggesting they were used to develop rapid prototyping techniques (later called "versioning"). He wrote:

> As the 1990s drew to a close, theory-vanguardism began to wither as new architecture practices better suited to meet the challenges issued by globalization arose to claim the mantle of experimentation that the vanguard, whether in philosophical or theoretical guise, had so long held. Identified as post-critical, fresh, and ideologically smooth, these practices embraced much of the market-driven world their theory-hamstrung predecessors held in contempt.[50]

This new, flexible, and adaptable mode of practice, unencumbered by the slowness, negativity, and resistance of theory, was capable of nimbly responding to yet unaddressed market needs and niches. Criticality was out; opportunism was in.

50. Speaks, "Intelligence after Theory," 105.

When Speaks, located at the time in Los Angeles, became the guest editor for a series of A+U magazine editions, he pushed his blunt "design intelligence" agenda. Shortly after, when landscape architect James Corner, then at UPenn, picked upon Speaks's writings, the debate caught on from coast to coast. Corner, directly echoing Speaks' sentiment, proposed ecology as a metaphor to adapt practice to the realities of the market. In a short essay titled "Not Unlike Life Itself," he expressed his concerns about the professional viability of the discipline calling for more nimble, adaptive, and resilient models of practice.[51] As a science that deals with instability and uncertainty, ecology has a few lessons to teach designers who wish to navigate the ever-turbulent market.

In his very short piece, Corner managed to establish a triple equivalence between life (reality), nature (ecology), and the market. The market is like ecology, ecology is like life, life is reality. It would be hard to come by with a clearest example of the ecological metaphor being

51. James Corner, "Not Unlike Life Itself," in *The Landscape Imagination: Collected Essays of James Corner, 1990-2010*, ed. Alison Bick Hirsch (New York, New York: Princeton Architectural Press, 2014); Pierre Bélanger, *Going Live: From States to Systems* (New York: Princeton Architectural Press, 2015). Years later, Bélanger's publication, which concludes with a chapter paraphrasing Corner, signals the metaphor is still very much alive and kicking.

deployed to naturalize the market ideology. All three instances illustrate the "appeal to nature fallacy," which claims something is good by virtue of being natural. From these premises, it follows that if architecture is to survive in the market—a market which itself behaves following the same "natural" laws studied by ecology—, then architecture ought to align itself with ecology. This is the same form of economic Darwinism or "market realism" Speaks seems to espouse.[52]

The science of ecology, through its study of living systems, has superseded biology (which focuses on organisms) in being associated with the study of the biotic world. Thusly, as a cultural metaphor, ecology has become synonymous with life. Ironically, ecology the science, has been shaped by the mechanist conceptions of engineering (via cybernetics, complexity theory, and system dynamics). The repertoire of concepts imported from these fields (e.g. resilience, adaptability, uncertainty, instability, dynamic equilibrium, open-endedness, emergence, self-organization, autopoiesis, feedback loops), once naturalized, is re-exported to describe man-made objects and cultural artifacts like corporate culture or financial markets. This is the process

52. Roemer van Toorn, "No More Dreams? The Passion for Reality in Recent Dutch Architecture... and Its Limitations," in *The New Architectural Pragmatism: A Harvard Design Magazine Reader*, ed. William S. Saunders (Minneapolis: University of Minnesota Press, 2007), 54–74; Mark Fisher, "Capitalist Realism," STRIKE!, June 3, 2013. Van Toorn mentions brings up the term "market realism" to refer to the type of pragmatism illustrated by certain architectural practices. The term echoes but predates Fischer's more developed idea of "capitalist realism."

through which ecology, the metaphor, having become synonymous with nature, has the effect of "naturalizing" everything it is associated with. Then, for instance, the markets' "invisible hand" (a concept wrongly attributed to Adam Smith), becomes "self-regulation" in the new ecological-cybernetic jargon. When man-made systems or cultural artifacts become naturalized, we lose sense of their historical contingency, and we think them as inevitable (simply "natural").

According to positive science, natural laws are universal and transhistorical. But self-aware matter, thinking meat, the phenomenon called "mind," human brains, introduces a level of complexity and uncertainty that seems to defy deterministic and reductionist accounts of nature. This means that the so-called "laws" of the market are not as inexorable as the laws of physics.[53] The laws of natural selection or the survival of the fittest become just metaphors when applied to society.[54] Agency, if free will is not an illusion, means we can envision and enact alternatives.

---

53. Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Winchester, UK; Washington [D.C.]: Zero Books, 2009); Mark Fisher, "Capitalist Realism," STRIKE!, June 3, 2013, http://strikemag.org/capitalist-realism-by-mark-fisher/. Fischer provides an in-depth analysis and critique of ideological naturalization of the market logic under capitalism.

54. Adam Curtis, "All Watched Over by Machines of Loving Grace," TV Mini-Series (United Kingdom: BBC, 2011). In his 2011 three-part documentary, Curtis explores the role that ecology had as a metaphor in the "naturalization of ideology from the gestation of the New Economy under Alan Greenspan during president Bill Clinton's administration to the colonial rule of Africa by the Europeans."

Putting aside lofty philosophical musings, the object of interest here is Corner's last equivalence: that, if it is to survive, design should follow ecology (a.k.a. life, a.k.a. nature, a.k.a. the market, according to his equivalences). If design is to follow "nature," a careful consideration of the definitions of nature is in order. Not doing so, puts design at risk of becoming a vehicle for the aesthetization of ideology. In such scenario, design could no longer be projective since projection (unlike extrapolation) implies fundamental change. Merely following "the path of least resistance" would preclude any meaningful change. On the contrary, it makes design complicit in the naturalization, through aesthetics, of the market doctrine.[55]

In 2007, a special volume of Harvard Design Magazine, collected several essays regarding post-criticality under the title *The New Architectural Pragmatism*.[56] As editor William Saunders summarizes in the introduction, there were those who embraced this new attitude (Robert

55. Douglas Spencer, "Architectural Deleuzism II: The Possibility of Critique," Blog, Critical Grounds, March 24, 2012, http://terraincritical.wordpress.com/2012/03/24/architectural-deleuzism-ii-the-possibility-of-critique/; Douglas Spencer, "Nature Is the Dummy," *New Geographies: Grounding Metabolism* 6 (2014): 108–13; Douglas Spencer, *The Architecture of Neoliberalism: How Contemporary Architecture Became an Instrument of Control and Compliance*, 1st edition (London; New York: Bloomsbury, 2016).

56. William S. Saunders, ed., *The New Architectural Pragmatism: A Harvard Design Magazine Reader* (Minneapolis: University of Minnesota Press, 2007).

Somol, Sarah Whiting, James Corner, Alejandro Zaera-Polo), those who saw it with reserves (Dave Hickey, Sanford Kwinter, Reinhold Martin, Michael Hays, Roemer van Toorn), and those who navigated somewhere in the middle (Stan Allen). It is worth repeating a few points raised by those who remained skeptical. Namely that, more than criticality, what was to blame was academization; that the post-critical should avoid becoming the post-intellectual; that if the postcritical is characterized by positive affirmation (as opposed to negative resistance), we ought to ask what is it affirming and how is it different than the "dominant neoconservatism."[57]

Within this debate, two more texts merit attention for their influence: Sarah Whiting and Robert Somol's "Notes around the Doppler Effect and Other Moods of Modernism" and George Baird's "Criticality and its Discontents."[58] Whiting and Somol trace back an early

57. David Hickey, "On Not Being Governed," *Harvard Design Magazine*, Fall 2007; Reinhold Martin, "Critical of What? Toward a Utopian Realism," in *The New Architectural Pragmatism: A Harvard Design Magazine Reader*, ed. William S. Saunders (Minneapolis: University of Minnesota Press, 2007), 150–61; Stan Allen, Hal Foster, and Kenneth Frampton, "Stocktaking 2004: Questions about the Present and Future of Design," in *The New Architectural Pragmatism: A Harvard Design Magazine Reader*, ed. William S. Saunders (Minneapolis: University of Minnesota Press, 2007), 150–61.

58. Robert Somol and Sarah Whiting, "Notes around the Doppler Effect and Other Moods of Modernism," *Perspecta* 33, no. Mining Autonomy (2002): 72–77; George Baird, "'Criticality' and Its Discontents," *Harvard Design Magazine*, Fall 2004.

discussion regarding criticality and autonomy to a 1984 issue of *Perspecta*, Yale's architectural Journal. In it, the editors argued that architecture is inevitably engaged with questions beyond itself.[59] In contrast, on that same issue, in his canonical essay "Critical Architecture: Between Culture and Form" (1984), theorist Michael Hays argued for a more nuanced understanding of a dialectic between autonomy and instrumentality ("negative critique" and "conciliatory commodity" in his terms).[60] For Hays, autonomy is a precondition for engagement, and design is neither fully autonomous nor subservient to external agendas but rather inhabits a fluid space between matters concerning itself and the world at large.

Whiting and Somol argue that what Hays's saw as the exceptional character of critical architecture, had become the default mode of architectural practice. To make this case, they look at another volume of *Perspecta* where, after seventeen years of Hays' essay, the matter of disciplinarity is explicitly formulated in his terms. The fact that, as the new editorial implied, all

59. In this case, architecture is narrowly defined as comprising matters pertaining to form and style.

60. Michael Hays, "Critical Architecture: Between Culture and Form," *Perspecta* 21 (1984): 14–29.

architectural practice had by default a critical component, meant that the discipline had been completely subsumed in and exhausted by the critical project.

As a corrective measure to what they saw as the dominant paradigm of criticality and trying to break from the older generation, Whiting and Somol proposed an alternative mode of practice which they called "projective."[61] To distinguish it from the critical, they established a series of oppositions. If the critical relied on indexicality, representation, and dialectics then the projective turned toward the diagrammatic, the performative, and a mental image akin to the Doppler effect. Perhaps the most telling opposition is the one between hot and cool—terms borrowed from media theorist Marshall McLuhan.

According to Whiting and Somol, McLuhan distinguishes between hot and cool media in terms of their resolution. Cool media, being low resolution and prone to its information being compromised, requires the participation of the user. Hot media is high resolution and can convey information with precision. If applied to architecture, a hot or critical architecture would imply and engagement with the production of difference—this is to say, the process of distinguishing

61. Somol and Whiting, "Notes around the Doppler Effect and Other Moods of Modernism," 72.

itself from the background, the generic or the normative. "The hot resists through distinction, and connotes the overly difficult, belabored, worked, complicated. Cool is relaxed and easy." Through their notion of the "projective," Somol and Whiting call for an architecture that is "less reflective and more effective." In this regard, they share the sentiment expressed before them in different ways by Koolhaas, Speaks, and Corner. In what is perhaps an arguably weak effort to pay lip service to the critics, they close with a single sentence clarifying that "setting out this projective program does not necessarily entail a capitulation to market forces […]."[62]

Whiting and Somol argument rests on the premise that criticality had become the norm, subsumed the discipline, and became exhausted. But can criticality be exhausted if history is an ongoing process? Will not there always be something new to think about? Like Hays, they search to clarify a relationship between architectural discourse and the world at large. But while Hays relied on the nuance of a dialectic, Whiting and Somol rely on a set of reductive, unresolved oppositions.

62. Somol and Whiting, 77.

It is important to understand the cultural context in which the debate was taking place. In this regard, one aspect of the problem was the way criticality was understood. For people like Corner, Speaks, Somol and Whiting, critical architecture was associated to the North American avant-garde characterized by its academicism and regressiveness. Criticality and autonomy (the opposite of instrumentality) was often associated with resistance, distancing, and disengagement. But another important aspect of the debate's cultural context was the general sense of living in a "post-political" world. When ideology is naturalized to the point of being indistinguishable from reality, discourse cannot help being a tacit capitulation to the status quo.

Indeed, the debate around post-criticality being had in architectural academic circles echoed a broader cultural moment. In their seminal essay "The Californian Ideology" (1995), art critics Richard Barbrook and Andy Cameron describe a paradoxical convergence of free market capitalism, libertarianism, Silicon Valley techno-evangelism, and new age counterculture around notions of a cybernetic ecology modeled after the myth of Spaceship Earth.[63] The ideology was one that promised a form of governance without politics—where a distributed intelligence would

63. Richard Barbrook and Andy Cameron, "The Californian Ideology," *Mute*, September 1995; Adam Curtis, "All Watched Over by Machines of Loving Grace," TV Mini-Series (United Kingdom: BBC, 2011).

achieve self-regulation. As was the case within architecture, here too, ecology served as the metaphor that de-politicized social debates.

In "Criticality and Discontents" (2004), architectural educator George Baird offers a summary and analysis of the development of the debate. He traces criticality back to architect Manfredo Tafuri who wrote against capitalism in the sixties and seventies. Salient in Baird's analysis is his skepticism toward the term "projective" as a satisfying alternative to criticality. Since the notion of a "project" was central in Tafuri's critique, it is not clear how the "projective" constitutes a fundamentally different approach:

> After all, Tafuri had been the most assertive contemporary advocate of an architecture that would not accept the terms of reality as they were presented. Indeed, in an extended series of essays over the span of the 1970s, he formulated an utterly distinctive conception of the architectural "project," one which would at one and the same time propose a new architectural form, would do so on the plane of the entire urban entity in which it was to be located, and would, by inference, transform that entire urban entity itself into something new.[64]

64. Baird, George. "'Criticality' and Its Discontents," in *Harvard Design Magazine* (Fall 2004).

Furthermore, as Baird explains, Tafuri's understanding of criticality and resistance was much more concerned with operativity and activism than what Eisenman and Hays's interpretations led American audiences to believe. Baird also points to the obvious: that even the criticism of criticism (and theory) requires its own theory. Echoing Denise Scott Brown's warning in "Learning from Pop," he writes:

> Then too, I am very curious to see to what extent the putatively "projective" forms of practice being advocated by the new critics of criticality will develop parallel models of critical assessment with which to be able to measure the ambition and the capacity for significant social transformation of such forms. Without such models, architecture could all too easily again find itself conceptually and ethically adrift."[65]

Considering Whiting and Somol's definition and its ambiguous relationship to Tafuri's thinking, the new "projective" design sensibility left things far from settled. For one, there was nothing fundamentally different in the rejection Speaks, Somol, and Whiting express toward the avant-garde: Tafuri himself declared the avant-garde obsolete and expressed interest in socially engaged practices. Then, there is also the question of instrumentality. Whiting and Somol

65. Baird, 2004.

contrapose it to autonomy and summarize its features thusly: projection, pragmatism, and performance. Yet Tafuri was profoundly dedicated to the notion of project. As Baird points out, "his [Tafuri's] highly activist conception of the architectural "project" lay at the heart of his theoretical position."

Despite the debate, architecture was enjoying a boon. The newly found market success of innovative architectural practices seemed to validate the post-critical position. Architect Stan Allen summed up what ought to be the commitments of these new practices: "public legibility, active engagement of new technologies, and creative means of implementation."[66] If Gehry's 1997 Bilbao Guggenheim, which foreshadowed many of the sentiments expressed in the debate, marked the beginning of this period, then Harvard's *New Architectural Pragmatism* arguably marked its end. Just a few months after its publication the subprime mortgage crisis triggered the 2007-9 GFC.

66. Duany, Andres, Peter Davey, Hal Foster, Zaha Hadid, Patrik Schumacher, Paul Shepheard, Martha Schwartz, et al. 2004. "Stocktaking 2004: Nine Questions About the Present and Future of Design." Harvard Design Magazine, Spring 2004.

Shortly after the financial collapse, critic Kazys Varnelis wrote a brief and lucid admonishment equating the fall of the markets to the fall of post-critical or pragmatic ideology in architecture:

> Now that architecture has allied itself with a failed theory of the market, what will become of it? This is not an idle question. As society and culture reconfigure, an architecture that has little to offer except a direct representation of capital flows is unlikely to succeed.[67]

The party was over. Design firms shut down *en masse*. Large firms were not immune either. With multimillion dollar projects put indefinitely on hold, studios like Gehry's own had to lay off up to half of their staff.[68] Potentially an entire generation of architecture graduates was lost in a market unable to provide jobs for all. Some disciplinary soul searching was in order once more.

---

67. Varnelis, Kazys. 2008. "The Post-Critical Collapse." Blog. Varnelis.net. November 3, 2008. http://varnelis.net/blog/the_postcritical_collapse.

68. Dan Glaister, "Architect Frank Gehry's Projects Hit Hard by Economic Downturn," *The Guardian*, March 3, 2009, sec. Art and design, http://www.theguardian.com/artanddesign/2009/mar/03/frank-gehry-economy-architecture.

Design Ecologies against the Post-Political

This was the context in which *Ecological Urbanism* (2010) was published.[69] Edited by architectural educator Mohsen Mostafavi (at the time Dean of the Graduate School of Design at Harvard) and landscape architect Gareth Doherty, the book was part of a larger initiative that included an exhibition and a symposium under the same name. The 2010 initiative, which collected contributions from more than 130 figures from a plurality of backgrounds, was the most important collective attempt to discuss the relationship between ecology and the design disciplines.[70]

In contrast to urban ecology—a field which applies the methodologies of ecological science to urban settings—the project of *Ecological Urbanism* deployed ecology as an inclusive

69. Mohsen Mostafavi and Gareth Doherty, *Ecological Urbanism* (Baden, Switzerland: Lars Müller Publishers, 2010).

70. Architecture theorist Susannah Hagan argues the term can be traced back to the late nineties though its use then is virtually unrelated to Mostafavi and Doherty's. See: Miguel Ruano de Oleza, *Ecourbanismo Entornos Humanos Sostenibles: 60 proyectos* (Barcelona: Gustavo Gili, 1998).

cultural metaphor that sought to expand the disciplinary focus on the urban. Borrowing from philosopher Felix Guattari's formulation of ecology in *The Three Ecologies* (2000), *Ecological Urbanism* recognized the subjective and collective dimensions of ecology (besides the putatively scientific).[71] Its agenda brought into the fold narratives and discourses regarding the urban that went beyond the mainstream litanies of climate change, green architecture, and green technologies.

In the opening essay "Why Ecological Urbanism? Why Now?," Mostafavi recognized the problem design faces when responding to the "moral imperative" of the environmental crisis.[72] In his view, sustainable design was not always the best representative of design excellence or innovation (think architecturally enhanced greenwash). But more importantly, he noted, there was the problem of environmental imperatives supplanting disciplinary contribution. He was not alone in this observation. In "The Counter Histories of Sustainability" (2008), architecture historian Panayiota Pyla warned that, "as a practice, sustainability is constantly running the

71. Félix Guattari, *The Three Ecologies* (London: Athlone Press, 2000).

72. Mohsen Mostafavi, "Why Ecological Urbanism? Why Now?," in *Ecological Urbanism*, ed. Gareth Doherty and Mohsen Mostafavi (Baden, Switzerland: Lars Müller Publishers, 2010), 13.

danger of turning into a totalizing doctrine that subsumes critical thinking."[73] Pyla's warning shared the same preoccupations of expressed earlier by political ecologists regarding *The Limits to Growth* debate. Critic Wolfgang Sachs put it succinctly when he wrote:

> As governments, business and international agencies raise the banner of global ecology, environmentalism changes its face. In part, ecology—understood as the philosophy of a social movement—is about to transform itself from a knowledge of opposition to a knowledge of domination.[74]

The question of how should design address the environmental imperative is not too different from the core question around criticality. In both cases, the problem revolves around the terms in which architecture engages the world at large, the disciplinary "outside." As Mostafavi framed it, the problem of ecology in design resembled the struggle between subservience to external agendas (i.e. instrumentality) or independence of disciplinary contribution (i.e. autonomy). If the ecological metaphor helped depoliticize design discourse at

73. Panayiota Ioanni Pyla, "A Counter History of Sustainability," in *After Zero* (Amsterdam: Archis, 2008).

74. Wolfgang Sachs, "No Sustainability Without Development" (Critical Reflections of the Culture of the West, Brussels: The Ecumenical Association for Church and Society, 1995).

the turn of the millennium, now the ecological imperative was reopening the political question of disciplinarity in the wake of the GFC.

Ecological Urbanism did not seek to offer a definitive answer to the question of the precise terms in which design should engage ecological or environmental matters in particular or the world in general. As architect Susannah Hagan observes in her homonymous book, Mostafavi and Doherty's was a fruitful anthology, raising the profile of a timely matter, but it "left it largely to the reader to make sense to the disparate, even contradictory at times, entries brought under the same umbrella."[75] If *Ecological Urbanism* did not have definitive coordinates on a political map, it was because it did not set out to answer the question, but to open up the debate from as many different entry points as possible, so as to foster better question-making.

Landscape architect Chris Reed and ecologist Nina-Marie Lister followed up the debate opened by *Ecological Urbanism* with *Projective Ecologies* (2014).[76] In the foreword, urban theorist

75. Susannah Hagan, *Ecological Urbanism: The Nature of the City* (New York, New York: Routledge, 2015), 109.

76. However, not without irony, one of the titles originally proposed for the book was Critical Ecologies. I know this firsthand from Professor Lister whose course at the GSD "Critical Ecologies" I took in 2012.

Charles Waldheim, refers to ecology not only as metaphor, but as medium and model for design practice. Ecology is a somewhat troublesome term since, as a metaphor, it has been used to "refer to almost everything, reducing its meaning to almost nothing. However, whether promiscuous or fecund, *ecologies, in the plural, offer a medium for a synthesis* among the broad range of discourses and disciplines that borrow from it."[77]

Compared to open-endedness of *Ecological Urbanism*, which used ecology as a metaphor to open up the urban, *Projective Ecologies* sought to define a particular, yet still pluralistic ecological attitude (unlike, Hagan's attempt to restrict ecology to a narrower positivist reading).[78] Reed and Lister's choice of the "projective" modifier seemed to bring discussion full circle, back to the political debate of criticality. But the connection was oblique since, even though ecology is

77. Charles Waldheim, "Foreword. Ecologies: Plural and Projective," in *Projective Ecologies*, ed. Chris Reed and Nina-Marie E. Lister (New York, New York: Actar Publishers, 2014). Emphasis added.

78. Susannah Hagan, *Ecological Urbanism: The Nature of the City* (New York, New York: Routledge, 2015), 9. Hagan writes:

> "An urbanism that doesn't recognize the centrality of science, or the importance of fully understanding the city as a collection of interrelated physical processes, will never produce an artificial ecosystem. The development of an Ecological Urbanism doesn't so much require a "new sensibility" as a greater willingness on the part of architects to learn the science."

plural and inclusive, politics are absent in their ecological project for design.[79] This omission is the more troubling when considering the publication's timing.

The biggest difference between the contexts of design discourse in the nineties and the second decade of the 21st century is the enormous maturation of the analytical apparatus of political ecology accelerated by the interrelated crisis of environmental degradation and social inequality. Voices all around warned against the danger of ecology, the metaphor, leading back to a depoliticized discourse. In her inaugural 2015 lecture as chair of the landscape architecture department at Harvard, landscape theorist Anita Berrizbeitia said:

> Today, the idea of process is limiting because it works against the agency of design as a political and social project, which entails imagination and critical thinking. The future of design lies not in focusing on the things that will happen anyway but in giving shape to things that would not otherwise happen, and yet need urgently to happen.

When Berrizbeitia called for a shift of focus from "things that will happen anyway" to "things that need to happen urgently" she was voicing a growing sentiment that called for the

79. Reed and Lister, *Projective Ecologies*, 14. Emphasis added.

recovery of a normative aspect in design practice. Her statement echoed earlier positions held by speculative philosophy and radical theorists. Namely, the concept of "the great refusal"—a call for the rejection of consumer culture in the name of the emancipatory power of art—which is described by sociologist Herbert Marcuse in his *One Dimensional Man* (1964). Marcuse took the concept from philosopher Alfred North-Whitehead who used it to refer to "the determination to not to fall for the facticity of things as they are presented, but to favor the imagination of the ideal." [80]

Her statement reflected the pendulum completing its full swing. Social and political matters were rising once more.[81] If the question if political engagement, which more than ever pertains to ecology as well, is still open, might we look for clues elsewhere?

---

80. Alfred North-Whitehead, *Science and the Modern World* (Cambridge: The University Press, 1926); Herbert Marcuse, *One Dimensional Man* (Massachusetts: Beacon Press, 1964); Anita Berrizbeitia, "The Limits of Process: The Case for Precision in Landscape Architecture," in *New Geographies 8: Island*, ed. Daniel Daou and Pablo Perez-Ramos, 1st ed. (Cambridge, MA: Harvard University Graduate School of Design, 2016).

81. To give but two examples, the 2016 Pritzker was awarded to architect Alejandro Aravena, recognized for his socially engaged architecture. Later that same year, as curator of the Venice Biennial, he helped set an agenda that sought to close the gap between "architecture and civil society."

In "Nature at the End of the Millennium: Production and Re-enchantment" (1999), geographer Neil Smith provided an elucidating assessment of the state of affairs between political discourse and ecology. Smith noted that "the strengths of left analytical antisepticism have not left much room for the reconstruction of a powerful anti-ideology of nature that takes seriously the realities of the production of nature interwoven with deep emotional significance."[82] Since the seventies, when political ecology began coalescing bringing together environmental activists, Marxists, feminists, science critics, and social theorists, the Left has pursued this question predominantly analytically. But as Smith warns, quoting sociologist Max Weber, "the fate of our times is characterized by rationalization and intellectualization and, above all, by 'the disenchantment of the world.'"[83] As to how such project could be pursued or where it could begin, he observed that the most obvious difficulty is that it "takes place at […] the "desolate junction of poetics and political economy."[84]

82. Neil Smith, "Nature at the Millennium: Production and Re-Enchantment," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree (London: Routledge, 1998), 280.

83. Smith, 281.

84. Smith, 279.

Smith's formula for a new ecological sensibility is relevant because it suggests an inextricable link between design and politics. Not only that, but it also recognizes the need for a broader cultural shift under the notion of re-enchantment. The following chapter takes a closer look at the current cultural milieu in order to better understand the challenges it poses.

Page left intentionally blank.

CHAPTER 2: ZEITGEIST

An Uncommon Sense of Urgency

This dissertation is about the relationship between design and ecology, how has the evolution of political ecology been reflected in design, but also how can this relationship become a two-way street. Writing about ecology and ignoring the environmental crisis would be difficult. Though this dissertation is not about climate change or the larger environmental crisis (at least not in the traditional sense), it is pertinent, for the sake of transparency and intellectual honesty, to state a position regarding such highly politized matters.

It is tempting to begin with a list of the most recent incendiary headlines, something that has become, sadly, customary. There is no shortage on news regarding the losses in artic ice coverage or biodiversity, a new milestone in atmospheric CO_2 concentrations, yet another record-setting fire, drought, or hurricane season, or even a Pulitzer-winning piece of journalism

uncovering a corporate environmental scandal. These will be saved for the footnotes. Let us get straight to the bottom line: Global society has failed.

If we are to adopt the position of "climate realism," we must come to terms with the fact that we have failed to take the necessary actions to avoid the worse of climate change according to the scientific consensus. Due to the delayed nature of the effects of greenhouse emissions in the atmosphere, global warming is "baked in." This means that even if all emissions stopped now, the effects of the past 20 years of emissions are yet to be felt. Environmentalism is not a fad. Nor is it a "new normal."[1]

At the time of this writing, according to the latest report by the Intergovernmental Panel for Climate Change (IPCC)—the United Nations body dedicated to providing information relevant to understanding climate change—, global society has ten years to change course in order, not to avoid climate change—that ship is factually long gone—, but to avoid its most deleterious effects and embark into uncharted waters. Absolutely nothing suggests that the global

1. J. R. Ravetz, "What Is Post-Normal Science?," *Futures* 31 (1999): 689–703. A "normal" presupposes an apprehensible state of affairs. If anything, the new climate regime is characterized by the extreme uncertainties and high stakes studied by post-normal science.

community will meet the necessary changes to avoid crossing the threshold of two degrees Celsius. On the contrary, all evidence suggests the models put forth by climate scientists have fatally erred on the side of caution and, changes that were believed to occur towards the end of the century, will start taking place in the next decade or two. In other words, the worst-case scenarios now are the best.

For the uninitiated, the central fact is that the presence of CO_2 increases the amount of energy the atmosphere can store. This fact was recognized as early as in 1896 by scientist Svante Arrhenius.[2] In 2018, a Pulitzer-winning journalistic effort revealed that leadership at Exxon and Shell, two of the world's largest private oil companies, were made aware of the situation by their own researchers since the seventies.[3] The oil giants proceeded to fund organizations and thinktanks dedicated to sow public doubt.[4] In *Dark Money* (2016), investigative journalist Jane

2. Svante Arrhenius, "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground," *Philosophical Magazine and Journal of Science*, 5, 41 (April 1896): 237–76.

3. Benjamin Franta, "Shell and Exxon's Secret 1980s Climate Change Warnings," The Guardian, September 19, 2018, http://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/sep/19/shell-and-exxons-secret-1980s-climate-change-warnings.

4. Up to 2016, these companies have invested two billion dollars in misinformation campaigns.

Mayer documents this and other actions undertaken by the billionaire elite against climate science.[5]

In 2013, the IPCC determined that to avoid a two-degree Celsius increase in global temperatures, total CO_2 emissions should remain below 800 billion tons. Considering what has been emitted since, the remaining allowance is 270 billion tons. On average, yearly emissions amount to 37 billion tons which leaves little more than ten years to decarbonize the entire economy. Despite all efforts, 2017 saw a raise of 2% in CO_2 emissions.

Adding to this, publicly and privately-owned fossil fuel corporations have identified the equivalent of an additional 2.5 trillion tons of CO_2 in fossil assets. A quantity ten times larger than the allowed budget has already been accounted in the financial and geopolitical calculus of global actors that have every incentive to avoid turning their fossil wealth into stranded assets. Bluntly, nothing short of a miracle will avoid a two-degree Celsius increase in global

5. Jane Mayer, *Dark Money: How a Secretive Group of Billionaires Is Trying to Buy Political Control in the US* (Melbourne: Scribe, 2016).

temperatures.[6] This is already bad news, but, as in a nightmarish infomercial, "wait, there's more!"

A growing number of scientists agree there is a fundamentally flawed premise in environmental science: the nature of the rate of change. Generally, change is measured in units per year. For example, sea level rise is measured in millimeters per year. Even though there is awareness that changes are accelerating, observing annual rates presupposes that the rate of change is lineal. Predictions of future scenarios work by extrapolating such rates of change sometimes without accounting how much the rate of change itself might change. It is increasingly clear that the mechanisms of climate change are fundamentally non-linear.[7] Not

6. Johan Rockström et al., "Planetary Boundaries: Exploring the Safe Operating Space for Humanity," *Ecology and Society* 14, no. 2 (November 18, 2009), https://doi.org/10.5751/ES-03180-140232. The planetary crisis is not limited to climate change. The "planetary boundaries" framework proposed in 2009 by environmental scientists led by Johan Rockström from the Stockholm Resilience Centre and Will Steffen from the Australian National University proposes there are nine critical areas for Earth system processes. Climate change is one, but there is also biodiversity loss, the cycles of nitrogen and phosphorus, ocean acidification, land use, freshwater, ozone depletion, atmospheric aerosols, and chemical pollution.

7. Peter Wadhams, *A Farewell to Ice: A Report from the Arctic* (New York: Oxford University Press, 2017). A classic example of a feedback mechanism leading to non-linear changes is the loss of Artic sea ice. The most up to date models estimate that it is likely the region will witness a summer free of ice sometime in the 2020s. Given that ice helps keeping temperatures low by reflecting solar radiation—the albedo effect—its presence reduces up to 25%

only are certain individual feedback loops—self-reinforcing processes—not sufficiently studied, but little research has been done in terms of how feedback loops could reinforce and compound each other. The difference between a lineal change and a non-lineal change perspective is that effects that were estimated to be felt toward the end of the century will now be felt within the average person's lifetime—sometime in the next ten or twenty years.

The recognition of the non-lineal nature of climate change has made researchers pay more attention to so-called "tipping points." Tipping points, like falling domino pieces, could trigger what is known as "runway climate change."[8] Tipping points are particularly critical in scenarios beyond two degrees Celsius. After this threshold, climate models' uncertainty increases drastically.[9] Recent studies suggest the possibility of a "hothouse earth" scenario. Johan

---

the effects of emissions in the last thirty years. According to climate scientist Peter Wadhams, the disappearance of Artic ice could accelerate up to 50% the warming process.

8. Runaway change is when the climate system is pushed beyond a threshold triggering a transition into a new state at a rate determined by the system itself independent of human action.

9. Chi Xu et al., "Future of the Human Climate Niche," *Proceedings of the National Academy of Sciences* 117, no. 21 (May 26, 2020): 11350–55, https://doi.org/10.1073/pnas.1910114117. A recent paper published in the Proceedings of the National Academy of Sciences estimates that, under a business as usual scenario, by 2070 a third of the world population will live in regions affected by nearly lethal heat waves.

Rockström, director of Stockholm's Resilience Center, warns that we may be within a single degree Celsius of triggering a runway effect that could cause an accelerated rise in temperatures independent of human action.[10]

As it becomes increasingly clear that global human society is beyond the point of no return, the field of sustainability science has shifted its focus from mitigation to adaptation.[11] A key concept in this new approach is resilience.[12] Adaptation strategies based on resilience assume we will be able to "bounce back" and keep our ways of living. Doing so will require adjustments—like changing our diets or consumption habits—, that are everything but

10. Will Steffen et al., "Trajectories of the Earth System in the Anthropocene," *Proceedings of the National Academy of Sciences* 115, no. 33 (August 14, 2018): 8252–59, https://doi.org/10.1073/pnas.1810141115. The article suggests that though several individual feedback mechanisms have been identified (Artic ice loss, Amazonian and boreal forest deforestation, the Artic Jetstream, the Sahel, the glaciers, Siberian tundra, Indian monsoon, el Niño, among others), the way they could interact compounding each other is yet to be studied.

11. In the seventies and eighties, the idea was to avoid climate change; in the nineties and the aughts, focus went on to lessen its effects in what were called mitigation strategies. In the last decade, recognizing that climate change is already here and its worst effects are unavoidable, adaptation and resilience have become the new center of attention.

12. C. S. Holling, "Resilience and Stability of Ecological Systems," *Annual Review of Ecology and Systematics* 4 (1973): 1–23. The concept of resilience as defined by the ecologist C. S. Holling is the measure of the persistence of a system and its capacity to absorb change and disturbance while maintaining the same internal relationships.

structural. However, given that nothing points to the possibility of keeping change below two degrees Celsius and considering the consequences of not doing so—increased armed conflict, climate refugees, and political instability as the United States' Department of Defense has recognized—, we ought to consider adaptability strategies that part from a different premise.

Counter-Sustainability

One great obstacle to acting in the face of the crisis is denialism. Today, a diffuse majority wages a battle against a vocal minority of climate change denialists. The existence of this group—composed of billionaires with private interests, lobbyists, corrupted public officials and experts, and segments of the population prey of propaganda and misinformation campaigns, together with other conspiracy theory believers (anti-vaxxers, flat earthers, to name a couple)—is symptomatic of a contemporary anti-enlightenment zeitgeist. But while it is true that climate change denialism in particular and science denialism in general have to be abated, there is

another form of denialism, perhaps more insidious since it affects people concerned with matters of social and environment justice.

Individually and collectively, we are victim of mechanisms that push us to ignore, underestimate, or respond inadequately to the titanic magnitude of climate change.[13] From the point of view of the collective, social and radical ecology argues that the attitude towards environmental issues has been dominated by the ideology of neoliberalism.[14] Key attributes to this approach are hyper individualism, free-market fundamentalism, incrementalism, and atomism.[15] Hyper individualism is seen in the individuation of responsibility (a form of victim-blaming).[16] Instead of promoting collective political action, people are told to become better,

---

13. Ugo Bardi, "Cassandra's Legacy: Cassandra and the Limits to Growth," *Cassandra's Legacy* (blog), September 6, 2011, https://cassandralegacy.blogspot.com/2011/09/cassandra-and-limits-to-growth.html. Chemist and environmentalist Ugo Bardi has called this the "Cassandra Effect" in honor of the woman who in Greek mythology was cursed to utter true prophecies but had no one believe them.

14. Murray Bookchin, *Toward an Ecological Society* (Montréal; Buffalo: Black Rose Books, 1980); Carolyn Merchant, *Radical Ecology: The Search for a Livable World* (New York: Routledge, 1992). It is no coincidence that both, the current global environmental movement and neoliberalism, developed in the seventies.

15. Jem Bendell, "Deep Adaptation," *IFLAS Occasional Paper*, July 27, 2018.

16. For example, in recent years, the state of California has suffered historic droughts. Even though it is well documented that the agricultural sector is responsible for the largest share of water consumption, local

more informed, and ethical individual consumers: change their light bulbs, buy fair trade coffee, take shorter showers, do not use plastic straws, and so on. Free-market fundamentalism opts for making use of byzantine market mechanisms, such as cap and trade systems, instead of creatively exploring what could be achieved by direct government intervention. Incrementalism contents itself with achieving small successes instead of strategies capable of accelerating and scaling up change to the pace and scope required as suggested by the scientific consensus. Atomism sees climate change as a problem separate from governance and finance instead of trying to think about new political economies that allow changing course and reclaiming a different future.

From the point of view of the individual, according to sociologist Stanley Cohen, there are two types of denial: interpretative and implicative. When we accept certain facts but interpret them in such a way that makes then unacceptable, we fall into what is known as interpretative denial. On the other hand, if in response to troubling facts, we engage in activities that do not correspond to the nature or magnitude of the problem, we fall into implicative denial. This is what could be called "placebo activism": actions that make us feel better but have little bearing on

---

authorities encourage the citizenry to curb their water consumption while paying a blind eye to commercial and industrial consumption.

the problem (what philosopher Herbert Marcuse's referred to when he warned against mistaking movement for progress).[17]

Regarding other forms of denial, philosopher Timothy Morton has said:

> Denying the problem, […] amplifies the danger. And more subtle forms of denial exist. Wishing the problem away by "doing one's bit"—I use wartime rhetoric deliberately—is also avoiding the void. […][R]epetitive, compulsive activity kept the horror at bay. Helpful as they are, recycling and other forms of individual and local action could also become ways of fending off the scope of the crisis and the vastness and depth of interconnectedness. These responses fit contemporary capitalist life. Being tidy and efficient is a good idea, but it is not the meaning of existence.[18]

Cohen's insights help see this more subtle form of denialism: the space for action defined by the paradigms of sustainability and resilience is wholly insufficient to influence the root causes of our current quandary.

17. Herbert Marcuse, *One Dimensional Man* (Massachusetts: Beacon Press, 1964), 6.

18. Timothy Morton, *The Ecological Thought* (Cambridge, Massachusetts: Harvard University Press, 2010), 32.

In a polemic article titled "Deep Adaptation," Jem Bendell, founder of the Sustainability Leadership Institute at the University of Cumbria in the United Kingdom, breaks rank with the consensus of the scientific community accusing it of being slow, avoiding alarmism, thinking pessimism is counterproductive, and operating under the wrong premises regarding the nature of climate change.[19] Arguably much of Bendell's criticisms have to do with the scientific community's messaging, but one is factually concerning: non-lineal rates of change.

Bendell's arguments on the face of growing environmental data bolster the case for recognizing and addressing the more insidious type of climate change denialism that exists within environmentalists who believe in mitigation, adaptation, or other environmental policies framed under the notion of sustainability. Bendell's deep adaptation approach revolves around resilience, relinquishment, and restoration. The problem of these strategies is that they are operate under the same register as the "politics of limits" under which the environmentalist movement has operated traditionally. As much as environmentalism should be infused with a

19. In stark contrast to the scientific establishment, Bendell assumes collapse is unavoidable; catastrophe, probable, and extinction, possible. His agenda focuses on resilience, relinquishment, and restoration. Resilience should address the question of how to preserve what we want to preserve; relinquishment, what do we have to let go to not make things worse, and restoration, what can we recover to help us face future challenges?

healthy dose of realism (which is to accept that our current reality is grim), little will be achieved if this is not complemented by a similar reinvigoration of the space of possibility enabled by political imagination. In other words, the politics of the real always need to consider the politics of the possible.

Sustainability is an obsolete concept to frame the ecological crisis in any meaningful manner for several reasons. First, even if global society's growth plateaued, the dialectic between the material (energy and matter) and the immaterial (information, i.e. ideas and culture) would mean that an unchanging, steady-state is impossible.[20] Second, following from this insight, a mode of existence defined by limits, as implied by sustainability, would preclude the development of the necessary knowledge to avert potential "existential risks."[21] Lastly and most relevantly here, sustainability places the focus on resource scarcity completely negating the class dimension of ecology. Whenever we hear that the top percentage of the world's population or

20. Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015); David Deutsch, "Unsustainability," in *The Beginning of Infinity: Explanations That Transform the World*, Reprint edition (London; New York: Penguin Books, 2012), 76–99.

21. Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, 1st ed. (New York: Random House, 2007); Nick Bostrom, "The Future of Humanity," ed. Jan-Kyrre Berg, Evan Selinger, and Soren Riis, New Waves in Philosophy of Technology (New York: Palgrave McMillan, 2009).

the top number of polluting companies are responsible for the lion's share of emissions or resources consumed, we do not have a problem of scarcity but of proper redistribution. In this regard, we should speak of social and environmental justice instead of sustainability. However, if we are to believe the Left's analyses—suggesting that socio-environmental justice and biospheric integrity are structurally incompatible with the capitalist system—it becomes evident that any sound ecological theory must by necessity overlap with some form of postcapitalism.[22]

For many years, Marxist cultural critic Frederic Jameson saying that "it is easier to imagine the end of the world than the end of capitalism" went uncontested as some sort of cultural "second law of thermodynamics." Refreshingly, in the period after the Global Financial Crisis (GFC), the number of publications taking this challenge head on only seems to be increasing. To name some, the past few years have seen the publication of *Postcapitalism* (2015) by journalist Paul Mason, *Inventing the Future* (2016) by scholars Alex Williams and Nick Srnicek, *Utopia for Realists* (2017) by historian Rutger Bregman, Leigh Phillip's *The People's*

22. James O'Connor, "Is Capitalism Sustainable?," ed. Martin O'Connor, *Is Capitalism Sustainable?: Political Economy and the Politics of Ecology* (The Guilford Press, 1994); James O'Connor, "The Second Contradiction of Capitalism," in *Greening Marxism*, ed. Ted Benton (New York: The Guilford Press, 1996), 17–35.

Republic of Walmart (2019), and Aaron Bastani's *Fully Automated Luxury Communism* (2020).[23] From the adoption of a universal basic income, shorter work weeks, decentralized blockchain based democracies, right to idleness, and the abolition of national borders, they differ in their finer details, but all have in common: (1) a departure from the old Left versus Right dichotomy in politics, (2) a critique of the parochialism of local politics, (3) an embrace of technological literacy, (4) the recognition that climate change is just the symptom or one facet of a deeper crisis triggered by capitalism, and (5) a shared sense of postmodernism's inadequacy to frame the ecological crisis productively. The term "climate realism" seeks to overcome certain forms of social constructivism and scientific skepticism derived from postmodern critique.

So, here we are. If we believe climate change can be fought from within capitalism, we have the technologies and the policies. If we do not, we have the analytical tools, the renewed class consciousness, and the social will for mobilization. As citizens, the first set of solutions

23. Paul Mason, *Postcapitalism* (London: Penguin Books, 2016); Rutger Bregman, *Utopia for Realists* (London: Bloomsbury, 2018); Aaron Bastani, *Fully Automated Luxury Communism*, (New York: Verso, 2020); Nick Srnicek and Alex Williams, *Inventing the Future: Postcapitalism and a World without Work* (London: Verso, 2016); Leigh Phillips and Michal Rozworski, *People's Republic of Walmart: How the World's Biggest Corporations Are Laying the Foundation for Socialism* (New York: Verso, 2019); Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015).

translate into either becoming more responsible consumers (if we believe in green capitalism and "voting with our dollars") while the second translates into collectively organizing for political change (if we agree capitalism will gladly kill anything for profit). As designers, the same solutions translate into either "green design strategies" or politico-ecologically conscious projects, interventions, or activism that foster a sense community and environmental well-being or at least raise awareness.[24] If the analysis is sound and the solutions are there, what gives then?

Anti-enlightenment and Postmodernism

If the GFC of 2007-9 did not dispel once and for all the neoliberal myth that "a high tide lifts all boats," at least it seriously put into question its moral legitimacy.[25] Since then,

24. Examples of "green design strategies are energy efficiency LEED certifications, bioclimatism, cradle-to-cradle principles, hi-tech, vernacular, eco- and bio- architecture styles, biomimicry and any other technology and policy-based solutions. Examples of politico-ecologically conscious approaches are the Transition Towns Initiative, Critical Regionalism, and research and academic projects that seek to raise awareness on such matters.

25. George Monbiot, "Neoliberalism: The Ideology at the Root of All Our Problems," *The Guardian*, April 15, 2016, sec. Books, http://www.theguardian.com/books/2016/apr/15/neoliberalism-ideology-problem-george-

architecture's political vocation has been reinvigorated through new practices and discursive concerns as the themes of symposia, biennials, publications, and other forms of cultural production suggest. However, our political climate—characterized by the worldwide regression of democracy—seems to point not to the decline of the current politico-economic system, but a wholly different cultural phenomenon characterized by the erosion of the egalitarian and democratic values promoted by the Western Enlightenment.

The victories of populist, anti-globalist demagogues show that espousing traditional neoliberal discourses does not guarantee electoral victory.[26] Those who discount this phenomenon by attributing it to the lower, rural, uneducated, or anti-intellectual classes underestimate the coherence of its underlying ideology (as wrong as it might be). This

---

monbiot. Environmental journalist George Monbiot offers a concise summary of the problems with neoliberal ideology regarding ecology.

26. Democratic candidate Hillary Clinton had the endorsement of Wall Street executives, the military industrial complex and even super-conservative figures like former Vice President Dick Cheney.

phenomenon is also underestimated by those who read it simply as the re-emergence of plain, old populisms or nationalisms.[27]

The same way in which modernity's emancipatory values degenerated into totalitarian doctrines and the alienation of humans and nature, today, the endlessly critical and dogmatically pluralistic values of postmodernity have degenerated into relativism and the impossibility of a common accord.[28] The irony of the situation is that, not only did critical theory and the progressive Left failed to articulate an effective alternative, but their intellectual arsenal has been weaponized against in a sort of cultural autoimmune reaction.[29]

---

27. The Economist, *Populism Is Reshaping Our World*, 2017, https://www.youtube.com/watch?v=ekc5EAPPPgk.

28. Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Winchester, UK; Washington [D.C.]: Zero Books, 2009). Critic Mark Fisher put it thusly: "Where postmodernism embraced difference and plurality, parody, and complicitous critique (to use Linda Hutcheon's phrase), it now takes for granted this challenge and itself becomes, along with modernist styles, a frozen aesthetic, an expressionless commodity decorating the background of our life world."

29. Neil Smith, "Nature at the Millennium: Production and Re-Enchantment," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree (London: Routledge, 1998), 280.

From the point of view of design, the recovery of a political commitment is a good first step to address our current crossroads. Nevertheless, if the depth of the undergoing cultural schism is fully acknowledged, it is easy so see how architecture's renewed political consciousness might still be inadequate. Not only is an alternative to the late-capitalist neoliberal model still needed, but now, simultaneously, radicalized ideologies—neofascist, anti-globalist, anarcho-capitalist, paleo-conservative, ethno-nationalist, turbocharged thanks to the postmodern apparatus—need to be countered.[30] All, while weathering the cascade of headlines on how the planet is being roasted.

The prospects seem overwhelming. Apathy or resignation are understandable reactions considering the track record of political hopelessness of the past five decades. Critic Mark Fisher called these feelings "neoliberal melancholia."[31]

---

30. Geographer Erik Swyngedouw, quoting Slovenian philosopher Slavok Žižek, states that we live in a post-political era where critical theory has been neutralized and assimilated as a fundamental part of the neo-liberal ideological fantasy allowing the illusion of consensus. The argument here goes further stating that not only has the critical apparatus been neutralized, but it has been instrumentalized against both left and center ideologies.

31. Mark Fisher, *Ghosts of My Life: Writings on Depression, Hauntology, and Lost Futures* (London: Zero Books, 2014).

Philosophers Harrison Fluss and Landon Frim declared that the far right (which includes the alt-right movement) has adopted the postmodern critical apparatus weaponizing it against the liberal Left.[32] According to Fluss and Frim, the values of the reactionary right are that "first, the universe is fundamentally incomprehensible and mysterious; second, that there isn't a universal human nature, but only unsurmountable differences between individuals, and, third, that reason represents a form of totalitarianism since it erases essential differences between humans."[33] The only way of fighting against irrationality and divisive rhetoric based on hate and fear is to revisit and update the liberal values of the Enlightenment.

In *The Progress of This Storm: Nature and Society in a Warming World* (2017), after offering a harsh but precise critique of trends within political ecology, sociologist Andreas Mälm also

32. Harrison Fluss and Landon Frim, "Aliens, Antisemitism, and Academia," Jacobin Magazine, March 2017, http://jacobinmag.com/2017/03/jason-reza-jorjani-stony-brook-alt-right-arktos-continental-philosophy-modernity-enlightenment/. The alt-right movement includes supremacist, neo-Nazi, anti-Semitic, Assimilationist, nativist, anti-feminist, homophobic, and Islamophobic groups. The cabinet of U.S. President Donald Trump has included several figures associated with the movement including presidential senior advisor Stephen Miller's, special assistant Julia Hahn, national security advisor Michael Flynn, and the infamous strategist and former director of the Breitbart News website, Steve Bannon. Fluss and Frim argue how the principles of enlightened modernity can find their origin in the Semitic philosophical tradition and, therefore, any anti-modern thought is also anti-Semitic.

33. Fluss and Frim, 2017.

suggested that a reconsideration of some of the values of the Enlightenment is needed to correct the cultural maladies of postmodernity. His book focuses on the effect that postmodern critical theory has had on the debates around global warming and calls for the recognition of a "climate realism" to remedy epistemological relativism and science skepticism that characterize postmodern critique.[34]

Briefly put, the problem of nature is as follows: the emancipatory project of the Enlightenment sought to free humans from nature's yoke and other humans. Until then, human history had consisted of cycles of growth and collapse (the so-called "Malthusian trap"). With the intellectual and technological revolutions of the seventeenth and eighteenth centuries, humans became capable of mobilizing large swaths of nature improving, if albeit unevenly, the material conditions of life.[35] However, the separate conception of nature and society also made

34. Mälm, Andreas. *The Progress of This Storm: Nature and Society in a Warming World.* (London; New York: Verso, 2018), 189.

35. For example, the discovery of blood circulation led to the discovery of metabolism itself, which in turn led to a better understanding of the chemical cycles of the soil. This is the basis that eventually led to the invention of artificial fertilizers and the agricultural revolution that broke the so-called "Malthusian trap" in the nineteenth century. The science of agronomy made it possible to overcome the demographic pressures exerted by previous biophysical limits.

possible the alienation under which modern capitalism (and mainstream environmentalism) operate. For this reason, some point to the Enlightenment as the moment where nature and culture were separated (i.e. Cartesian dualism).

In neoclassic economics, nature (natural capital) is an inexhaustible sink and source of cheap capital (resources) and labor. The concept of "externality"—referring to the unaccounted economic impact experienced by third parties—illustrates how nature is conceived as something "other," separate, literally external. This alienation results in ways of organizing society that impoverish the biophysical realm and are socially unjust. Ironically, mainstream environmentalism, which constantly fights again economic ideology, shares the same conception of external nature. This is evident when environmentalism speaks of an idealized, pristine nature that ought to be restored or when it sees in this romantic, pre-modern ideal the only legitimate source of ethical values (i.e. bioethics). Such conceptions of nature result in a series of dichotomies which by default will always be antagonistic (e.g. human-nature, natural-artificial, urban-wilderness).

As an antidote to the effects of alienation between humans and nature, postmodern theory developed frameworks around the notion of hybridity that sought to blur or reverse the separation. Anthropologists spoke of nature as a social construct (studying the ways in which a group's worldview bears upon its conception of nature); geographers spoke of the material substrate of the process of co-production of nature (the dialectic between the way in which cultures shape the environment and, in turn, the environment shapes them), and philosophers spoke of hybrid assemblages and the agency of the non-human world (how the inexorable imbrication of human and natural systems means that it's impossible to find any pure elements).[36]

Mälm argued that, by blurring differences between the human and the natural, postmodern formulations preclude the possibility of conceiving a distinct human agency necessary to resist and, ultimately, change the "system" (he suggests it would be more productive

36. William Cronon, *Uncommon Ground: Toward Reinventing Nature* (New York: W.W. Norton & Co., 1995); David Harvey, *Justice, Nature, and the Geography of Difference* (Oxford, UK; Malden, MA: Blackwell Publishers, 1996); Bruno Latour, *We Have Never Been Modern* (Cambridge, Massachusetts: Harvard University Press, 1993); Timothy Morton, *Ecology without Nature: Rethinking Environmental Aesthetics* (Cambridge, Massachusetts: Harvard University Press, 2007).

to talk about "system change" rather than climate change).[37] If humans and nature operate under the same laws, it is, by definition, impossible to reclaim the distinct agency required to change the system.

Put in other words, there are two conceptions of nature. One is dualistic or external where nature is defined stipulatively as anything that is not human. Another one is universal or monistic where nature is defined operatively as anything that is governed by the laws of physics. In the case of external nature, its opposite is the artificial, but in the case of universal nature, its opposite is the supernatural. Given that, so far, the laws of physics cannot explain the so-called "hard problem of consciousness," a universal conception of nature means free-will or agency is either an illusion or a supernatural phenomenon.

Both definitions of nature are useful to some extent and sometimes they are unknowingly mistaken for one another leading to logical contradictions and inconsistencies.[38] In fact, the

37. Here, by system, he is referring to the political-economic model of neoliberalism. That we can refer to it simply as "the system" is symptomatic of the "naturalization" of capitalism.

38. To give two examples, Mälm analyses such inconsistencies in the arguments of Cronon and Smith. Morton performs a similar analysis in Arne Naess' notion of deep ecology.

distinction between natural and social sciences arises from these distinctions, and the so-called "science wars" of the nineties hinged around the epistemological and ontological conflicts that arise from this unresolved issue.[39] After social constructivism challenged common-sense realism and scientism—the belief in science as an ideology supposedly apolitical and transhistorical—with extreme forms of idealism that negated objective reality or counterproductively undermined the social role of science, the work of philosophers such as Latour, Stengers, and Haraway sought to reach a more agreeable middle ground.[40] Deciding whether theirs or other attempts have been successful at bridging the cultural gap between the sciences or solving the problem of nature is beside the point here. What is crucial is that, in the current moment of scientific denialism, the postmodern critical apparatus seems to have been co-opted and weaponized against the Left by a new anti-enlightened cultural moment.

39. McKenzie Wark, "The Science Wars: Physics vs Cultural Studies," 1996.

40. William Cronon, *Uncommon Ground: Toward Reinventing Nature* (New York: W.W. Norton & Co., 1995); Michael Soulé, "The Social Siege of Nature: Reinventing Nature? Responses to Postmodern Deconstruction," ed. Michael Soulé (Washington, D. C.: Islands Press, 1995), 137–70.

In 2012, the philosopher Nick Land, known in some circles as "the father of accelerationism," wrote an essay titled "The Dark Enlightenment."[41] The text has become foundational for the neo-reactionary movement (abbreviated NRx by its members). The extensive manifesto presented serious arguments against democracy, egalitarianism, and progress; proposed a return to centralized forms of government such as neo-cameralism (where a country is owned by a corporation and ran like a business), the substitution of government by a purely technological apparatus, nationalist economic policy, and ultraconservative social values.[42] Given the affinity of certain epistemological orientations, the ideas elaborated in Land's text were adopted by paleo-conservative and neofascist groups in places like Eastern Europe, Silicon Valley

41. Nick Land, "The Dark Enlightenment," Blog, http://www.thedarkenlightenment.com, 2012, http://www.thedarkenlightenment.com/the-dark-enlightenment-by-nick-land/#comment-75364.

42. Thomas Carlyle, *On Heroes, Hero-Worship and the Heroic in History* (Oxford: Oxford University Press, 1841). Land was greatly influenced by thinkers such as the Scottish historian Thomas Carlyle who many consider to be a key figure in the later development of fascist ideologies in the twentieth century. Carlyle wrote that "history is the biography of great men." At the time of this writing, a video from the administration presented at the US-North Korea summit in Singapore begins by paraphrasing Carlyle when he says that, of the seven billion people, only a few have the power to change the course of history with their actions. (The video was described by a comedian as a cross between a real estate promotion and a cheap martial arts movie.)

techno-billionaires, and the Trump White House.[43] Ignored by mainstream media for years, the movement permeated all levels of society and extended beyond the US and Europe.[44] The most visible symptom was the resurgence of far-right nationalist parties—opportunist political demagogues supported by extra-urban, blue collar classes. Calling adherents of these ideologies "deplorables" suggested that their movement was undeserving of serious intellectual attention, but this perception was mistaken.

A New York Times op-ed piece titled "Meet the Renegades of the Intellectual Dark Web" (2018) described an emerging group of thinkers and commentators whose ideas were not fully aligned with so-called "PC culture."[45] At the time, philosopher of religion Sam Harris was

43. Curtis Yarvin and Peter Thiel, both Silicon Valley entrepreneurs with connections to the White House, have been the most vocal figures of this movement in the North American context. Among their influences are the self-proclaimed Italian "super fascist" Julio Evola, founder of the school of magical idealism, the American economist Murray Rothbard, precursor of anarcho-capitalist libertarianism, and the Russian philosopher Alexander Dugin, promoter of the acceleration of the end of history through "total war."

44. Jamie Bartlett, "Meet the Dark Enlightenment: Sophisticated Neo-Fascism That's Spreading Fast on the Net," *The Daily Telegraph*, January 20, 2014; Matt Sigl, "The Dark Enlightenment: The Creepy Internet Movement You'd Better Take Seriously," *Vocativ*, December 2, 2013.

45. Bari Weiss, "Opinion | Meet the Renegades of the Intellectual Dark Web," *The New York Times*, May 8, 2018, sec. Opinion, https://www.nytimes.com/2018/05/08/opinion/intellectual-dark-web.html.

one of the figures that had garnered more media attention. Harris has recounted the moment he felt something had gone awry during a conference panel with biologist Richard Dawkins and physicist Neil DeGrasse Tyson, both outspoken atheists. Generally, Harris' criticism of religion did not sit well with the conservative right. However, his statement that not all cultures offer the same potential for individual flourishing triggered strong criticism from the Left. After his lecture, where he criticized some Islamic factions, an audience member approached him to say that he could not state that forcing women to wear burqas was objectively wrong and that it was just a matter of opinion. Harris replied with a question: Would it also be a matter of opinion if the tradition was to pull an eye out of every third baby? Though Harris' example was a false equivalence, the answer he received left him dumbfounded: "it would depend on the reason behind the ritual." He was struck by what he characterizes as "moral relativism operating under the banner of multiculturalism blinding otherwise educated people to the intolerance and cruelty in other cultures." Experiences such as Harris' suggest that, in the absence of constant critical re-evaluation, certain tools, concepts, values, and frameworks associated to the Left and stemming from postmodern critique had become dogmatic.

An example of one such case of conceptual ossification is the notion of cosmopolitics developed by Stengers and later adopted by Latour.[46] The aim of cosmopolitics was to expand the realm of the political to include those who have been voiceless or those whose voices have been ignored. For example, this would mean that when considering the pertinence of large infrastructural projects, the say of experts should have the same weight as that of affected local indigenous groups.[47] Without a doubt, this was a much-welcomed proposition in the context of post-colonialism and social justice movements.

However, as philosopher Steven Shaviro observed, Stengers' formulation of cosmopolitcs left some crucial questions unanswered.[48] Case in point: if all voices are to be equally heard, what to do with the opinions of climate change denying evangelical fundamentalists?[49] Latour himself

---

46. Isabelle Stengers, *Cosmopolitics* (Minneapolis: University of Minnesota Press, 2010); Albena Yaneva and Alejandro Zaera, eds., *What Is Cosmopolitical Design?: Design, Nature, and the Built Environment* (Burlington, Vermont: Ashgate, 2015).

47. Mario Blaser, "Is Another Cosmopolitics Possible?," *Cultural Anthropology* 31, no. 4 (2016): 545–70.

48. A post-colonial moment when those who have been historically excluded are to be back into the fold: women, minorities, the LGBTQ+ community, non-human persons, and the environment.

49. Steven Shaviro, "The Pinocchio Theory: Cosmopolitics," Blog, May 28, 2005, http://www.shaviro.com/Blog/?p=401.

in his seismic essay "Why Has Critique Run out of Steam?: From Matters of Fact to Matters of Concern" (2004) lamented having developed the toolkit for scientific skepticism now turned against the fight against global warming.[50]

Postmodern critical theory and the Left not only failed in articulating an effective alternative ideology against neoliberalism, but its critical apparatus became co-opted and deployed against itself. The re-emergence of far-right parties and the worldwide regression of democracies—political actualizations of Dark or anti-enlightenment ideals—were like an autoimmune response to the remedy postmodernism once seemed to be. The vaccine worsened the infection.

Our current anti-enlightened moment is a sorry state of affairs, but we ought to remain vigilant about an overcorrection. Consider Harvard scholar Steven Pinker's call for a return to the values of the Enlightenment. In *Enlightenment Now: The Case for Reason Science, Humanism and Progress* (2018), he argued that the world is experiencing unprecedented levels of peace, public

50. Bruno Latour, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225–48.

health, literacy, and overall prosperity.[51] Pinker's findings came from extensive empirical data analysis. He specifically called to leave behind the skepticism that questions positivist science and the notion of progress.[52] Nevertheless, as writer Jeremy Lent argues in an incisive analysis, the dangers in Pinker's narrative lie in its veiled conservatism.[53]

---

51. Steven Pinker, *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress* (New York, NY: Penguin Random House, 2018).

52. His optimism made him a darling of the global elites. His books have been recommended by the likes of billionaire philanthropist Bill Gates; he has presented his views on "PC culture" to global leaders in Davos, and Time magazine has named him one of the hundred most influential figures.

53. Jeremy Lent, "Steven Pinker's Ideas About Progress Are Fatally Flawed. These Eight Graphs Show Why.," www.resilience.org, May 18, 2018. Lent was careful in his rebuttal of Pinker's research. He avoided falling for the skepticism and relativism, applying instead Pinker's same empirical methods (plus a healthy dose of criticality). Lent deployed eight graphs to question each Pinker's main theses. Consider only one: "A rising tide lifts all the boats." Pinker retells the story of World Bank economist Branko Milanović who, while studying worldwide income raises by percentile from 1998 to 2008, discovered the so-called "elephant graph" (for its resemblance to an elephant with an erect trunk). What the graph seems to reveal is that, though the top 1% of the population increased its earnings disproportionately, the lower percentiles seem to have enjoyed similar gains (apparently only middle classes in developing countries didn't experience improvements). However, as Lent points out, Milanović's graph is deceptive because it compares income growth as a percentage in radically different population groups:

> If an executive making 200k per year sees a raise of 10%, they can now buy their teenage son a car with the extra 20k. But the same 10% increase would represent a measly twenty-five cents for the three billion people living on $2.50 per day.

Pinker's elephant graph, which he uses to argue that everyone benefits of a growing economy regardless of its distribution, is an elegant way to hide the fact that the top 1% of the world's population has seen their income grow 65 times in absolute terms compared to the bottom half of the world's population. In other words, what Pinker

Lent denounces Pinker for aiming to establish a necessary relationship between the notion of progress and a free market economic model with centrist values. As Lent's analysis suggests, the progress the world has witnessed over the past century has occurred *despite* the model espoused by the likes of Pinker.[54]

Up to this point, we seem to be torn between proposals to return to the Enlightenment values coming from the Left, the Dark Enlightenment coming from the far-right, and independent individuals (like those in the Dark Intellectual Web) revealing that the old distinctions between progressives and liberals are not enough to chart the intellectual coordinates of all positions involved. The reading offered here is that the political gridlock the world witnesses results from a deeper cultural crisis between the progressive, liberal values articulated in the emancipatory project of the Enlightenment and the moral relativism which a postmodern sensibility seems to have degenerated. Postmodern sensibilitie sought to be disassociated from

---

unabashedly suggests is the old notion that a rising tide lifts all boats which is the main theme of so-called "trickledown" economics or "Reaganomics" for its connection to the US President Ronald Reagan economic policy.

54. In one of his eight graphs, Lent shows how improvements in public health track closer to improvements in public education than with GDP growth.

anti-enlightenment attitudes. The next chapter will offer a more in-depth review of this matter. For now, we turn back to design.

Design and Post-capitalism

How do these considerations concern designers? In terms of dealing with climate change, the design disciplines fall, for the most part, within one of the two types of denialism described by Cohen. In our interpretative negation, we minimize the severity of the problem and maintain the status quo of practice. In our implicative negation, we underestimate the role the design disciplines could play and seem content with the role assigned to them by the mainstream.

The role designers are relegated to when it comes to addressing climate change is narrow. Take for example *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming* (2017), where environmentalist Paul Hawken compiles the top hundred most

promising strategies in terms of their potential to abate climate change.[55] The strategies are sorted in categories such as energy, waste, transportation, agriculture, buildings, and cities, and so on. In the categories pertaining the built environment disciplines, designers are left with the promoting of green roofs, better building insulation, LED lighting, and so-called "net-zero" buildings. In terms of cities, urban designers can increase bike lanes, design for pedestrians, and reduce water leaks. Even when the book observes the impact of producing concrete, the role given to design is minimal.[56] These examples illustrate the mainstream conception of what could be design's contributions to the environmental problem. It does not matter whether vertical gardens, pocket parks, or timber construction could be included in the list or not. The point is that it is a piecemeal approach with actions that serve to give the illusion of doing something—placebo environmentalism. For this reason, social ecologist Murray Bookchin distinguished

55. Paul Hawken, *Drawdown: The Most Comprehensive Plan Ever Proposed to Roll Back Global Warming* (London: Penguin Books, 2018).

56. Vaclav Smil, *Making the Modern World: Materials and Dematerialization*, 1st ed. (New York: Wiley, 2013). For a more comprehensive overview of the roles and impacts of different modern material industries environmental historian Smil's work.

between ecology, which he considered radical and innovative, and environmentalism, which he saw as reformist or state-oriented and failed to address the root cause of ecological problems.[57]

Compared to design's synthetic prowess made evident in the comprehensive projects of the early twentieth century—oftentimes now derided as "utopian"—the mainstream view of design's potential contribution is minute and disjointed. In *Gray World, Green Heart* (1994), landscape architect and educator Robert Thayer expressed this precise point writing:

> "Can a few conspicuous solar houses, constructed wetlands, bike paths, recycling industries, wildlife habitat corridors, organic agriculture plots, and wind farms really be the key to saving the world? Isn't a much greater transformation needed in global, economic, political, and social institutions? The answer to the last question is, of course, yes."[58]

57. Murray Bookchin, *Toward an Ecological Society* (Montréal; Buffalo: Black Rose Books, 1980).

58. Robert L. Thayer, *Gray World, Green Heart* (New York: Wiley, 1994).

Thayer makes a keen observation that the institutions needed for change depend on the consciousness of the people that will create them. Paraphrasing Marcuse, "art might not change the world, but it can change the minds of those who can change the world."[59]

In *Good City Form* (1981), urban planner Kevin Lynch considers the main failure of conventional utopian visions to be either the envisioning of a radical society in an ordinary city or an extraordinary city inhabited by an unaltered society.[60] We ought to recognize, as the work of urban theorists and radical geographers suggest, the dialectic between space and society. In other words, that there is a reciprocal relationship between specific forms of political economy and urbanization patterns. It is as important to theorize the mechanisms post-capitalism as it is to imagine its form. As French sociologist Henri Lefebvre put it: "A revolution that does not produce a new space has not realized its full potential."[61]

---

59. Herbert Marcuse, *The Aesthetic Dimension: Toward a Critique of Marxist Aesthetics* (Boston, MA: Beacon Press, 1978), 33; Malcolm Miles, "Eco-Aesthetic Dimensions: Herbert Marcuse, Ecology, and Art," *Cogent Arts & Humanities* 3, no. 1 (2016).

60. Kevin Lynch, *Good City Form* (Cambridge, MA: MIT Press., 1981).

61. Henri Lefebvre, *La Production de l'Espace* (Paris: Éditions Anthropos, 1974), ??.

The contemporary Left does not have a progressive and radical aesthetic project. As the work of philosophers like Jacques Rancière or Slavoj Žižek suggest, there is an insoluble relationship between politics and aesthetics.[62] Any politico-ecologic project requires a description of the type forms and urbanization patterns that would accompany and foment different social and politico-ecologic relationships. This spatial and aesthetic description must stem from a structurally transformative analysis of such relationships. Otherwise, it will not amount to more than the mere aesthetization of unquestioned ideologies of nature. The dialectic between aesthetics and politics in general and space and modes of social production and reproduction in particular means that any postcapitalist project is also an aesthetic and spatial one. Yet, to my knowledge, with the exception of an essay by architect Alejandro Zaera-Polo, there are no serious proposals for developing a postcapitalist design program or framework. This is an immediate area ripe for research and exploration.

In 2016, Zaera-Polo proposed a "political compass" for architecture. The diagram positions nearly 200 design practices in a field with seven sectors: activism, populism,

62. Jacques Rancière and Peter Engelmann, *Politics and Aesthetics* (Cambridge: Polity Press, 2019).

historicism, materialism, existentialism, cosmopolitanism, and techno-criticism. In the essay accompanying the diagram, "Well into the 21st Century: The Architectures of Postcapitalism?" (2016) Zaera-Polo observes a resurgence of political involvement in architecture and identifies the GFC of 2007-9 as the trigger.[63]

The biggest problem with his compass is that it assigns a political commitment to all practices regardless of whether it is deliberate or post-rationalized. For example, the "populist" category includes offices such as BIG, MAD and FREE which could easily be seen as prime examples of commodified architecture and watered-down aesthetics primed for mass consumption. This problem is especially acute in the "existential" category where the isolation of certain offices might be considered a voluntary distancing from the system (instead of a simple

63. Zaera-Polo, Alejandro. 2016. "Ya bien entrado el siglo XXI, ¿las arquitecturas del Post-capitalismo?" El Croquis 187. It is beyond the scope of this writing to analyze each category, but a few trends observed by Zaera-Polo are worth being mentioned. In response to the complexity of parametricism (a style explicitly linked to neoliberal techno-science), today, there is a preference for simpler, iconic, or monumental shapes eschewing algorithmic form-finding processes for strategies closer to collage or *objet trouvé*. The deployment of historical references is intensified to resist the frivolous commodification of architecture. In response to new representation imposed by photorealism, the craft of graphic representation is recovered in didactic axonometric drawings, line drawings in neo-naïve pastel color palettes, and even the populist graphic language of comic books. Lastly, in response to the photogenic, spectacular, and real estate brochure-friendly images produced by the architects in the so-called star-system, there is a return to emphasizing materiality, inconspicuous aesthetics, anonymity, "realism" or povera as a way to avoid the superficiality of the image.

failure to become commercially viable). Zaera-Polo even wonders if the obsession with the production of drawings (as opposed to the construction of buildings) stems from the impossibility of landing clients in depressed markets. Lastly, many offices are included under the rubric of generic or anonymous aesthetics when these types of offices have always existed, and instead, what characterizes this new crop is an indifference towards political matters.

As is the case with every taxonomy, the greater its general explanatory power the weaker its resolution and vice versa. Zaera-Polo seeks to formulate a post-capitalist taxonomy. Yet, by defining aesthetic categories negatively (that is to say, in terms of what they are against: commodification, banality, lack of criticality, opaque complexity, techno-scientism), we are left with a catalog of anti-capitalist footnotes instead of a coherent post-capitalist narrative. Zaera-Polo's model is not perfect, but it offers a point of departure.

Without referencing postcapitalism, at least three recent books have explored the relationship between politics and architecture practice and discourse in the period after the GFC. *Architecture Against the Post-Political: Essays in Reclaiming the Critical Project* (2014) and *Can Architecture Be an Emancipatory Project?: Dialogues on the Left* (2016) both edited by architecture

theorist Nadir Lahiji and *Positions on Emancipation: Architecture between Aesthetics and Politics* (2018) edited by architecture theorists Florian Hertwerk and Nikolaos Katsikis in 2018.[64] All are the result of round table discussions (among theorists in the former case and practitioners in the latter). Like Zaera-Polo, both recognize the GFC as a watershed moment for the discipline.

Hertweck and Katsikis quote historian Charles Jencks who laments the lack of clear positions in architecture and observe how the discipline seems to be infected with a form of "neoliberal indifference" since the nineties. Hertweck offers a brief recount of political militance that seems to wax and wane beginning with the student protests of 1968 and concluding with our present moment (coincidentally, some commentators compared the extreme number of worldwide protests in 2019 with the 1968 movements).[65]

---

64. Nadir Lahiji, ed., *Architecture Against the Post-Political: Essays in Reclaiming the Critical Project* (Routledge, 2014); Nadir Lahiji, ed., *Can Architecture Be an Emancipatory Project? Dialogues on the Left* (Winchester, UK; Washington [D.C.]: Zero Books, 2016); Florian Hertwerk and Nikos Katsikis, eds., *Positions on Emancipation Architecture between Aesthetics and Politics* (Baden, Switzerland: Lars Müller Publishers / University of Luxembourg, 2018).

65. Back then, emancipation meant the liberation of society from architecture which was considered an instrument of technocratic control. Architect Aldo Rossi declared architecture ought to become autonomous as an anti-capitalist act. Figures like architects Giorgio Grassi and Leon Krier proposed a return to craft in response to industrialization. Despite the range of positions, two things united all dissidents: preventing architecture from

Today, there is a renewed academic interest in the works of sociologist Henri Lefebvre, cultural critic Frederic Jameson, architect Manfredo Tafuri, and philosopher Karl Marx. On the professional front, new generations of practicing architects express a growing disquiet for topics like political polarization, global warming, and social inequality. Architect Alejandro Aravena—better known for his socially committed work—was awarded the Pritzker price, and, shortly afterward, his curatorial proposal as director of the Venice Biennial sought to bring the focus back to social themes. These are all signs of a changing disciplinary sensibility.

Contrasting with the inductive aesthetic taxonomy of Zaera-Polo, Hertweck and Katsikis' deductive categories referred to modes of practice: activism, pragmatism,

becoming an instrument of a functionalist technocracy and avoiding subordination to external disciplines such as sociology. In Germany, in the eighties, the figure of the architect went from being seen as "an independent author to a consultant or middle person at the service of the users of the built environment."[65] Finally, in the nineties, a so-called "Third Way" emerged.[65] This alternative was espoused by sociologists Anthony Giddens and Ulrich Beck and in politics by prime ministers Tony Blair and Gerhard Shcröder. The clearest representative of this position was the architect Rem Koolhaas. According to him, neither leftist nor conservative architects could have a real impact since both groups had rejected getting involved with "the dirty reality" of global capitalism. Koolhaas' practice sought to change the built environment as much as the discourse of the discipline. Nevertheless, the Third Way approach was criticized for being what was considered a form of "soft capitalism." After the GFC and the subsequent popular discontent with the neoliberal narrative, the architectural pragmatism associated with "Third Way" politics raised new questions about architecture's political competency.

"programmatism," analysis, and narrative.[66] Activists fight from the front lines many times working *pro bono* for NGOs. Pragmatists believe architecture can trigger incremental changes, no matter how small, from a progressive practice. "Programmatists" favor involvement with spatial production from its early stages so that they can better position themselves to influence the planning process. Analysts put design's representation and visualization tools at the service of research in order to reveals processes or conditions otherwise invisible (a large part of their work involves the production of "critical cartographies" sometimes in collaboration with geographers or sociologists). Lastly, narrators develop speculative design fictions informed by a critical vision. All the groups and individuals included in their list had explicit political aspirations (unlike Zaera-Polo's taxonomy which is more of an interpretation).

Lahiji's volume goes a step beyond a descriptive survey of architectural practices. Instead, through critical discourse, it offers a prescriptive analysis of the relationship between architecture

66. In contrast with the inductive and exhaustive categories proposed by Zaera-Polo, Katsikis and Hertwerk work with an ad hoc deductive taxonomy of practice.

and the sociopolitical conditions of capitalism.[67] The production of the built environment is the responsibility of multiple agents of which architects are some of the least influential. Consequently, architects find themselves confined between two extremes. One is the path of a "disciplinary protectionism" where practitioners seek to claim exclusivity rights over an area of specialization which risks confirming their "sublime uselessness" (quoting Tafuri). This amounts to a complete involuntary alienation mistaken for professional autonomy. On the other end, architects find themselves forced to claim a larger competency (as was the case of architect Walter Gropius' notion of a "total architecture") with the consequence that architects are made responsible for things beyond their control.[68] In both cases, the reduction of architecture to the objects produced by its labor reinforces its political impotence.

67. Architect and historian Libero Andreotti, theorist David Cunningham, assistant dean to Yale university School of Architecture Peggy Deamer, historian Joan Ockman, geographer Erik Swyngedouw, and theorist Nadir Lahiji.

68. Henri Lefebvre, *Toward an Architecture of Enjoyment*, ed. Łukasz Stanek (Minneapolis, Minnesota: Minnesota University Press, 2014).

Perhaps the most poignant critique is the one leveled by critical geographer Erik Swyngedouw who, tired of critics who revel in the negative dialectic of critical theory, calls for action under the banner of the figure of the "insurgent architect" (borrowing the term from critical geographer David Harvey).[69] Though for Swyngedouw architecture is incapable of constituting an emancipatory project, architects, like any other actor involved in the production of space, can "co-animate emancipatory political sequences."[70] According to him, to become an insurgent architect, it is necessary to

> leave behind the straitjacket of the niche one occupies in the social edifice betting instead for the truth of the emancipatory process, subscribing to the desire of its spatialization, finding the courage to take a position in agonistic political encounters.[71]

In other words, critique exists to enable the political theater of inclusion that legitimizes neoliberalism's ideological fantasy creating the illusion of consensus (in reality, a placebo). The dichotomy between the autonomous and the "vassal architect" forms part of this ideological

---

69. David Harvey, *Spaces of Hope* (Berkeley: University of California Press, 2000).

70. Lahiji, *Can Architecture Be an Emancipatory Project? Dialogues on the Left*, 34.

71. Lahiji, 49.

fantasy. Therefore, the solution lies not in critique but in action. Ultimately, emancipatory politics are "the transgression of the ideological fantasies that structure the reality of late-capitalist life."[72] Yet, Swyngedouw also warns that insurgent action is not really transgressive if it limits itself to acts of *local* resistance.[73] On the contrary, the objective of the insurgent architect is to reveal a possibility beyond resistance and aspire toward *universality* (emphasis added).[74] This last condition is what marks the most important break with the postmodern sensibility that has dominated critical discourse in the past few decades.

Here, the analysis presented in this chapter comes full circle back to the way in which the current zeitgeist is better characterized by the cultural clash between Enlightenment and anti-

---

72. Lahiji,, 52.

73. Srnicek and Williams, *Inventing the Future.* At this point, Swyngedouw's analysis coincides with the criticism of "political parochialism" made by the sociologists Alex Williams and Nick Srnicek in their Manifesto and with the observation made by the writer Paul Mason on the problem of "One No, Many Yeses" (referring to one No against the neoliberal policies of the state and many Yeses in favor of a plurality of particular causes such as feminism or racial discrimination).

74. Lahiji, *Can Architecture Be an Emancipatory Project? Dialogues on the Left*, 54. Concretely, the spatialization of the universal values of equality, freedom, and solidarity and a collective control of the communal goods for which it requires careful organization, critical thinking, radical imagination, and political will to inaugurate a new, free and solidary order capable of abolishing the existing one.

Enlightenment values. Having analyzed the parallel histories of design and ecology in Chapter 1 and providing now a broader reading of the cultural context, the next chapter will turn to analyzing the effect different metaphors have in terms of defining reality and horizons of political possibility.

Page left intentionally blank.

CHAPTER 3: THE LIMITS OF ECOLOGY

On Limits

Following the four categories of analysis described in the introduction—litany, social causation, discourse/worldview, and myth/metaphor—this chapter turns to a discursive analysis of myths and metaphors.

According to literary theorist Roland Barthes, myths are culturally shared narratives that describe collective human realities meaningfully. "They reach stability through repetition, but they have to be open to interpretation. Myths' cultural appeal hinges on this ambivalence."[1] It is important to distinguish myths from fictions. Myths do not oppose reality. In this regard, paraphrasing philosopher Donna Haraway, mythical narratives are not simply "made up," but "made."[2]

1. Sabine Höhler, *Spaceship Earth in the Environmental Age, 1960–1990* (Routledge, 2015), 98.

2. Höhler, *Spaceship Earth in the Environmental Age,* 99.

Barthes's semiotic analysis of myths foregrounds the notion of the neologism. As a conceptual amalgam, its function is constitutional to a myth's ambivalence.[3] Gaiapolitics, Heliopolitics, and Cosmopolitics are the neologisms that result from conjugating the sphere of the political with different notions of limits. The power of myth lies in its capability to either reconcile controversial arguments or open new vistas in seemingly exhausted discursive spaces. Each one of these neologisms probes the limits of the ecological metaphor when circumscribed to different horizons of political possibility. Before exploring this triad, it is pertinent to elaborate briefly on the notion of limits themselves.

Since 1972, ecological debates have been heavily defined by what could be called a "politics of limits." The publication of *The Limits to Growth* (1972) on the same year as the first World Conference on the Human Environment celebrated in Stockholm attests to this interpretation. The worldview of the planet as a closed system, cybernetically regulated through flows and feedback mechanisms, defined much of the ecological imaginary of environmental discussions at international and institutional levels.

3. Roland Barthes, *Mythologies* (Paris: Editions du Seuil, 1957), 120-121. "A mythology needs most often ephemeral concepts, in connection with limited contingencies: neologism is then inevitable."

The definition of "sustainable development" was the result of one of many such discussions following the Stockholm conference. Following Barthes' formulation of myths, the neologism of "sustainable development" attempts to square antagonistic narratives of permanence and change. The appeal of this formulation lies in its ambiguity—one of the reasons it has been widely adopted and at the same time derided. Indeed, there are over thirty different definitions for the term collected from different bodies of scholarship.[4] Another pertinent reading of sustainable development sees it as the latest incarnation of the myth of progress.[5]

The contention is that the debate around the notion of sustainability, and, in fact, most environmental discourse, is dominated by a fixation on limits. This fixation stems from a dualistic conception of nature—nature as external or beyond the limits of human culture. This translates into the nature "over there" of the economist who thinks of environmental impacts as

4. Desta Mebratu, "Sustainability and Sustainable Development: Historical and Conceptual Review," *Journal of Environmental Impact Assessment Review* 18 (1998).

5. Jacobus Du Pisani, "Sustainable Development: Historical Roots of the Concept," *Environmental Sciences* 3, no. 2 (2006): 83–96.

"externalities" or the original nature "back then" of the environmentalist that seeks to "restore" landscapes to their unspoiled state. Such acceptation of the concept of limit results in a "negative biopolitics"—a view where, by default, any human action is detrimental to the environment: Ecology as a zero-sum.[6] The three metaphors and their associated political narratives turn the notion of limit inside out suggesting that an "affirmative biopolitics" is possible under a relational (universal or non-dualistic) conception of nature that does not exclude the possibility of a distinct human agency. In other words, a conception of nature where there is no outside, nature without limits.

Besides the historical connection between sustainability and limits described above, philologically, sustainability can be traced back to the German *nachhaltigkeit*. Coined by the German accountant Hans Carl von Carlowitz in *Sylvicultura oeconomica* (1713), the first treatise on forest management, the term implied a certain "limitless" quality to the processes it was

6. Alf Hornborg, "Cornucopia or Zero-Sum Game? The Epistemology of Sustainability," *Journal of World-Systems Research* 9, no. 2 (2003): 205–16.

applied to.[7] It is this perpetual or never-ending character alluded by the word what links it to the question of limits.

In 1679, a few years before Carlowitz's speculations on endless yields, the Dutch scientist Antoine van Leeuwenhoek was the first person on record to systematically try to estimate the limit of the human population the Earth could sustain.[8] By extrapolating the population density of the Netherlands to the rest of the estimated habitable surface of the planet, he set the maximum world population at 13.4 billion. Leeuwenhoek's assumption, that a simple extrapolation would be enough to obtain an accurate answer, has come to be known as "The Netherlands Fallacy."[9] Nevertheless, Leeuwenhoek's first attempt to calculate what today we would call the Earth's "carrying capacity" inaugurated a long tradition within demographics from where perhaps the most influential work was produced by the English economist Robert Thomas

7. Nathan Thanki, "Sustainable: A Philological Investigation," *HumJournal*, 2011; Hans Carl von Carlowitz, *Sylvicultura Oeconomica, Oder Haußwirthliche Nachricht und Naturmäßige Anweisung zur Wilden Baum-Zucht* (Leipzig: Braun, 1713).

8. Joel E. Cohen, *How Many People Can the Earth Support?* (New York: Norton, 1995).

9. Paul R. Ehrlich and Anne H. Ehrlich, *The Population Explosion* (New York: Simon and Schuster, 1990).

Malthus.[10] Malthus theorized that rising numbers of humans would unavoidably trigger food shortages—a process that would lead to societal collapse.[11] This scenario has come to be referred to as the "Malthusian catastrophe."[12] But like in Leeuwenhoek's case, a fallacy can be teased out in Malthus' reasoning. He assumed that his insights on animal populations could be extrapolated to humans as well. This is a form of "appealing to nature," a logical fallacy that assumes that correctness follows only from nature.[13] The nineteenth-century economist Henry George points at this flaw with the quip: "Both the jayhawk and the man eat chickens, but the more jayhawks, the fewer chickens, while the more men, the more chickens."[14]

---

10. Nathan F. Sayre, "The Genesis, History, and Limits of Carrying Capacity," *Annals of the Association of American Geographers* 98, no. 1 (2008): 120–34.Incidentally, the modern understanding carrying capacity presents flaws not too dissimilar from Leeuwenhoek's "Netherlands fallacy."

11. Thomas R. Malthus and James Bonar, *First Essay on Population, 1798* (New York: A.M. Kelley, 1965).

12. Gregory Clark, *A Farewell to Alms: A Brief Economic History of the World* (Princeton, NJ: Princeton University Press, 2007).

13. Mohan Rao, "Abiding Appeal of Neo-Malthusianism: Explaining the Inexplicable," in *Economic and Political Weekly* 39, no. 32 (August 7, 2004): 3599-3604.

14. Henry George, *Progress and Poverty, An Inquiry into the Cause of Industrial Depressions and of Increase of Want with Increase of Wealth; The Remedy* (New York: The Modern Library, 1938).

Malthus's reasoning illustrates what is known as "epistemic conservatism"—the conception that there are unmovable, universal, "natural" limits. The notion of "emancipation" developed during the Enlightenment sought precisely to liberate humans from the limits imposed by nature.[15] Sometimes this position is characterized as hubristic (because only human arrogance could believe acting above the laws of nature is possible) or irrational (because commonsense realism should suffice to show that any other option belongs to the realm of magical thinking). In such cases, emancipatory attitudes can be characterized, usually derogatively, as "Promethean" or "Cornucopian." That there are no proper names to refer to the opposite of Malthusian scarcity or austerity is telling of just how engrained certain ideas are (the "misery of [ecological] theory," to paraphrase Marx). Regardless of this cultural bias, the point is that there are two opposing schools of thought when it comes to thinking about limits. For lack of better words, journalist John Tierney referred to them as "boomsters" and "doomsters."[16]

---

15. Ted Benton, "Marxism and Natural Limits: An Ecological Critique and Reconstruction," in *New Left Review* 178, no. 1 (November-December 1989): 51-86.

16. John Tierney, "Betting on the Planet" in *The New York Times*, December 2, 1990. The term "boomster" was used by journalist John Tierney to set aside so-called "optimists" from catastrophists or "doomsters."

Boomsters favor growth over development and liken the economy to a perpetual motion machine. They hold the techno-optimist view that there are no limits or obstacles that cannot be overcome by human ingenuity, technology, and science in their quest for emancipation (whether emancipation is collective or individual is an unsettled matter, root of many political maladies).[17]

Doomsters favor development over growth (if at all) and view the world as a closed, zero-sum game.[18] They hold the seemingly commonsensical view that, in a finite world, infinite growth is impossible—a notion shared by the neo-Malthusian, the paleo-conservative, and even the moderate Luddite of the "small-is-beautiful tradition."[19] It is also the view behind the "thermodynamic fatalism" of the ecological economist who rails against 'uneconomic' growth

17. Pisani, "Sustainable Development: Historical Roots of the Concept," 22.

18. Hornborg, "Cornucopia or Zero-Sum Game? The Epistemology of Sustainability."

19. Tierney, "Betting on the Planet." Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972); Stephen Emmott, *10 Billion* (New York: Random House, 2013); Jon Lindblom, "Techno Cultural Acceleration: A Few Initial Remarks," Accelerationism: Cosmism, Prometheanism, New Enlightenment, May 15, 2013; Ernst F. Schumacher, *Small Is Beautiful: Economics as If People Mattered*, Harper Torch books, 1778 (New York: Harper & Row, 1973).

trying to chart "a prosperous way down" relying on a Calvinist ethic of austerity and contentedness.[20]

This modern schism between worldviews defined by scarcity and abundance can be traced back at least to philosophers Karl Marx and Friederich Engels who attempted to disprove Malthus by reformulating his law.[21] For them, a rising human population would not translate into resource shortages but, on the contrary, could be a boon for scientific advancement (more minds applied to a problem) which would eventually increase food production. As Engels succinctly wrote, "What is impossible to science?"[22]

But why growth in the first place? Biologist Vladimir Vernadsky observed that life, unhindered, spreads (just as Boltzmann described the second Law of Thermodynamics: Energy,

20. Herman E. Daly, *Steady-State Economics: The Economics of Biophysical Equilibrium and Moral Growth* (San Francisco: W.H. Freeman, 1977); Howard T. Odum and Elisabeth C. Odum, *A Prosperous Way Down: Principles and Policies* (Boulder: University Press of Colorado, 2001).

21. K. J. Walker, "Ecological Limits and Marxian Thought," *Politics* 14, no. 1 (1979): 29–46; John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York: Monthly Review Press, 2000).

22. Karl Marx and Friedrich Engels, *Collected Works* (New York: International Publishers, 1987).

unhindered, spreads).[23] Growth or expansion seems to be intrinsic to life. The question of why growth can also be addressed by thinking about the end, not as limit, but as purpose.

Like with any other concept, growth should be considered as a historically contingent phenomenon. In other words, a historical materialist account of growth would be different depending on whether it described the mechanisms of biological growth or the processes the lead to economic growth under capitalism. However, to illustrate the process through which "generative metaphors" port ideas from one domain to another, momentarily think of growth as a simple increase in abstract quantities.

Consider three narratives. The first is biological: Life expands on earth as molecules do in empty space checked only by environmental pressures; energy inputs in a system will increase the system's internal order while decreasing the surrounding order (excreting degraded matter and heat energy). Growth would seem almost synonymous to life.[24] The second is social: Growth as

---

23. Dorion Sagan, "Thermosemiosis: Boltzmann's Sleight, Trim's Hat, and the Confusion Concerning Entropy," in *The Cosmic Apprentice: Dispatches from the Edges of Science* (Minneapolis; London: University of Minnesota Press, 2013), 122.

24. Vladimir I. Vernadskiĭ, *La Biosphère* (Paris: Librairie Félix Alcan, 1929); Ilya Prigogine and Isabelle Stengers, Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man's New Dialogue with Nature* (Toronto; New

the requisite to fulfill the human right of ever-increasing improvements in health, education, affluence, and overall well-being. This is the emancipatory project which is at odds with the epistemic conservatism of Malthus.[25] The third is technological: Innovation is an auto-catalytic process, a cybernetic self-reinforcing feedback loop where technological progress accelerates itself. Incidentally, Marx referred to this process as the first contradiction of capitalism and believed it would be the reason why capitalism would end itself.[26] Nick Land called it teleoplexy—the abstract mechanism through which the future shapes the present.[27]

The point is not to fixate on the differences between these accounts and decide whether growth is determined by biological, social, or technological *limits*. Rather, in their shared *goals*, these accounts foreground the commonality behind doomster and boomster narratives: a search

---

York, N.Y.: Bantam Books, 1984); James Lovelock, *Gaia: A New Look at Life on Earth* (Oxford; New York: Oxford University Press, 1979).

25. Benton, "Marxism and Natural Limits," 65.

26. Merritt Roe Smith and Leo Marx, *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

27. Nick Land, "Teleoplexy: Notes on Acceleration," in *#Accelerate#*, ed. Robin Mackay and Armen Avanessian (Falmouth, United Kingdom; Berlin: Urbanomic Media Ltd. in association with Merve, 2014), 509–20.

for the ideal path toward improving future human prosperity. Then, where does the true difference in their worldviews lie?

Though commonly doomsters are associated with environmentalism and boomsters, with economic growth, not all boomsters profess a blind faith in technology and not all doomsters distrust progress. There are economists that search for zero-growth economies, and there are environmentalists that advocate for massive geoengineering projects.[28] Positions are not as clear cut as the boomster-doomster narrative would make it seem.

To understand a deeper source of disparity, we turn, once again, to an unresolved contradiction in the concept of nature and its two formulations. In universal nature (i.e. what is governed by the laws of physics), teleological thinking (pertaining to transcendental final causes) was purged by Darwinism. In cybernetics and systems theory, the concepts of teleonomy and self-organization remain to explain, from material causes, the goal-seeking behavior observed in biological or mechanical systems alike. The narrative of progress (i.e. human emancipation)

28. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, MA: Harvard University Press, 1971); Herman E. Daly, *Beyond Growth: The Economics of Sustainable Development* (Boston: Beacon Press, 1996); Stewart Brand, *Whole Earth Discipline: An Ecopragmatist Manifesto* (New York: Viking, 2009).

presupposes a teleological history. Marx's idea that capitalism would eventually end itself ushering into communism is teleological. An enormous problem lies in the entanglement of the teleology of human progress and the teleonomy of natural growth. Can there be progress (a human value) without growth (a physical phenomenon)?

Decoupling progress from growth is the crucial point that differentiates all the positions normally associated with boomsters and doomsters. But, if we pay close attention, decoupling progress from growth is really decoupling teleology from teleonomy, the human realm (where agency or free-will enables final causes) from the realm of nature (where everything is explained by material processes and physical laws). This is why the myths built around nature (be it external or universal nature) are akin to the base code in a culture's operating system.

Bringing back historical contingency, the problem of decoupling growth from progress *under capitalism* hinges on the narrative we choose to build around nature. So far, *under capitalism*, we have the illusion of two opposing narratives which in reality are the same. As theorist McKenzie Wark wrote:

> Most historical thought that takes ameliorating climate change seriously assumes one of two big-picture narratives, the first which is *capitalist realism*. This insists that there is no

> alternative, and we just have to stick with the program. If it takes the planet down with it, then so be it. The alternative narrative imagines a kind of non-technical, holistic, and spiritual alternative, often drawing its images from a pre-capitalist landscape. But as was already clear to Marx, this is capitalist romance, a story constructed within capitalism itself as one of the byproducts of its own momentum. It is a kind of capitalist realism in negative, where we all ride bamboo bicycles, but it rarely ventures beyond an ideological mirroring of capitalist realism. [29]

Wark appropriately identifies that both the doomster and the boomster operate under the same natural myth. He proceeds to outline some requisites to an alternative narrative. Like others who have reached the same conclusion, he identifies the need for a technologically literate left, unafraid of the global, the abstract or the complex:

> What we need is an alternative realism. […] This requires reorienting critical thought away from certain dominating tendencies: rather than speculative realism in philosophy, a speculative fiction that makes no claims to be a spokesmodel for the object world […]; rather than an obsession with […] capital and […] communism, a working knowledge of the ways labor and nature confront and confuse each other; rather than a totalizing critique of technology as the acme of Western metaphysics, a frank acknowledgement of the entangling of our cyborg bodies with the technical. [30]

German statesman Otto von Bismarck defined politics as "the art of the possible" in reference to his pragmatic approach to power or *realpolitik*. Before discussing politics, we should

29. McKenzie Wark, *Molecular Red: Theory for the Anthropocene*. (London and New York: Verso, 2015), xx.

30. McKenzie Wark, xxi.

discuss what is "real." How do different metaphors naturalize different ideologies so that they are taken for what is real (natural)? And what becomes possible under different notions of what is real—Wark's "alternative realisms"? The following three chapters explore politics as the space of possibility under different metaphors of nature.

The Metaphor of the Island

Islands have a long tradition in science, art, and the humanities. One only needs to think of naturalist Charles Darwin and the Galapagos, writer J. G. Ballard's *Concrete Island*, or Plato's *Atlantis* to realize the extent to which the figure of the island has been used as a generative metaphor to derive insights and extrapolate them across fields. As philosphopher Robin MacKay pointed out, the prevalence of islands lies in their epistemological power as cognitive tools and their imaginative allure as vehicles for speculation.[31]

31. Robin MacKay, "Philosophers' Islands," *Collapse* 6 (2010): 431–56.

Epistemologically, islandness has served to speak of questions of identity and difference by sharply marking the limit between the territory of pure understanding and the "stormy ocean" of the unknowable.[32] On islands and imagination, philosopher Gilles Deleuze notes that, despite the generalized causal distinction that geographers make on islands, there is ultimately a common reason that explains their speculative captivation: the possibility of disengaging with humanity and beginning anew.[33] Islands, then, possess great capacity to frame and simplify the seemingly unbounded and complex and to kindle different imaginaries serving as settings for all kinds of real life and thought experiments.

---

32. Immanuel Kant, *Critique of Pure Reason*, trans. F. Max Müller (London: Macmillan, 1881), chap. 3, "Of the Ground of the Division of All Objects into Phenomena and Noumena," A235/B294; and Friedrich Nietzsche, *The Gay Science*, ed. Bernard Williams, trans. Josefine Nauckhoff and Adrian Del Caro (Cambridge: Cambridge University Press, 2001), sec. 343. The term islandness is borrowed from Stefania Staniscia, *Islands: Hot Spots of Change* (Barcelona; Barcelona, Spain; Basel, Switzerland; New York, NY: LISt Lab ; International Sales and Distribution, ActarD/Birkhauser, 2011).

33. Gilles Deleuze, "Causes and Reasons of Desert Islands," in *Desert Islands and Other Texts*, 1953–1974, ed. David Lapoujade, trans. Michael Taormina (Los Angeles: Semiotext(e), 2004), 9. Deleuze notes the difference between "continental islands" as fragments of larger landmasses from which they have detached, and "oceanic islands" emerging out from the deep of the ocean.

In "The Challenge of Nissology" (2008), hydrologist and geomorphologist Christian Depraetere argued that in the world archipelago, islands "are the rule and not the exception," claiming that islands ought to be studied "on their own terms" and not as epiphenomena of larger continental trends.[34] This is a useful heuristic to extend the use of the metaphor by releasing the island from its strict geomorphologic definition. In this regard, following literary critic Marc Shell's "islandology," we can distinguish between the way we think *about* islands and the ways we think *by means* of them.[35]

For all the praise modern globe-girdling infrastructural networks get or all the worrying triggered by the ever-increasing pervasiveness of a politico-economic system that threatens with subsuming every aspect of nature, there are still around 150 isolated human groups on Earth. Of these, the people of North Sentinel Island are the most isolated one. What little is known about the island and its inhabitants is thanks to modern aerial imagery, anthropological inference, and

34. Christian Depraetere, *The Challenge of Nissology: A Global Outlook on the World Archipelago* (University of Prince Edward Island, 2008), 14.

35. Marc Shell, *Islandology: Geography, Rhetoric, Politics* (Stanford, California: Stanford University Press, 2014), 18.

historical recordings of a sparsely populated timeline beginning with the first mention by a surveyor onboard an East India Company vessel in 1771 who simply noted a "multitude of lights" while passing by at night.[36]

North Sentinel Island lies westward of the southern tip of the Great Andaman Archipelago in the Bay of Bengal. From migration patterns, anthropologists believe the island was first colonized 60,000 years ago. The differences between the Sentinelese dialect and those of the rest of the Andaman tribes suggest they have remained uncontacted for thousands of years. The island itself, more or less square in shape and roughly the size of Manhattan, is almost entirely covered by forest. In contrast to its urbanized North American counterpart, Sentinel island is estimated to sustain a median population of barely 250 individuals and a maximum population of roughly 400 given the resources available and the pre-agricultural stage of technological development in which its inhabitants remain.

Regardless of the accuracy of the estimates, the Sentinelese hold the record for longest enduring human group living in what economist John Stuart Mill described as the "stationary

36. George Weber, *Lonely Islands: The Andamanese.* (Liestal, Switzerland: The Andaman Association, 1998).

state."[37] If historian Jared Diamond popular account of the fate of Easter Island turned the Rapa Nui people into the poster children for human driven collapse in an isolated environment, the Sentinelese could very well be the embodiment of sustainability according to ecological economics.[38]

Adding to its noteworthiness, an unexpected event complicates whatever interpretations on sustainability we might extract from it. In 2004, a massive tsunami claimed the lives of 350,000 and redrew entire coastlines in the region. The island did not escape unscathed. Its landmass tilted raising one of its corners several meters above sea level creating new sand banks

---

37. John Stuart Mill, "Of the Stationary State," Book IV, Chapter VI in *Principles of Political Economy: With Some of Their Applications to Social Philosophy* (London, England: J.W. Parker, 1848).

38. Jared M. Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking, 2005); Erle Ellis, "Overpopulation Is Not the Problem," *New York Times*, September 14, 2013, sec. Op-Ed; Andrew C. Revkin, "An Ecologist Explains His Contested View on Planetary Limits," Blog, The New York Times, September 16, 2013. Their case supports ecologist Erle Ellis's statement that whatever factors define overpopulation, they are more about technology than they are about the environment.

Ellis's Op-Ed piece apparently triggered so much controversy that just two days later, he wrote a brief follow up to clarify some of his points. Regarding carrying capacity, he stated: "Of course our planet has limits. However, the total number of people that can be supported by Earth's resources cannot be predicted merely by knowing the total amount of matter or surface area on Earth. Based on existing technological capabilities, the 9 to 10 billion humans now forecasted for this century—when human populations are expected to peak—can be sustained using existing resources.

along its shores in the process. Luckily, the Sentinelese seemed to survive with no apparent harm, but the story could have been different. In fact, the story has been different for several other local tribes in the archipelago many of which have gone extinct or are close to disappearing as a result of their interaction with outsiders (the most common case being the spread of disease for which they have no immune resistance).[39]

Be it gigantic tsunamis or microscopic pathogens, one insight gained from this story is that achieving a steady state is not enough to ensure endurance or permanence. Mainstream environmental debates revolve around (upper) limits to growth that should not be crossed to avoid "environmental overshoot." But minimum levels of development should also be discussed to ensure appropriate response capabilities are in place should other existential threats arose.

Given the unpredictable nature of risk, the "precautionary principle" can be cut both ways, though there is a fundamental asymmetry: It is arguably easier to calculate upper limits to growth (based, for example, on known and estimated available resources, maximum theoretical

39. Adam Goodheart, "The Island of the Lost Savages," *The American Scholar* 69, no. 4 (2000): 13–44.

efficiencies, and hard biophysical constraints such as our own metabolic needs) than it is to calculate minimum limits which would still allow being prepared for the unknown.[40]

In "Risk Society's Cosmopolitan Moment" (2008), sociologist Ulrich Beck elaborates on his theory of world risk society in terms of three key features: non-compensability, incalculableness, and delocalization. Of these, delocalization is of particular interest when considering the parable of the island. Beck defines this feature in terms of how the causes and consequences of risks are not limited to space, time, or specific social groups, but instead become omnipresent. Delocalization makes the anticipated state of emergency overcome boundaries thus becoming cosmopolitan. The perceived risks—which cannot be externalized—are capable of "awakening the energies, the consensus, and the legitimation necessary for creating a community of fate that will demolish the wall of nation-state borders."[41] In Beck's analysis, cosmopolitanism transcends the necessity for friend-foe distinctions in political theorist Carl Schmitt's worldview.

---

40. Cass R. Sunstein, *Laws of Fear: Beyond the Precautionary Principle* (Cambridge, UK; New York: Cambridge University Press, 2005).

41. Ulrich Beck, "Risk Society's Cosmopolitan Moment," in *New Geographies: Zero*, ed. Neyran Turan, vol. 1 (Cambridge, MA: Harvard University Graduate School of Design, 2008), 24–34.

Global risks cut through the isolationism and self-sufficiency of social groups and create a political space that gives rise to a universal "public sphere across all boundaries." The irony is that it is not a Kantian categorical imperative what brings us together in a pluralist world of irreconcilable differences, but a dark moment of perceived of existential threat. This is what Beck calls "the enlightenment function" of global risk in which the limits imposed by the figure of the island dissolve.

Gaiapolitics

Gaiapolitics is borrowed from French philosopher Bruno Latour.[42] It is a formulation that seeks to address the political challenge posed by the ecological crisis (i.e. environmental crisis) and the crisis of ecology (the question of what is nature, which is the question at the very core of modernity).

42. Bruno Latour, "A Tale of Seven Planets–An Exercise in Gaiapolitics" (Harvard University, Cambridge, MA, October 16, 2018).

Since the seventies, political ecology has shed light on the social constructedness of environmental matters drawing from political and critical theory. The ecological crisis runs so deep that it does not only require a reconsideration of what we mean by "environment," "nature," or "ecology," but it also necessitates a reconstitution of the political. Latour proposes that reconstitution through "Gaiapolitics." The aim is at least threefold. First, the traditional distinctions between Left and Right politics are no longer helpful to frame ecopolitical matters. The novel climate regime implies the emergence of a third attractor which is neither local nor global but terrestrial, according to Latour. The second aim is to rethink the reach of the sphere of the political which in his view should extend to include non-human actors (as intractable such task might be). The third aim is to refresh our conceptual repertoire and redirect attention from "nature"—too much of a contentious term to be salvaged—to the terrestrial.

Here, we test the limits an ecological metaphor circumscribed to a terrestrial horizon—our lonely, fragile island-oasis.

"There is no world, there are only islands," the French philosopher Jacques Derrida once declared. What he meant was that, despite the assumption that all beings inhabit a common

world, no two share the same *Umwelt*, or experience of it. For him, the unity of the world is a construction, and therefore, what we all inhabit are islands incommensurably separate in a "world archipelago."[43]

Amidst the growing political fissures of globalization, the image of Derrida's world archipelago seems to defy one of the tacit yet most widely established catchphrases of our time: "Everything is connected to everything else." Borrowing from proto-ecologist Alexander von Humboldt's "*Alles ist Wechselwirkung*" (everything is interconnection), it was biologist Barry Commoner who proposed this universal aphorism, as the first of his informal laws of ecology.[44] Following Commoner's principle, today economists talk about globalization and the seemingly endless reach of the neoliberal market system; technologists talk about the ever-expanding technosphere that girds the globe with undersea data cables and envelopes the ionosphere with

43. Jacques Derrida, *The Beast and the Sovereign, vol. II*, trans. Geoffrey Bennington (Chicago: University of Chicago Press, 2011), 8–9.

44. Alexander von Humboldt, *Reise Auf Dem Rio Magdalena, Durch Die Anden und Mexico, vol. 1*, ed. and trans. Margot Faak (Berlin: Akademie Verlag, 1986), 358; Barry Commoner, The Closing Circle: Nature, Man, and Technology (New York: Knopf, 1971).

swarms of satellites; and environmentalists talk about "Gaia" and its biospheric metabolism encompassing every living being and process.

Resembling Commoner's law is another powerful image of our time: the rhizome. In their introduction to *A Thousand Plateaus*, French philosophers Gilles Deleuze and Felix Guattari describe the rhizome as an image of thought where "any point […] can be connected to any other, and must be."[45] Rhizomes can be entered anywhere, have neither a beginning nor an end, are always in the middle, and remain forever open as an endless series of "ands."[46] During the last two decades, this rhizomatic image of ecology has exerted great influence on design thinking, promoting a notion of territory characterized as an open, fluid, indeterminate, and interconnected field that privileges *process* in detriment to the legibility of form and objects.

If the Enlightenment gave us the modern separation between the natural and manmade worlds, our present time of rhizomes, networks, hybrids, and assemblages might as well be

45. Gilles Deleuze and Felix Guattari, "Introduction: Rhizome," in *A Thousand Plateaus*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 7.

46. Deleuze and Guattari, 21.

named, as some have suggested, the "Entanglement."[47] In it, all boundaries seem to melt; order and disorder are no longer conceived as opposites; human activity turns into a force of nature; cities become inexorably linked to their planetary hinterlands; pristine nature becomes an illusion, landscapes become infrastructure, and the demarcation of boundaries becomes trivial. And yet, as the global political climate becomes increasingly skeptical of the neoliberal narrative of the market system's limitless expansion and the liquid metaphors that enable it, a revision of the figure of the island seems as pertinent as ever.[48]

As discussed earlier, modernity seems to be torn between two different narratives. Latour describes them thusly:

> "The present historical situation is defined by a complete disconnect between two great alternative narratives—one of emancipation, detachment, modernization, progress, and mastery, and the other, completely different, of attachment, precaution, entanglement, dependence, and care."[49]

---

47. Journal of Design and Science, http://jods.mitpress.mit.edu/

48. Zygmunt Bauman, *Liquid Life* (Cambridge, UK; Malden, MA: Polity Press, 2005).

49. Bruno Latour, "A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk)" (Networks of Design, Falmouth, Cornwall, 2008), 6.

The roots of this cultural split have been traced back to the Enlightenment and its emancipatory project and the industrial revolution which became the materialized the aspirations of greater control over the forces of nature. Just a few decades after the perfecting of the steam engine, economist Robert Malthus concluded his influential essay on demographics musing:

> It has been said that the great question is now at issue, whether man shall henceforth start forwards with accelerated velocity towards illimitable, and hitherto unconceived improvement; or be condemned to a perpetual oscillation between happiness and misery, and after every effort remains still at an immeasurable distance from the wished-for goal.[50]

Since posed by Malthus, this "great question" has remained at issue. His economic ideas had a profound influence over the nascent field of economics in the nineteenth century. Almost a hundred years after his writings, in the context of a looming coal shortage, economist George Jevons expressed similar concerns warning that "to disperse so lavishly the cream of our mineral wealth is to be spendthrifts of our capital—to part with that which will never come back"—a mistake which could lead to the sudden collapse of British civilization. Yet, recognizing the

50. Thomas Robert Malthus, *An Essay on the Principle of Population: As It Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Godwin, M. Condorcet, and Other Writers* (London: Johnson, 1798).

British empire as the beneficiary of the most explosive and exploitative period of growth in history, he also noted that much of that civilization, such as its "rich literature and philosophy," might never have existed without "the lavish expenditure of material energy" that "redeemed [it] from dullness and degradation a century ago." "To reduce coal consumption might only bring back stagnation," he cautioned, and he ended his book with a sentence in italics: "*We have to make the momentous choice between brief greatness and longer continued mediocrity.*"[51]

Just two years after Jevon's work on progress and coal, philosopher Karl Marx published his *magnum opus Das Capital* (1867). Inspired partly by the discoveries of chemist Justus von Liebig regarding soil metabolism and synthetic fertilizers, Marx set to dispel the myths of Malthus and Ricardo's epistemic conservatism.[52] Despite Marx's thorough analysis, Malthus' ideas persisted through the 20th century to our days. In the late sixties, with the advent of the

51. William Stanley Jevons, *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines* (Cambridge, MA: Macmillan, 1865).

52. John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York: Monthly Review Press, 2000). Foster provides a thorough rereading of Marx's arguments with an ecological lens.

modern environmental movement, a strain of neo-Malthusianism took hold in mainstream and academic debates.

Though Malthus originally spoke of agricultural production and demographic growth, his reasoning can be applied to any natural resource. Advances in thermodynamic science in the twentieth century suggested "energy" was the "master resource." The work of people like mathematician Alfred Lotka (e.g. Maximum Power Law), radiochemist Frederick Soddy (e.g. ergosophy), and system ecologist Howard Odum (e.g. emergy) attempted to rebuild their respective fields around a new notion of "energetic determinism." This school of thought led economist Nicholas Georgescu-Roegen to explore the relationship between thermodynamics and economics. In 1972 he wrote:

> But one thought has persisted in my mind ever since I became interested in the entropic nature of the economic process. Will mankind listen to any program that implies a constriction of its addiction to exosomatic comfort? Perhaps, the destiny of man is to have a short, but fiery, exciting, and extravagant life rather than a long, uneventful, and vegetative existence.[53]

53. Nicholas Georgescu-Roegen, "Energy and Economic Myths," *Southern Economic Journal* 41, no. 3 (1972): 347–81.

Though these passages from Malthus, Jevons, Georgescu-Roegen, and Latour span the three hundred years since humanity escaped the "Malthusian trap," the question remains virtually unchanged. Regardless of historical specificities, the parallelisms in their writing reveal them as instantiations of Malthus' "great question." These examples support Latour's characterization of our present moment as torn between two narratives. Even if philosopher François Lyotard noted that the postmodern condition is characterized by its dismantling of grand narratives, these still endure.[54]

Part of the staying power of Malthusianism after Marx has to do with a popular misunderstanding of thermodynamics and the concept of entropy wrongly understood as a measure of irreversibly increasing disorder (more on this later). The focus here is on a genealogy of metaphors *grounded* on the image of earthly nature—from the French "physiocrats" (rule by nature, *physis*, but also Gaia, the goddess of nature) who saw land and agriculture as the source of wealth, to ergosophy and thermodynamic economics who sought to anchor theories of economic

54. Jean-François Lyotard, *The Postmodern Condition: A Report on Knowledge* (Minneapolis: University of Minnesota Press, 1979); Bruno Latour, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225–48.

value in the laws of physics, to scientist James Lovelock's (much misinterpreted) 1972 Gaia hypothesis.[55]

Latour uses the figure of Gaia to characterize this counter-capitalist narrative:

> The wide expansion of the reach of "market organizations" along metrological chains has created a global domain of transcendent reality—second nature—that is now clashing with another mundane, immanent globe, that of planet Earth, namely Gaia, that is different from nature since it has its own historicity, reactivity, maybe sensitivity, and certainly power. The new fight between the two globes defines our time![56]

As the quote confirms, three hundred years of metanarrative gridlock should attest to the futility of this dualist framing. Yet, the discursive spaces between these two globes remains thin and barely charted. Circumscribing nature to the space of possibility defined by a terrestrial horizon—Gaia—results in a narrow conception of ecology as argued here. But the metaphor of

55. Lovelock, *Gaia: A New Look at Life on Earth*. Lovelock's hypothesis had more to do with biospheric homeostasis and endosymbiosis and less with neo-animism or teleology.

56. Bruno Latour, "On Some of the Affects of Capitalism" (Lecture, Danish Royal Academy of Science, February 26, 2014), http://www.bruno-latour.fr/fr/node/550.

the island—this time understood as a miniature world—can be deployed to upend the limited view of Gaiapolitics and open it to a larger horizon.

From Sentinel island, we now move to its conceptual antipode: Easter island. In a chapter titled "Unsustainable" (2011), physicist David Deutsche tells the story of the historian Jacob Bronowski who traveled to Easter Island to film part of his television series *The Ascent of Man*.[57] He wanted to use the backdrop of the island—famous for its colossal statues—to make the point that our civilization, unlike others, is unique in history for its capacity to make progress. The series had been commissioned by English naturalist Sir David Attenborough. Coincidentally, twenty-eight years later, Attenborough himself would end on Easter Island to shoot the closing scene of his 2000 series *The State of the Planet*.[58] One island, two stories, as we see here.

57. David Deutsch, *The Beginning of Infinity: Explanations That Transform the World*, Reprint edition (London; New York: Penguin Books, 2012); Jacob Bronowski et al., *The Ascent of Man* (London: BBC Worldwide, 2011).

58. David Attenborough et al., *State of the Planet with David Attenborough* (London: BBC Worldwide, 2000).

In 1972, when Bronowski filmed his documentary, there were no specific theories as to why the Rapa-nui civilization on Easter Island had collapsed, but he wanted to use the statues as an illustration of a steady-state society. The island is littered with hundreds of identical statues built through the course of hundreds of years. With as many as ten percent of them abandoned on roads expressly built to transport them, one prevailing theory was that, as disaster loomed, the production of statues accelerated. In Bronowski's view, the islanders failed to evolve from their statue making. When faced with an existential threat, they resorted to the thing they knew and building ever larger numbers of resource intensive monuments. At the core of his argument is a cultural tendency for what Deutsche calls "progress suppression." Bronowski's intended to point out how we are *not* like the Rapa-nui.

When Attenborough, a vocal environmentalist, traveled to the island to conclude his series his message was the opposite: We are like them.

> A warning of what the future could hold can be seen on one of the remotest places of Earth . . . When the first Polynesian settlers landed here, they found a miniature world that had ample resources to sustain them. They lived well . . .[59]

59. Attenborough et al., *State of the Planet*.

"*A miniature world*," observes Deutsche:

> there in three words is Attenborough's reason for traveling all the way to Easter Island and telling its story. He believed it holds a warning to the world because Easter Island was itself a miniature world—a Spaceship Earth—that went wrong.[60]

The problem with Attenborough, according to Deutsche, is that his view of sustainability conflates the *natural* availability of resources with the *cultural* conditions of a static society. If the way of life of a group does not lead to changes that make the life of others or future generations any different, then that group can carry on living the way they have for generations on end. This is what some would understand as sustainable. But if the way of life of a group leads, for instance, to the development of a more efficient way of farming resulting in decreased infant mortality, this would be *unsustainable.* The population would grow because children who would have otherwise died now survive, while simultaneously fewer people would be needed to work in the fields. This alters the traditional way of living which can no longer be *sustained.* As Deutsche

60. Deutsch, *The Beginning of Infinity*, 421.

points out, "we have to learn to live with the *solution,* and to set about solving the new problems it creates."[61] Hence, "unsustainability" as an ideal for living.

Deutsche's comparison of these two diverging narratives underscores the logical fallacy behind the island-world extrapolation: The notion that modern western civilization has something to learn from an alleged case of forestry mismanagement by one remote group is not derived from any structural resemblance between the two historical situations. In other words, the island as miniature world is not a generative metaphor in Schön's sense.

There is one more takeaway. As a physicist, Deutsche does not see how "the laws of nature [could] possibly impose any bounds on progress." He is not alone among his ranks. Another physicist, Frank Tipler, writes: "Being too frugal today in the mistaken belief they are forever finite may prevent us from developing the unlimited resources permitted by the laws of physics."[62] In his "technological completion conjecture," mathematician and philosopher Nick Bostrom's suggests that: "if scientific and technological development efforts do not effectively

---

61. Deutsch, 422. Emphasis mine.

62. Frank Tipler, "There Are No Limits to the Open Society," *The Critical Rationalist* 03, no. 02 (September 23, 1998).

cease, then all important basic capabilities that could be obtained through some possible technology will be obtained."[63] Perhaps not unsurprisingly, these apologies of limitlessness share a common background in math and physics. Is it not odd, then, that ecological economics, which seeks to ground economic theory in physical law, reaches opposite conclusions?

The difference between these two interpretations lies in the fundamental conceptions of nature they work with. Whereas environmentalists or ecological economists operate under the notion of external nature, people like Deutsche or Tipler operate under the notion of universal nature—nature as everything that is governed by the laws of physics. For them, limits, if they exist at all, come from culture, history, and politics, not from nature.

And here we have yet another takeaway. In Deutsche's analysis, it is human agency, a problem-solving disposition, the scientific method, and values systems, what set societies apart, not geography. The question is whether these attributes pertain to the natural or the supernatural (keep in mind: the opposite of external nature is the artificial, but as philosopher Steven Vogel

63. Nick Bostrom, "The Future of Humanity," ed. Jan-Kyrre Berg, Evan Selinger, and Soren Riis, *New Waves in Philosophy of Technology* (New York: Palgrave McMillan, 2009).

points out, the opposite of universal nature is the supernatural).[64] Given Deutsche's background in physics, it would be safe to assume that he shares a materialist worldview. The problem is that such view denies the existence of free-will. In other words, is not there a drop of forbidden teleological syrup in Deutsche's immanentist sauce? This is yet another understated contradiction at the heart of the problem of nature.

"No lifestyle is sustainable," concludes Deutsche, in the sense that no static, traditional way can remain unchanged. Only progress is sustainable, but all triumphs are temporary. The fact that there are unforeseen and unforeseeable risks means societies have to be ever ready to face them. Deutsche warns against trying to shape the future in our current image by means of sustaining our present lifestyle. Instead, the ethical aspiration should be to embark in an "open-ended journey whose every step is unsustainable until it is redeemed by the next." We now move to the metaphor of the ship as the vehicle to embark on such journey.

64. Steven Vogel, *Thinking Like a Mall: Environmental Philosophy after the End of Nature* (Cambridge, Massachusetts: MIT Press, 2015).

The Metaphor of the Ship

A ship is a vehicle that allows travels and expeditions, but it can also become a shelter like a lifeboat or an ark. A spaceship can serve the same functions, though the sense of confinement is stronger in space. As historian of science Sabine Höhler argues, for roughly twenty years, the Earth as Spaceship metaphor was emblematic of a time best represented by the torch passing between the space race and the global environmental movement: the same science that fueled the national ambitions of the Cold War superpowers was now responsible for the growing sense of planetary interdependence. Dissecting the spaceship Earth metaphor allows to address several of the many narratives underlying scientific worldviews and political sensibilities that endure to this day. Figures from inventor Richard Buckminster Fuller to system scientist Jay Forrester to ecologist Howard Odum contribute insights regarding the feedback mechanisms of cybernetics or neo-Malthusian concerns with population.

The earliest known use of the spaceship Earth comes from economist Henry George who wrote in *Progress and Poverty* (1879):

> It is a well-provisioned ship, this on which we sail through space. If the bread and beef above decks seem to grow scarce, we but open a hatch and there is a new supply, of which before we never dreamed.[65]

The metaphor makes another early appearance in "Astronomy and Architecture" (1907), a posthumous essay by Nikolai Fedorov, the father of Russian cosmism (since most of his writings were published after his death by his followers, it is possible Fedorov's use could be the earliest). Fedorov wrote:

> Imagine that this solar energy, once directed earthward, might alter the density of its new home weaken the bonds of gravity, giving rise in turn to the possibility of manipulating its celestial course through heavens, rendering the planet Earth, in effect, a great electric boat.[66]

---

65. Kalen, San (2010). "Ecology Comes of Age: NEPA'S Lost Mandate". *DUKE Environmental Law & Policy Forum.* 21:113 (Fall). Retrieved March 5, 2016.

66. Nikolai Fyodorov, "Astronomy and Architecture," in *Russian Cosmism*, ed. Boris Groys (Cambridge, MA: The MIT Press, 2018), 74.

In 1966, the economist Barbara Ward, took up the image of the Earth floating in the incommensurability of space to describe the fragile political situation:

> In the last few decades, mankind has been overcome by the most fateful change in its entire history. Modern science and technology have created so close a network of communication, transport, economic interdependence--and potential nuclear destruction--that planet Earth on its journey through infinity, has acquired the intimacy, the fellowship, and the vulnerability of a spaceship.[67]

For the 1972 World Conference on the Human Environment, Ward and microbiologist Rene Dubos prepared a study titled *Only One Earth.* Following economist Kenneth Boulding's suggestion that a socioeconomic paradigm shift from a 'cowboy' to a 'spaceman' economy was necessary, they put forth the notion of a third party for whom we must act: "The word stewardship implies management for the sake of someone else."[68] Stewardship also suggests a divine power over nature bestowed on humans. This dual interpretation suggested a new

67. Barbara Ward, *Spaceship Earth* (New York: Columbia University Press, 1966), vii.

68. Barbara Ward and René J Dubos, *Only One Earth: The Care and Maintenance of a Small Planet* (New York: Norton, 1972), xviii.

approach to environmentalism that brought together the hard calculus of management with a humane empathy toward others. Stewardship foregrounds the question of the human role in nature. As media theorist Marshall McLuhan had observed: "There are no passengers on Spaceship Earth; we're all crew."[69]

As discussed in previous chapters, 1972 also saw the publication of the environmental best-seller *The Limits to Growth*. The study was based on the World-3 model developed by engineer Jay Forrester—earlier presented in *World Dynamics* (1971). The history of system dynamics, the field developed by Forrester, is also linked to ships. The core insight behind Systems Dynamics came to Forrester when he discovered a self-reinforcing mechanism (i.e. a positive feedback loop) throwing off the navigational systems of the navy ship he was working on as a young engineer.

Just like the faulty ship, his World3 model for the Earth system saw the planet as a vessel regulated by the non-linear interactions of several feedback mechanisms. *The Limits to Growth*, conducted by three of his students, summarized the world in five variables: resources, food,

69. Marshall McLuhan in 1964 as quoted in *Encyclopaedia of World Environmental History*, ed. S. Krech III, J. R. McNeill and C. Merchant (New York and London: Routledge, 2004), vol. 1, 356.

population, industrial output, and pollution. The behavior of these variables was plotted over time with the aid of computer simulations. Its business-as-usual scenario did not account for major changes in political, economic, or physical relations. The result was a series of curve graphs that anticipated a growth period followed by a sharp collapse toward the mid-twenty first century. As Höhler notes, the vertical axis was purposefully omitted and the values on the horizontal axis were vague. "The simple visual chart offered both a readily apprehensible message of alarm and a plea for imminent action."[70]

In its mathematical, abstract, mechanical reductionism, *The Limits to Growth* seemed to suggest completeness—a statement about the whole "world system" and its future. It presented an image of the world as a closed system, an island. Just like other island metaphors, its closure allowed the illusion of being apprehensible for the purposes modeling and forecasting, but also negated cultural difference and ignored political negotiation.

Like Forrester's, most readings of spaceship Earth (more "ship" than "space") are a scaled-up version of the island—the reverse image of Deutsche's "miniature world." There is

70. Höhler, *Spaceship Earth in the Environmental Age, 1960–1990*, 68.

little else to extract from such reading. Instead, here we pay attention to other instances of spaceship Earth which conceive the planet not as a closed system, but as part of a larger cosmic assembly (more "space" than "ship"). This spaceship Earth, open toward the infinity, is powered by the warm bath of stellar radiation which animates and transforms it.

When environmentalist Steward Brand published the *Whole Earth Catalog* (1968), he aptly chose a phrase from biophysicist Harold Morowitz to grace its inner cover: "The energy that flows through a system acts to organize that system."[71] The statement shares the same cosmic and plentiful reading of thermodynamics present in the writings of Fedorov, Vernadsky and Fuller who, in his Operating Manual for Spaceship Earth wrote:

> It is obvious that the real wealth of life aboard our planet is a forwardly-operative, metabolic, and intellectual regenerating system. Quite clearly, we have vast amounts of income wealth as Sun radiation and Moon gravity to implement our forward success. Wherefore living only on our energy savings by burning up the fossil fuels which took billions of years to impound from the Sun or living on our capital by burning up our Earth's atoms is lethally ignorant and also utterly irresponsible to our coming generations

71. Stewart Brand, *Whole Earth Catalog: Access to Tools*, vol. 1 (Menlo Park, California: Stewart Brand, 1968); Harold J. Morowitz, *Energy Flow in Biology: Biological Organization as a Problem in Thermal Physics* (New York: Academic Press, 1968).

> and their future days. […] If we do not comprehend and realize our potential ability to support all life *forever*, we are cosmically bankrupt.[72]

In contrast to the "thermodynamic fatalism" of the isolated systems of ecological economics, the readings of spaceship Earth as a system open to the cosmic energy flows is a reading of thermodynamics that anticipates the shift from closed to open or "far from equilibrium systems" described in the eighties by Nobel chemist Ilya Prigogine. This shift implied that the phenomenon of life was no longer understood as contrary to the inertia of physical laws but aligned in a process of cosmic evolution.

As Höhler reminds us, the power of myths lies in their capacity to bring together controversial arguments. "The spaceship was a figure that enabled environmentalists and technocrats to argue very different positions on and in the same terms."[73] Beyond these groups,

---

72. R. Buckminster Fuller, *Operating Manual for Spaceship Earth* (Carbondale: Southern Illinois University Press, 1969). Emphasis added.

73. Höhler, *Spaceship Earth in the Environmental Age, 1960–1990*, 74.

spaceship Earth represented, at once, crisis and progress, openness and closure, control and interdependency, all central viewpoints to an evolving ecological worldview.

If Gaiapolitics explores the consequences of *grounding* ecology in a terrestrial plane — Gaia—, here, we turn our attention toward metaphors *revolving* around the sun—Helios—and its images of heat *transfers*, energy *radiation*, and thermo*dynamics*.

The development of ecological economics consolidated the conceptual bridge between environmentalism and thermodynamics. The founders of ecological economics included ecologist Howard Odum and economist Herman Daly. In *Environment, Power and Society* (1970), Odum, a leading figure in the development of energy accounting and founder of systems ecology, developed an ecological conceptual framework and methodology based on energy accounting.[74] He introduced the notion of emergy to distinguish between different energy qualities, described human activity as "entropy generating," and included a chapter tellingly titled "Energy Basis for Religion." Herman Daly had been a student under Nicholas Georgescu-Roegen, author of the

74. Howard T. Odum, *Environment, Power, and Society* (New York: Columbia University Press, 1970).

key treatise *The Entropy Law and the Economic Process* (1972).[75] Georgescu's influence on Daly is evident, even if Daly's ideas regarding steady-state Economics were not as radical as his.

The idea of thermodynamic fatalism finds its most strict and radical interpretation in Georgescu's "minimal bioeconomic program." Georgescu Roegen was dissatisfied with both the neoclassical and Marxist economic models since, according to him, both ignored the material grounding of the economic process.[76]

Georgescu based his economic theory on the first two laws of thermodynamics: that energy cannot be created or destroyed in a closed system, but merely transformed (a conservation principle) and that energy tends to degrade irreversibly (also known as the law of entropy).[77] For

75. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, Mass.: Harvard University Press, 1971).

76. The three most important sources of influence for his work were thermodynamics (which he picked from a monograph written by French scientist Henri Borel), evolutionary economics--the notion that capitalism can only be understood as an evolutionary process of innovation and 'creative destruction' cycles (which he picked from his exchanges with Peter Schumpeter during his stay at Harvard University in the thirties), and the observation that during both world wars, the old refineries in his home country of Romania where strategic military targets validated his belief in the primacy of energy resources.

77. It must be clarified here that what "energy" is a contested matter. Also, as elaborated further ahead, even if the law of entropy is universal and inexorable, what entropy is or the consequences of the law are subject to more nuanced interpretation.

him, the economic concepts of production and consumption only obscure the principle of conservation. Also, since the degradation of energy is unavoidable and irreversible, Georgescu used the terms "low entropy" to refer to valuable resources and "high entropy" to refer to waste and pollution. Since the Earth is a thermodynamically closed system, there are only two types of low entropy resources: mineral resources extracted from the Earth's crust and sunlight. Minerals are extracted at a pace defined by man, but the rate at which the Earth is bathed in sunlight is beyond human control.

In "Energy and Economic Myths" (1972), Georgescu expressed his views on growth which are helpful to understand his subsequent rejection of steady state economics and sustainable development. Following economist Joseph Schumpeter, he clarifies a necessary distinction between growth and development. Growth, Georgescu writes, occurs only when the per capita production of commodities increases (which necessarily implies a depletion of resources). Development, on the other hand, has to do with the introduction of innovations. Notably, Georgescu sees both events as part of a single dialectical process: development has historically translated into growth, and growth occurs in association to development.

Further, Georgescu claims that "the roots of economic growth lie deep in human nature." Though for him development is not inevitable, it the human instinct of curiosity what fosters one innovation after the other, and thus growth. Lastly, the distinction between growth and development allows to conceive "economic growth" without "growth." In other words, development without growth which is the core of Georgescu's degrowth program.

Given Georgescu's rejection of substitutability of natural stocks, he came to denounce sustainable development—even after his collaboration with the Club of Rome in the early seventies, which arguably influenced the formulation of the term in subsequent Earth summits. For him there simply was no sustainable rate of extraction of finite natural stocks as any rate necessarily diminishes the stock. He also strongly criticized the idea of steady-state economics developed by his student Herman Daly.[78] Daly's steady-state proposed an economy where a constant stock of manmade capital and human population are sustained by the minimal flow of natural resources. Daly's goal is to distribute resources fairly among present and future

70. Nicholas Georgescu-Roegen, *Thermodynamics and We, the Humans* (1993), 194.

generations. But as Georgescu argued, when the purpose is to stretch finite resources for as long as possible, zero growth is more desirable than growth, but negative growth is even better.

Georgescu's reasoning left no alternative. Following his interpretation of the laws of thermodynamics, the ultimate fate of the universe is certain to be "heat death." Environmental economist Robert Ayres coined the term "thermodynamic pessimism" to refer to the type of hardliners Georgescu best represented.[79]

Georgescu was well aware of the Jevons' paradox—namely, that efficiency gains are re-invested into further economic expansion. In other words, growth and development, as defined by economist Schumpeter, go hand in hand. This realization led him to state regarding humanity's fate: "We must not doubt that, man's nature being what it is, the destiny of the human species is to choose a truly great but brief, not a long and dull, career."[80]

---

71. Robert U. Ayres, "On the Practical Limits to Substitution" in *Ecological Economics* 61 (2007): 115–28.

80. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process.* (Cambridge, Mass.: Harvard University Press, 1971), 314.

Though his work was ignored by the economic establishment and reviews warned against "incorrect statements and philosophical generalizations," his ideas set the foundations for ecological economics.[81] Is there a way around Georgescu's thermodynamic fatalism? He leaves the faintest of cracks in his thesis when he writes:

> The impossibility of a macro-system not in a state of chaos to be perpetually durable may one day be explicitly recognized by a new thermodynamic law just as the impossibility of a perpetual motion once was. Specialists recognize that the present thermodynamic laws do not suffice to explain all nonreversible phenomena, *including especially life processes.*[82]

---

81. Bengt Månsson, "Entropy and economic processes—physics perspectives" in *Ecological Economics* (Amsterdam: Elsevier. 36:2001), 165–179; Malte Faber et al, "The Use of the Entropy Concept in Ecological Economics," in *Ecological Economics: Concepts and Methods*. Ed. Malte Faber, (Cheltenham: Edward Elgar, 2001); Toyoaki Washida, "Material Dissipative Conditions and the Impossibility of Complete Recycling," in *Faculty of Economics* (Kobe University: Kobe, Japan, April 17, 1998). Recently Ayers has argued it is possible to recycle indefinitely as long as there is enough energy provided to do so meaning a spaceship economy is possible on Earth. This view implies that is energy and not material resources the ultimate constraint in a sustainable economy--a position labeled as "energetic dogma." Nevertheless, Ayers position is not shared by most other experts in the field, the general consensus in ecological economics being that though "it is undeniable that complete recycling is theoretically possible under the condition of sufficient energy," complete recycling is impossible for practical purposes since "recycling is a social process which includes many physical processes supported by human activities therefore making the dissipation of matter unavoidable."

82. Nicholas Georgescu-Roegen, "Energy and Economic Myths," in *From Bioeconomics to Degrowth: Georgescu-Roegen's* "New Economics" in Eight Essays, ed. Mauro Bonaiuti. (New York: Routledge, 2014), 79.

Georgescu fundamentally misunderstood entropy. He applied it equally to matter and energy (which is not the case) at a macro level (which is equally wrong). He later attempted to correct these mistakes by proposing a fourth law of entropy to describe the degradation of matter to rule out the possibility of endless recycling. His proposals generated great controversy between the ecological economists and physicists.

Georgescu dismissed advocates of steady-state economics on the grounds that they equated their system to an open thermodynamic state (living organisms are open thermodynamic systems since they exchange matter and energy with their environment). He recognized that open thermodynamic systems are useful to study biological organisms but that the concept rests on some very delicate conditions which can only permit the steady-state to exist in an approximated manner and over a finite duration.[83] Here, Georgescu relied on Nobel physicist Lars Onsager whose work on reciprocal relations allowed a complete description of irreversible processes earning him the Nobel prize in chemistry in 1968. But the work of chemist Ilya Prigogine on dissipative structures in far-from-equilibrium systems, for which he was awarded the Nobel prize nine years after

83. Georgescu-Roegen, 79.

Onsager, provided the proper intellectual apparatus to better understand life from a thermodynamic perspective.[84] Prigogine's work on irreversibility (i.e. change, evolution, and the arrow of time) provided the missing bridge between biology and physics—a link Georgescu himself was aware was sorely missing.

To offer a counterbalance to this restrictive reading of thermodynamics, instead of metaphors of "internal combustion," let us turns our attention to outward images of "solar radiation."

Heliopolitics

Beginning around the first decade of the twenty-first century, a group of Russian futurist thinkers and scientists began to enjoy increased attention from western scholars.[85] In *The Russian*

84. Prigogine, Ilya, and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature*. Toronto; New York, N.Y.: Bantam Books, 1984.

85. Gean Moreno, "Editorial—'Accelerationist Aesthetics,'" *e-flux* 46, no. 6 (2013). Most notably, since 2013 the journal e-flux had featured pieces on cosmism and the tangentially related newer accelerationist movement.

Cosmists (2012), literature scholar George M. Young explained that though the group was never formally recognized, the figures it encompassed all share esoteric interests paired with strong scientific backgrounds.[86] The group included philosopher Nikolai Fedorov, head figure and author of the posthumously published *Our Common Task*—a publication proponent of scientific immortalism and which in some aspects anticipated *Our Common Future* (1987) where the first institutional definition of sustainability was formulated; engineer Konstantin Tsiolkovsky, the father of rocketry and author of the *Call of the Cosmos* (1918), and physician Alexander Bogdanov, proponent of tektology, a field considered to be a precursor of Systems Theory.[87]

Two cosmist figures of special interest here are biophysicist Alexander Chizhevsky and biochemist Vladimir Vernadsky. Chizhevsky made important discoveries in aeroionization and hemodynamics, research which eventually earned him an unsuccessful nomination for a Nobel

---

86. George M. Young, *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers* (Oxford; New York: Oxford University Press, 2012).

87. Konstantin Tsiolkovsky, *The Call of the Cosmos* (Moscow: Foreign Language Publishing House, 1920); Nikolai Fedorov, *What Was Man Created For?: The Philosophy of the Common Task*, ed. Elisabeth Koutaissoff and Marilyn Minto (London: Honeyglen, 1990); World Commission on Environment and Development, *Our Common Future* (Oxford; New York: Oxford University Press, 1987); Alexander Bogdanov, *Essays in Tektology: The General Science of Organization,* trans. George Gorelik (Seaside, California: Intersystems Publications, 1980).

prize. Instead, he came to be better known as the founder of heliobiology—the study of the sun's effect on biology.[88] It is now better understood that the appearance of solar spots and flares affect the amount of x-ray, ultraviolet, and radio frequency radiation emitted by the sun. These patterns have a periodicity of roughly eleven years which has concrete tangible effects in life processes and organisms. For example, variations in solar activity show up in growth rings of trees and have effects on crop yields, the reproduction and migration patterns of animals (including insect pests), the surge and spread of diseases, and the human body's production of hormones.

Chizhevsky developed heliobiologic research as early as 1915 describing the correlations between solar activity and the development of epidemics and increases in nervous and mental illnesses. However, his doctoral thesis *Physical Factors of the Historical Process* (1921) provoked great controversy and eventually lead to him being imprisoned under accusations of occultism. He claimed to have found a correlation between the number of "significant historical events" and solar maximums from the fifth century to the present and called this new field historiometry. For

88. Alexander Chizhevsky, "'The World Historical Cycles,' from The Earth in the Sun's Embrace," in *Russian Cosmism*, ed. Boris Groys (Cambridge, Massachusetts: The MIT Press, 2018), 64.

the soviet regime, Chizhevsky's research implied that the Great October Revolution took place not because of the leadership of Joseph Stalin and Vladimir Lenin, the workers, and historic necessity, but also thanks to sunspots and invisible cosmic rays.

Despite how questionable his later research was, Chizhevsky's position among cosmists stands out for being the only figure less interested in the normativity of human action over the universe, and more into the ways the universe, through its invisible radiation, played a role in regulating life.

Vladimir Vernadsky is considered a figure of the stature of Darwin or Einstein and certainly one of the greatest scientific minds of the twentieth century. His research on soils led to the sequential establishing, first, of geochemistry and later, of biogeochemistry as he discovered the chemical cycles and interactions between the lithosphere and the atmosphere, and the role biological organisms play in them. He borrowed the term "biosphere" from the Austrian geologist Eduard Suess and developed it in a 1926 book of the same title.[89] He emphasized that the exchange of matter leads to the fundamental planetary unity blurring the boundary between

89. Eduard Suess, *Die Entstehung der Alpen* (Wien: W. Braumüller, 1875); Vernadskiĭ, *La Biosphère.*

organic and inorganic realms calling all present life "living matter."[90] More importantly, and in marked contrast to Suess's account of the biosphere as a self-sustaining envelope of the lithosphere, Vernadsky's image is open to the universe. *Biosfera* begins with a chapter dedicated to the cosmos and the primordial role solar radiation plays as the activator of all life processes. For Vernadsky, the biosphere is, first and foremost, the region of transformation of cosmic energy.[91]

Through his writing and his lectures at the Sorbonne, Vernadsky had important influence over western thinkers among which was the surrealist writer Georges Bataille. Having read a copy of the *Biosphere* the year of its publication, Bataille was among the first to adopt and spread Vernadsky's ideas in Europe. Deeply impressed, Bataille published a short collection of heliophilic, heliophobic (and heliophallic) aphorisms which amount to nothing else than Vernadsky's scientific theses translated to ecoerotic verse. In *The Solar Anus,* he writes:

90. A modern version of Greek hylozoism—the notion that all matter is alive.

91. He referred to vegetable matter quite literally as "green fire."

> But the first form of solar love is a cloud raised up over the liquid element. The erotic cloud sometimes becomes a storm and falls back to earth in the form of rain, while lightning staves in the layers of the atmosphere.
>
> The rain is soon raised up again in the form of an immobile plant.
>
> Animal life comes entirely from the movement of the seas and, inside bodies, life continues to come from salt water.
>
> The sea, then, has played the role of the female organ that liquefies under the excitation of the penis.
>
> The sea continuously jerks off.
>
> Solid elements, contained and brewed in water animated by erotic movement, shoot out in the form of flying fish.[92]

The emphasis Vernadsky places on the openness of Earth's life processes toward the cosmos is evident in Bataille's notion that all human economies are open to the wider environment and must ultimately "measure up to the universe."

In *The Accursed Share* (1946), Bataille outlined a unique economic vision celebrating excess. This vision of exuberance is based on the expenditure (as opposed to waste) of the sensual and ritualistic energies of excess—the accursed share—produced by humans. He differentiates

92. Georges Bataille and André Masson, *L'Anus Solaire* (Paris: Editions de la Galerie Simon, 1931).

between homogeneous, "nature-produced" energy that lends itself to work and is thus quantifiable and heterogeneous energy that is "sovereign, not servile" and escapes classification for it is neither useful nor purposeful.[93] In so doing, he anticipated Odum's concept of emergy.

For Bataille, the idea of expenditure necessarily entails an ethics of gift-giving, where the unintended consequences of a generous squandering of excess are what redeem lavishness. As literature scholar Allan Stoekl suggests, Bataille's is a post-sustainability vision where "endurance" or "lastingness" is an after effect rather than the main objective of society. Stoekl writes:

> Another model of spending based on what Bataille called an "economy on the scale of the universe" seems appropriate at a time when certain human profligacy has revealed itself to be an ecological and cultural dead end. Bataille's importance, however, stems from the fact that he puts forward a model of society that does not renounce to profligate spending but affirms it. What is affirmed however is a different spending—a different energy—and that difference perhaps means the difference between a simple meltdown of civilization and its possible continuation, but on a very different scale.[94]

---

93. Georges Bataille, *La Part Maudite: Essai d'Économie Générale* (Paris: Les Éd. de Minuit, 1946). In distinguishing between energies, he was anticipating systems ecologist Howard Odum's concept of emergy used in the field of energy accounting to differentiate energy according to its quality.

94. Stoekl, Allan. Bataille's Peak: Energy, Religion, and Post-Sustainability. Minneapolis, Minnesota: University of Minnesota Press, 2007.

Bataille's economic program is one of the most developed alternatives to the litany of scarcity and closedness that dominate environmentalism. Historian Nigel Clark even saw in Bataille a precursor of postmodern hybrids:

> Bataille's 'accounting' for the role of solar energy in human and other terrestrial life was at the crux of his argument—taken up as a staple of post-structural and postmodern thought—that the systems we compose for ourselves can neither be closed at their beginning nor at their end—and are thus destined to be perpetually energized and animated by their outside.[95]

An apology of excess such as Bataille's, seems anathema in our times of dire ecological crisis. The reason any argument that goes against the grain of environmental dogma has a hard time gaining credence is partly due to a deep-seated misunderstanding in thermodynamic science.

---

95. Nigel Clark, *Inhuman Nature: Sociable Life on a Dynamic Planet* (London: SAGE Publications, 2010), 22.

The much dreaded second law of thermodynamics states that the total entropy of an *isolated* system always increases over time. Much like competition or "survival of the fittest" was misconstrued to justify social Darwinism, entropy has become one of those misunderstood concepts that give rise to misleading ecological metaphors which in turn shape the political narratives.[96] The conflation of entropy with disorder stems from physicist Ludwig Boltzman's 1898 summary of his own work.[97] This association has since put the conception of life as ordered patterns of evolving complexity, at odds with the universe's tendency toward disorder. The misconception is so widespread that several terms haveappeared trying to explain the occurrence of *order* in the universe—the clash between Newton and Darwin. Writer Kevin Kelly used the term exotropy to refer to the "force of life that runs counter to entropy." Inventor Buckminster Fuller popularized the term "negentropy" in his writings, and "syntropy" was introduced by

96. Donna J. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, Illustrated edition (Durham: Duke University Press Books, 2016). Donna Haraway on endosymbiosis and Lynn Margulis: cooperation and not competition seems to be the rule in the evolutionary dynamics of systems.

97. Dorion Sagan, "Thermosemiosis: Boltzmann's Sleight, Trim's Hat, and the Confusion Concerning Entropy," in *The Cosmic Apprentice: Dispatches from the Edges of Science* (Minneapolis; London: University of Minnesota Press, 2013).

Nobel laureate physicist Schrodinger in his popular *What is Life* (1944) to refer to the goal-seeking or purpose-oriented behaviors observed in living systems. This generalized misconception is still present today. Darwinist philosopher Daniel Dennett repeats the same mistake when he says that living beings are things that defy and constitute a systematic reversal of the second law.[98]

As philosopher Dorion Sagan—son of astronomer Carl Sagan and biologist Lynn Margulis, proponent of endosymbiosis—explains, the second law's true insight is that energy, if unhindered, "spreads out in space in a greater number of energy levels."[99] Entropy (coincidentally denoted with the letter *s*) is the *spread* function of energy. This dispersion does not happen right away. Life does not in fact run counter to entropy but can delay its immediate action in pursuit of more efficient gradient dissipating mechanisms. Even when the universe is relentlessly "running down," life is thermodynamically valuable.

---

98. Daniel Clement Dennet, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon & Schuster, 1995), 69.

99. Sagan, "Thermosemiosis: Boltzmann's Sleight, Trim's Hat, and the Confusion Concerning Entropy," 93.

This energetic "uphill" process begins at the atomic level where so-called endorgenic chemicals are created. These compounds contain more energy than the elements that go in them because they are formed with the input of external energy (lighting and cosmic radiation). The most important of these substances is adenosine triphosphate (ATP), a compound as ubiquitous as DNA, which serves as life's energy storage molecule. *Localized* living systems temporarily defer the *general* statistical thermodynamic predictions of energy gradient dissipation.

The understanding of entropy not as chaos but as universal tendency for energy to dissipate has major implications for the philosophy of nature. The secular eschatology of "the heat death of the universe" (i.e. thermodynamic fatalism) can be reinterpreted if entropy is understood not as a descent into chaos but a tendency to spread. As Sagan argues, this "phenomenologically observed tendency to spread is an intrinsically telic process" suggesting that "the world may be meaningless and yet have direction."[100] That processes may have a purpose

100. Sagan, 105.

(telos) does not preclude them from have more than one. Additionally, purpose should not be conflated with consciousness—this understanding is not suggesting a form of neovitalism.

Biosemiotics is a field at the intersection of semiotics and biology that studies the prelinguistic processes of meaning-making (understood as the production and interpretation of signs and codes) in the biological realm. Biosemiotics proposes a paradigm shift in the scientific view of life suggesting that semiosis (defined as a sign process which includes meaning) is one of its immanent and intrinsic features. The term was first used in 1962, but physiologist Thure von Uexküll (son of biologist Jacob von Uexküll, better known for his notion of *umwelt*) made pioneering contributions to the field seeking to challenge the normative view of biology.

Drawing a parallelism with biosemiotics, Sagan's "thermosemiosis" attempts to lay out a materialist teleology of life based on a different interpretation of the scientific paradigm of energy and entropy. Under this light, thermodynamics is not all-powerful. Not everything has to be reduced and explained in its terms. "Telothermy," as Sagan calls it, "is more like gravity whose

universal application in no way stops birds (whose wing energy comes from mitochondria studded muscles powered by a redox or delayed solar gradient) from flying."[101]

Evolutionarily, the dispersion of accumulated excess adds to the process of natural selection—an equally important process of sexual selection (Bataille's erotic retelling of Vernadsky's theories acquires another level of meaning.). A peacock's tail seems like an exorbitant squandering of energy gradient, but "thermodynamic beauty" is intrinsically tied to sexual selection which goes beyond mere survival. As Sagan notes, though this runaway expenditure can be a dead end, "regimes of rapid growth favored by the second law over and above survival can be aesthetic crucibles of experimentation from which new regimes may emerge."

Heliopolitcs begin to open up the earthbound life process to the vast cosmic horizon. They afford an understanding of the universe not as a lifeless, purposeless void but "as a telic medium" in which life, including human life, is deeply complicit in a process of meaning-making that does not violate Copernicanism. However, to fully realize the possibilities for re-

101. Sagan, 223.

enchantment this reorientation offers, the next step is to overcome heliocentrism and turn instead toward to the largest ecological horizon: the cosmos.

The Metaphor of the Flag

Flags are devices to signal and mark territories. They are carried by ships and planted on remote islands to claim ownership over them or mark a symbolic moment. As instruments of power, they are simultaneously rudimentary and sophisticated. The almost pre-cultural gesture of erecting a vertical mast perpendicular to the horizon might be one of the most primitive ways of marking a territory, symbolically connecting the earth with the sky. Yet, flags also rely on established protocols of rules and signs, the object of study of vexillology, to convey meaning and carry messages. Metaphorically, the act of planting a flag might be the simplest way of terraforming, of exerting power over the land, making it human. [102]

102. Carl Sagan, "The Planet Venus," *Science* 133 (March 1, 1961): 849–58; Carl Sagan, "Planetary Engineering on Mars," *Icarus* 20 (1973): 513–14. Vexillology is the study of flags. Terraforming is the process of

The Martian flag was designed in 1998 by planetary scientist Pascal Lee while taking part in a summer field campaign in Devon Island in the Arctic.[103] Born in France, Lee claims that his original inspiration came from the tripartite scheme of the French flag where each colored band stands for one of the three values of the French revolution: equality, fraternity, and freedom.

In terms of its vexillology, the Martian flag consists of three vertical bands of equal widths colored red, green, and blue from left to right. The exact pantone colors are “Red Clay” (18-1454 TCX), “Mint Green” (17-6333 TCX), and, rather ironically, “Imperial Blue” (19-4245 TPX). Though Lee is not an advocate of planetary engineering on Mars—a process known as terraforming, the colors have come to be seen by many as representative of the stages the planet would go through if it underwent such transformation. Red for the barren landscapes rich in iron

---

altering other planets to make them earth-like. The first scientific paper on the subject was presented by astronomer Carl Sagan in 1961.

103. Pascal Lee studied astronomy and space sciences at Cornell and worked as a research and teaching assistant for his thesis adviser Joseph Veverka, and the late Carl Sagan. After co-founding the Mars Society, Lee led the development, establishment, and early operation of the "Flashline Mars Arctic Research Station" or FMARS, the world's first simulated Mars habitat.

oxide. Green for the photosynthetic organisms that could jumpstart a greenhouse effect. Blue for the oceans that would form after rising temperatures melted the polar ice caps.

If instead of interpreting the flag as a visual descriptor of the changing landscapes resulting from ecological succession, if we reconsidered Lee's original inspiration in the French flag, what values could each color stand for?

The term "terraform" appears for the first time in "Collision Orbit" (1942), a short story by Jack Williamson though the concept predates his work. The idea of turning other planets into replicas of Earth appears in philosopher Nikolai Fedorov's "Astronomy and Architecture" published posthumously in 1907:

> It is by […] the application of science that the course not only of the Earth, but of whatever other planets may prove moveable by the same methods, is to be directed. The building up of Earth, too, will be accomplished by that same application: its transformation into a temple, and the other planets into new dwellings.[104]

In 1961, astronomer Carl Sagan published the first scientific paper discussing the planetary engineering of Venus, and in a paper written in 1972, he also discussed planetary

104. Fyodorov, "Astronomy and Architecture," 74.

engineering on Mars. Three years later, NASA addressed the issue of planetary engineering officially in a study but used the term "planetary ecosynthesis." The study concluded that it was possible for Mars to support life and be made into a habitable planet.

In popular culture, science fiction writer Kim Stanley Robinson's *Mars Trilogy* is arguably the single most important work to popularize the notion of terraforming producing its richest expression. The novel is mind-bogglingly precise in its technical aspects, but what sets it aside as a piece of ecological science fiction is the way in which Robinson uses it as:

> a Brechtian estrangement device to open up space for thinking about the organization of Earth. On Mars, questions of base and superstructure, nature and culture, economics and politics, can never be treated in isolation as all "levels" have to be organized together.[105]

In *Dying Planet: Mars in Science and the Imagination* literary scholar Robert Markley suggests that what Robinson's trilogy offers is:

> a theoretically sustained and sophisticated attempt to conjure into being a future that resists the romantic dystopianism of cyberpunk, the anti-technological bias of much

105. Wark, *Molecular Red: Theory for the Anthropocene*, 186.

green literature, and the blanket denunciations of capitalist technoscience that have become popular in some left-wing circles.[106]

There is a crucial difference between Earth and Mars which makes the red planet an especially effective setting for ecological thought experiments. On Earth, life and nature are synonymous and usually stand in opposition to humanity forming a tricky binary, the source of much misperception. On Mars (and in fact every other place in the universe), life and nature are two separate things. The triad they form together with humans allows Mars to advance more original angles to subjects such as environmental justice and technological determinism than the binary treatments the same issues receive on Earth. This asymmetry between Mars and Earth means that the projection of terrestrial narratives on Mars is not possible without undergoing first a process of "cognitive estrangement" (borrowing the term from science fiction theory scholar Darko Suvin) which has the effect of "denaturing" values and assumptions deeply engrained in Gaian ecological thinking.[107]

---

106. Robert Markley, *Dying Planet: Mars in Science and the Imagination* (Duke University Press, 2005).

107. Darko Suvin, "On the Poetics of the Science Fiction Genre," *College English* 34, no. 3 (December 1972): 372–82.

Each faction—abiotic nature, life, and humans—relates to a different value system or "environmental ethic" which must take responsibility for the totality of interactions between factions (and not just nature-culture as on Earth).

Initially, the politico-economic, cultural, environmental, and philosophical conflicts explored throughout the trilogy pit the Reds, proponents of terraformation—a heavy handed approach reliant mostly on technological means to turn Mars into an Earth-like environment—against the Greens, who champion a gentler, minimalist, and biologically driven approach known as ecopoiesis.

Later in the trilogy, we are presented with a two more alternatives to the biocentrism-anthropocentrism dichotomy. The first is reflected in the character of Ann Clayborne, a geologist part of the first mission to Mars. For her, the Martian geology itself challenges anthropocentric and biocentric justifications for terraforming. The debate between Red terraforming or Green ecopoiesis is irrelevant because geology itself has intrinsic value as a historical record. Clayborne's radical position foregrounds landscape as yet another protagonic agent in the novel. The evolving "environment" is not a passive background for the playing out of

politico-ecologic mythologies, but an integral character in the formation of the political eco-economy of Martian societies.[108]

The second alternative to the bio-anthro dichotomy is given a voice by Hiroko Ai, a biosphere designer that leads a group of colonizers that has split from the rest a hundred years after the first human landing on Mars. Ai develops a philosophy she calls "viriditas":

> There is a constant pressure, pushing toward pattern. A tendency in matter to evolve into ever more complex forms. It is kind of pattern gravity, a holy greening power we call viriditas, and it is the driving force in the cosmos. Life, you see… And because we are alive, the universe must be said to be alive. We are its consciousness as well as our own. We rise out of the cosmos, and we see its mesh of patterns, and it strikes us as beautiful. And the feeling is the most important thing in all the universe—its culmination, like the color of the first flower at first bloom on a wet morning. It is a holy feeling, and our task in this world is to do everything we can to foster it.[109]

---

108. Kim Stanley Robinson, *Green Mars* (New York: Bantam Books, 1994). On the role of landscape as active agent shaping life, Robinson writes:

> The point is not to make another Earth. [...] The point is to make something new and strange, something Martian. [...] All the genetic templates for [the] new biota are Terran; the minds designing them are Terran; but the terrain is Martian. And terrain is a powerful genetic engineer, determining what flourishes and what does not, pushing along progressive differentiation, and thus the evolution of new species.

109. Robinson, *Green Mars*, 127.

Reminiscent of philosopher Dorion Sagan's notion of thermosemiosis, Hiroko's "viriditas" ascribes the abstract principles of a scientific will to meaning (semiosis) on phenomenology. In other words, viriditas, more than a philosophy or an abstract program, describes the embodied nature of participating in the process of co-evolution which is life. The "greening energy" viriditas refers to the evolution of complexity of material structures that eventually gives rise to the phenomenon of mind in a manner reminiscent of the cosmogony of Russian cosmists who understood the rise of consciousness from inert matter as an event (cephalization) in an evolutionary process of cosmic scale.[110] More importantly, just like in Sagan's conception of thermosemiosis, beauty plays a creative role (through the energy-squandering process of sexual selection), viriditas recognizes an indissoluble relationship between ethics and aesthetics.

> Robinson offers a mode of writing that really does confront this era of metabolic rift with a renewal of utopian thought, in which, strangely enough, science fiction turns out to be a kind of realism of the possible.[111]

---

110. Vladimir I. Vernadskiĭ, "Some Words About the Noösphere," trans. George Vernadskiĭ, *American Scientist*, January 1945, 16–21. Cephalization refers to the evolutionary process through which inert matter develops consciousness.

111. Wark, *Molecular Red: Theory for the Anthropocene*, xix.

Robinson's "future primitive" sensibility constantly brings together aspects of the postmodern and the premodern turning the novel into an awesome heuristic to denature and confront what Latour called "the constitutive fictions of modernity": "the separation of culture from nature" and "the privileging of modern techno culture at the expense of premodern value systems."[112] His formulation's originality constitutes a renewal of utopian thought where, strangely enough, as theorist McKenzie Wark observes, "science fiction turns out to be a realism of the possible."

Cosmopolitics

The last chapter left us at an opening. Reaching this point, it is worth reflecting on what can be surmised from the discursive analysis behind Gaia and Helios before moving on. The earthbound metaphors of Gaiapolitics can be associated with a modern dual mythology of

112. Bruno Latour, *We Have Never Been Modern* (Cambridge, Massachusetts: Harvard University Press, 1993). 12.

progress and apocalypse, of humans and nature, and a closed world. This substructure is what leaves us with pro-economic growth narratives pitted against the environmental narrative based on limits. Heliopolitics, on the other hand, can be associated with a postmodern sensibility of open readings, hybrids, and a universal conception of nature where the boundaries between organism and environment, the biotic and the abiotic, human and nature melt away in a biospheric soup that spills into the vastness of cosmos. Framed in these terms, Cosmopolitics extends the exploration of cosmos as the last horizon of an ecological imaginary that, like the previous two, can be associated its own "cosmodern" sensibility. What sets aside the cosmodern vis-à-vis the modern and postmodern is the means by which it seeks a new moment of cultural re-enchantment. As Morton suggests, "the impossible viewpoint [of space] is a cornerstone of the ecological thought."[113]

To begin, consider three images, all appearing in the same year. The first is the *Blue Marble* (1972) photograph shot by the crew of the Apollo 17 mission. It was released in the same year as the all-time best-selling environmental publication *The Limits to Growth* (1972) and the

113. Timothy Morton, *The Ecological Thought* (Cambridge, Massachusetts: Harvard University Press, 2010), 120.

celebration of the first World Conference on the Human Environment in Stockholm. Together with these events, the photograph helped usher environmentalism into its "planetary" stage. The technology that made shooting *Blue Marble* possible from outer space was the same that was used to model the environmental predictions in *The Limits to Growth* report. The cybernetic model known as World3 modelled both the crew's life support systems that enabled this seemingly impossible photograph and the prospects of "Spaceship Earth" itself. Apollo's eye was a Hasselblad 500 EL camera, and it showed us Earth as a singular, lone island suspended in a fathomless abyss.

Next, consider the painting titled *The City of the Captive Globe* (1972) by artist Madeleine Vriesendorp. It depicts the Earth in a pit at the center of an urban grid bringing to mind a quote by philosopher Jacques Derrida: "There is no world, only islands." Instead of the lone oasis, an archipelago. Instead of outer space, the isomorphic grid of an ideal where every block represents an ideology. Together, they participate in the pluralistic "incubation of the world."[114] Produced

114. Terence Riley, "Drawn into a Collection: A Context of Practices" in *Envisioning Architecture: Drawings from The Museum of Modern Art*, ed. Matilda McQuaid (New York: The Museum of Modern Art, 2002), 172.

the same year as the demolition of the high-rise public housing project known as Pruitt-Igoe (which marked the symbolic death of modernism, according to historian Charles Jencks) and as the publication of *Learning from Las Vegas* (1972)—a postmodern manifesto in its own right—*The City of the Captive Globe* illustrates the postmodern take on ecology as a social construct.

Lastly, think of the Pioneer plaque designed by Linda Salzman, Carl Sagan, and Frank Drake in 1972—later included in the Golden Record onboard the 1977 Voyager probes missions. The plaque depicts the human figures next to a schematic drawing of the probe itself, the position of the sun with respect to other celestial bodies, and the cosmic address of the Earth within a diagram of the solar system. With a hydrogen atom as a unit, the plaque bootstraps an entire code system so its message can be deciphered if ever found by others. The plaque's diagrams constitute an earnest effort in a cosmopolitan universalism.

If the *Blue Marble* photo's rendering of ecology represents the modern view of ecology (detached, dualist, positivist) and *The City of the Captive Globe* painting represents the postmodern (hybrid, pluralist, and contingent), then the diagram featured on the Pioneer plaque (along with a plethora of media, from whale songs to the brainwaves of a woman thinking about

falling in love, included in the Golden Record) stands for a view of ecology we could call "cosmodern."

Cosmodernism was first defined by physicist and philosopher of science Basarab Nicolescu in his *Théorèmes poétiques* (1994) and later picked up by literary theorist Christian Moraru.[115] For Moraru, Cosmodernity is an emerging "soft" cultural paradigm, a new "imagination modality" whose linchpin is relationality. He describes cosmodernism as being:

> (a) an imaginary modality of mapping out today's world as a cultural geography of relationality; (b) by the same token a protocol of subjectivity formation; (c) an ethical imperative pointing to the present as much as to the future; and (d) a critical algorithm for decrypting and assembling a range of post-1989 narrative and theoretical imaginings into a reasonably coherent and, again, ahead-looking model.

After recognizing the emergence cosmodernism from a "planetary turn" in literature (like the planetary turn identified here in ecology and environmentalism), in more recent works, Moraru abandoned cosmodernism in favor of "geoaesthetics." Here, I propose to recover and

115. Basarab Nicolescu, *Théorèmes poétiques* (Monaco: Éditions du Rocher, 1994); Christian Moraru, *Cosmodernism* (Ann Arbor: University of Michigan Press, 2011); Basarab Nicolescu, *From Modernity to Cosmodernity* (Albany: SUNY Press, 2015).

expand the notion of cosmodernism by incorporating three seemingly disconnected subjects—cosmopolitics, cosmology, and cosmism. But like stars, to see them aligned in a constellation, these three spheres need to be regarded from a specific vantage point.

Political ecology seeks to shed light on the social constructedness of environmental problems. Today's "singular, but manifold" crisis calls for an urgent reorientation of our political affects.[116] Defining the grounds on which such a reorientation ought to take place amounts to nothing less than a re-envisioning of our conception of the world. As philosopher Bruno Latour points out, "Despite appearances, what counts in politics are not attitudes, but the form and the weight of the world to which these attitudes have the function of reacting. . .. This is the decisive discovery of political ecology."[117] The project of re-enchantment is the reconstitution of the

116. Much has been written on how (1) the environmental, financial, social, and political crises are all facets of a "singular, but manifold crisis" with its root in the totalizing algorithm of capitalist neoliberalism, and (2) how, out of these, the environmental crisis imposes the greatest objective urgency. Enough critical debate has taken place around the proper calibration of scientific affects leading to a tacit consensus around "climate realism" (borrowing the term from scholar Andreas Mälm). For converging critical views on this matter, see, for instance, Jason W. Moore, *Capitalism in the Web of Life* (New York: Verso, 2015); Andreas Mälm, *The Progress of This Storm* (London: Verso, 2018), and Bruno Latour, *Down to Earth*, 1st ed. (Cambridge, UK: Polity Press, 2018).

117. Bruno Latour, *Down to Earth*, 52.

world. Cosmopolitics, cosmology, and cosmism come together in it: cosmopolitics, as a timely political sensibility (a remedy not only to xenophobia but to anthropocentrism), cosmology as the stage where natural philosophy's speculations on the unknown are grounded in material scientific practice, and cosmism as an example of the political horizons such reorientation would make accessible.[118]

Here, it is important to distinguish between different conceptions of Cosmopolitanism. For the Greek cynics, being cosmopolitan revolved around a sense of belonging—not to a state, but to the world. For Kant, it was a matter of hospitality, a condition necessary for "perpetual peace." For Latour and philosopher Isabelle Stengers, cosmopolitics is a matter of inclusion, of which modes of knowing can assert their claim to truth and how political assemblages are

118. Denis Cosgrove, *Geography and Vision* (London: I. B. Tauris, 2008), 36. On the potential for re-enchantment found in cosmology, geographer Denis Cosgrove writes in reference to Humboldt's *Kosmos*: "But if Humboldt embraced a characteristic Enlightenment belief in positive scientific progress moving from myth to enlightenment by way of empirical observation within a disenchanted physical universe, he shared with Ruskin and other nineteenth-century students of nature the fascination with natural form and phenomenological apperception articulated by Johann Wolfgang Goethe. Humboldt acknowledged the enduring power of human imagination and speculation in making and framing science."

constituted beyond the human. In this manner, both cosmopolitanism and cosmopolitics are related through the notion of belonging.

Stengers' most recent formulation merits particular attention. Developed in her eponymous series inspired by her earlier work with chemist Ilya Prygogine, *Cosmopolitics* (2003) has to be understood in the context of postmodern critiques of "scientism," as a challenge to the hegemony of science in modern western societies. She proposed taking competing worldviews seriously rather than condescendingly tolerating them in a manner that levels the field between the modern and the premodern. This formulation was welcomed in a postcolonial context that tried to bring back the voices of those historically excluded (women, LGBTQ+, minorities, animals, etc.). It was also welcomed in the context of the so-called science wars of the 1990s—a reaction against techno-managerialism (erroneously perceived as apolitical). However, as discussed earlier, Stengers's formulation leaves the question of pluralism and inclusivity unresolved. For instance, philosopher Steven Shaviro's has asked, "Where do Stengers' and Latour's anti-modernist imperatives leave us when it comes to dealing with the fundamentalist, evangelical Christians in the United States today?" The postmodern affect not only failed to

produce an agreeable, progressive alternative to capitalism, but its analytical arsenal is now weaponized by movements such as climate change denialism.

Our political imagination is depleted.[119] Philosopher Jean-Jacques Rousseau's "noble savage" or philosopher Thomas Hobbes's "Leviathan" illustrate how political imaginaries are founded on myths. There is no more primordial myth than nature and its corollary, human nature. After his sober indictment of the failure of political-ecology, geographer Neil Smith's offers a corrective: the re-enchantment of society.[120] Smith hints at the "the desolate junction of

119. The 2007–2009 recession exposed the neoliberal farce. Trump's election, the Brexit vote, and the general regression of democracy worldwide are symptomatic of societies fed up with a political economy indefensible by its beneficiaries and unsustainable for the affected. The recent trends show political change is possible, but in the absence of an agreeable, progressive alternative, the world is retrenching into ethno-nationalism, xenophobia, and unilateralism. In "To Modernize or to Ecologize" (2004), Latour suggests, "The present historical condition is defined by a complete disconnect between two alternative narratives—one of emancipation, detachment, modernization, progress, and mastery, and the other, completely different, of precaution, attachment, entanglement, dependence, and care." The greatest promise of re-enchantment is to ignite a narrative to expand our political horizons beyond these poles.

120. Roland Barthes, *Mythologies* (Paris: Éditions du Seuil, 1957).

poetics and political economy" as the starting point of such project and adds the warning: "Access to poetic nature is thoroughly policed by politico-economic power."[121]

Sociologist Max Weber lamented the fate of our times as being characterized by "rationalization and intellectualization and, above all, the 'disenchantment of the world.'" If disenchantment translates into a strictly materialist naturalism, then it was biologist Charles Darwin's evolution theory that delivered the death blow to supernatural accounts in nature.[122] Before him, Western enlightened thought remained teleological: philosopher Georg W. F. Hegel's notion of evolution was orthogenetic, philosopher Immanuel Kant thought the ultimate station of human societies was eternal peace, and, in philosopher Karl Marx's politico-economic vision, capitalism necessarily led to communism.[123] Evolution demoted progress (unavoidable

---

121. Stephen Toulmin, *The Return to Cosmology* (Berkeley: University of California Press, 1985), 24. Here, following philosopher Roland Barthes's elucidations on myths and power, it is useful to remember that one function of myth is naturalizing certain worldviews. Paraphrasing writer Anaïs Nin, we should remain alert, for "we see nature not as it is, but as we are." Toulmin writes: "If we do think ourselves myth free, when we are not, that is (I am suggesting) largely because the material from which we construct our myths is taken from the sciences themselves."

122. Morton, *The Ecological Thought*, 30. According to Morton: "It was Alfred Russell Wallace who nervously persuaded Darwin to insert Herbert Spencer's insidious phrase "survival of the fittest" into *The Origins of Species*."

123. Hui Yuk, "Cosmotechnics as Cosmopolitics," in *e-flux* 86 (November 2017). Yuk writes:

and irreversible) to mere change (random and contingent); it turned the arrow of time into spaghetti. Cognitive scientist and philosopher Daniel Dennett calls Darwinism a "universal solvent" that removes any "trace of purpose or meaning in either nature or life." Evolution is a process with no ulterior goal other than conjugating creatures with their environment strictly in the present tense. In other words, evolution, unlike progress, is blind to the future.[124]

Given the nearly full scientific consensus around the neo-Darwinian materialist conception of the physical universe, a project for the re-enchantment of nature entails a great deal of diplomacy. Many, including Smith, warn about the dangers of falling for the naivete of Romantic, premodern, and magical worldviews or the corrupting mysticism of the so-called dark enlightenment. To avoid these dangers, we ought to recognize that our understanding of nature

---

Kant maintains that this relation between nature and cosmopolitics is necessary. If Kant sees the republican constitution and perpetual peace as political forms that may be able to bring forward a universal history of the human species, it is because he understands that such progress is also a progress of reason, the telos of nature. This progress toward an end goal . . . is the 'completion of a hidden plan of nature.' What does it mean for nature to have a hidden plan? *And why is the realization of cosmopolitics the teleology of nature?*"(Emphasis mine.)

124. Brian Snyder, "The Darwinian Nihilist Critique of Environmental Ethics, "in Ethics *&* *the Environment* 22, no. 2 (2017): 59–78.

is always technologically mediated, as philosopher Walter Benjamin keenly observed.[125] Philosopher Yuk Hui refers to this notion as cosmotechnics.[126] A quote mistakenly attributed to the poet William Butler Yeats goes: "The universe is full of magical things patiently waiting for our wits to grow sharper." In the original passage, writer Eden Phillpotts, who describes the beauty of a flower under a magnifying glass, refers to the development of sufficient technology to reveal the splendor of the cosmos. Today, nothing embodies this better than the gold-coated beryllium mirrors of the James Webb space telescope—an instrument many hope will allow the detection of life biosignatures in exoplanetary atmospheres.

Cosmic imaginaries are at their highest point of relevance since the end of the Apollo space program. We witness a burgeoning new space race and accelerated progress in cosmological discoveries.[127] In the political arena, polarization, unilateralism, and recalcitrant

125. Benjamin observed that it is not the case that through technology, human controls nature. Rather technology is what controls human relationship to nature. The difference is subtle but has profound implications.

126. The invention of the telescope and the microscope in the 1600s revealed hidden magnitudes resulting in a new relation with the cosmos. On one hand, nature ceased to be anthropomorphic with humans at the center. On the other, vast vistas opened, ready to be explored. It's a dual moment of enchantment and disenchantment.

127. Christian Davenport, *The Space Barons* (New York: Public Affairs, 2019). At the time of writing, Vice President Michael Pence announced plans to send humans back to the Moon by 2024.

nationalisms can only be confronted with a renewed sense of Kantian cosmopolitanism. In the context of the ecological crisis, cosmopolitics offers a reconstitution of the political to include non-human actors. Considering the multiple appearances of the cosmo- prefix in contemporary culture, it is no wonder why certain circles in the West rediscover with fascination the radical altermodernity of Russian cosmism. At this historical junction, perhaps a cosmodern sensibility can serve as a "soft heuristic" to reorient our questions not as isolated political, technoscientific, environmental, or aesthetic matters, but rather as a matter of "civilization itself."[128]

---

128. Christian Moraru and Amy J. Elias, *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century* (Evanston, Illinois: Northwestern University Press, 2015), xxv; George Young, *Russian Cosmists, The Esoteric Futurism of Nikolai Fedorov and His Followers* (London: Oxford University, 2012); Alex Williams and Nick Srnicek, "#Accelerate: Manifesto for an Accelerationist Politics," Critical Legal Thinking: Law and the Political, May 14, 2013; Robin Mackay and Armen Avanessian, *#Accelerate#* (Falmouth, United Kingdom; Berlin: Urbanomic Media Ltd. in association with Merve, 2014); Boris Groys, *Russian Cosmism* (Cambridge, MA: The MIT Press, 2018); Bruno Latour, *Down to Earth*, 89; György Lukács, *History and Class Consciousness* (Cambridge, MA: MIT Press, 1968).

On cosmism's rediscovery, Young's is the first Western publication on the matter. Alex Williams and Nick Srnicek reference cosmism as a source for political ambition. Writings by Fyodorov and Tsiolkovsky are included in *#Accelerate: The Accelerationist Reader. e-flux journal* dedicated its February 2018 volume to cosmism. Princeton's School of Architecture held the "Cosmism-Superhumanity" symposium in 2017, and theorist Boris Groys edited an anthology on Russian Cosmism in 2018.

On cosmodernism, "Moraru has observed that the post-1989 historical intermezzo of 'cosmodernism' translates . . . primarily into an imaginary, a way of picturing the world." On the notion of totality or society-as-a-

In "Back to Sublunar Earth" (2010), Latour presents the setbacks in space exploration since the end of the Apollo program to illustrate that technological progress is not inevitable and irreversible, as thinkers of the Enlightenment believed. The timing of his conclusion—representative of the "hermeneutics of suspicion" characteristic of his brand of postmodern critique—could not be more off. At the time of his writing, a fledging new space, partly fueled by a new generation of billionaires, was already unfolding.

In a lecture at Harvard almost ten years later, Latour again casts doubt over the prospects of outer space. He sees capitalism's endgame in the renewed interest in space: an escapist fantasy that negates the limits of our "climate regime."[129] He calls this the "out-of-this-world attractor," characterizing it as a utopia for the few. Ironically, just a day before, Jeff Bezos, at the time world's richest man and CEO of Amazon and aeronautics company Blue Origin, expressed his

---

whole, Latour writes: "The current situation . . . is not simply a contradiction, . . . a matter of economics, but rather of civilization itself."

129. Bruno Latour, "A Tale of Seven Planets—An Exercise in Gaiapolitics" (lecture, Harvard University, Cambridge, MA, October 16, 2018).

goal of seeing "a trillion humans inhabiting the solar system."[130] These contrasting takes around space fantasy illustrate that, more than "socialism for the rich and capitalism for the poor," what we experience is manifest destiny for the billionaires and existentialism for the rest. But instead of condemning the extraterrestrial imagination and abdicating to its space of political possibility, it ought to be reclaimed.

Latour proposes the "terrestrial" not only to counter the "out-of-this-world" attractor, but to counter the long-standing dichotomy between the local and the global. For him, the view from "the Great Outside" that characterizes the "out-of-this-world" attractor is simply too abstract—a dangerous illusion. The local and the global have redeeming moments but also pitfalls. The terrestrial aims to refine a delicate balancing act: "The soil allows us to attach ourselves; the world allows detachment. Attachment allows us to get away from the illusion of a Great Outside; detachment allows us to escape the illusion of borders."[131] In this regard, Latour's

130. Jeff Bezos, remarks delivered at the 25th anniversary event for *Wired* magazine (San Francisco, October 15, 2018).

131. Latour, *Down to Earth*, 41.

"terrestrial" shares a goal not too dissimilar from scholar Gayatri Chakravorty Spivak and Moraru's "planetary," which tries to reclaim the space of the world from the totalizing paradigm of globalization. Both concepts plot different paths toward a process of "worlding" that doesn't relinquish the space of possibility of the largest of scales—that of the planet, the world, the globe, or Gaia—to the suffocating singularity of globalization.[132] To paraphrase Robert Venturi, both the terrestrial and the planetary look for a process of worlding that embodies "the difficult unity of inclusion rather than the easy unity of exclusion."[133]

The "planetary" and the "terrestrial" are associated with the "geo-" prefix (as in geosocial, geophilosophical, geohistory, or geopolitical). A "cosmodern" affect would take them a step further, substituting the "geo-" with the "cosmo-." Otherwise, any new geo-affects risk having the same failings as previous ecological narratives.

Geographer Alexander von Humboldt, in his magnum opus *Kosmos* (1845–1862), used the term "cosmos" to refer to the unity of Earth and the heavens. It is not an opposition, but an

132. Jean-Luc Nancy, *La création du monde ou la mondialisation* (Paris: Galilée, 2002).

133. Robert Venturi, *Complexity and Contradiction in Architecture* (New York: The Museum of Modern Art, 1966), 88.

extension—vis-à-vis the cosmic, the terrestrial seems parochial. For all the importance Latour gives to ecology, there is a frustrating inwardness in his narrative, especially considering the speculative nature of his call to imagining new modes of existing in the world. Ecology released from its terrestrial horizon to include the entirety of the universe governed by the laws of physics reveals itself as cosmology. Why the obsession with "sublunar Earth" when what is required is nothing less than a "moon shot" effort? To quote geographer Denis Cosgrove, "To lose the sense of heavens is to risk losing also that of Earth."[134]

Ecological narratives are suffused with a scarcity worldview. This is best illustrated by the commonsensical argument of the limits-to-growth apologists: in a finite world, growth cannot be limitless. Few would dare challenge this self-evident statement.[135] Yet economists do, and, for that, they get criticized for not grounding their doctrine in material reality. In response, the so-called ecological economists have fashioned an economic theory from the ground up based on

134. Denis Cosgrove, *Geography and Vision: Seeing, Imagining and Representing the World* (London: I.B. Tauris, 2008), 48.

135. Leigh Phillips, *Austerity Ecology: A Defense of Growth and Progress* (Winchester, UK: Zero Books, 2015).

their understanding of the laws of physics.[136] It is ironic, then, that the second group that goes against the limits-to-growth argument is composed of physicists.[137]

Examples of "non-scarcity" or "open" worldviews (sometimes also called "post-scarcity" or "cornucopian") that lie beyond the Manichean space of the limits-to-growth framework are rare.[138] All the more reason to turn our attention to the recent discovery of Russian cosmism by the West. Previously, we explored the ideas of Alexander Chizhevsky and Vladimir Vernadsky and their influence on bridging biology and thermodynamics in a non-restrictive manner. These

136. Caradonna, *Sustainability*; Fernández-Galiano, *Fire and Memory*. Historical accounts on the "underground" school of economics are rare.

137. Deutsch, *The Beginning of Infinity*; Tipler, "There Are No Limits to the Open Society."

138. Karl R. Popper, "Natural Selection and the Emergence of Mind" (Lecture, Darwin College, Cambridge, November 8, 1977). "Although science has nothing to say about the personal creator, the fact of the emergence of novelty and of creativity can hardly be denied. I think that Darwin . . . himself would have agreed that though natural selection was an idea which opened up a new world for science, it did not remove from the picture of the universe that science paints the marvel of creativity, nor did it remove the marvel of freedom to create and the freedom of choosing our own ends and our own purposes."

In terms of arguments in favor of (non-capitalist) exuberance, besides Russian cosmism, the only example that comes to mind is Bataille's notion of a "universal economy" or Bernard Mandeville's *Fable of the Bees* (1714).

ideas are but a small glimpse of the rich depiction of nature, life, and humans offered by Cosmism.

Cosmism is the name given to a set of ideas put forth by a group of Soviet philosophers, artists, and scientists in the late 19th and early 20th centuries. The head figure of the movement was philosopher Nikolai Fyodorov. His writings were collected posthumously by his followers in *The Philosophy of the Common Task* (1916). Fyodorov's *Common Task* can be summarized as the abolition of death and the resurrection of the dead. This program ought to be understood not as a theological eschatology but as the radical conclusion of a rational emancipatory project—one that was not encumbered by the normative definitions of the terrestrial but attempted nevertheless to remain grounded in science and technology.

"Immortality for all" is the concrete result of the collectivization of time. For Fyodorov, private property (of space) could not be abolished unless it also involved private property of time. Truly emancipated individuals experience themselves as the ones to be preserved. Progress is the tyranny of future generations over the present. Therefore, the only true technology is the

technology of sustainability: mastery over time is the artificial production of eternity. For the cosmists, death is always artificial since it can be technologically prevented.

Another central cosmist figure was Konstantin Tsiolkovsky. Though he is known as the father of the Soviet space program, he saw his technical writings on rocketry only as a supplement to his philosophy of space exploration. Tsiolkovsky's *Will of the Cosmos: The Unknown Intelligence* (1928) is a rare illustration of the biopolitics of panpsychism.[139] For him, the brain is only a material part of the universe. All its processes originate in the cosmos. Therefore, the will of the mind is the same as the will of the universe. If the human brain is part of the cosmos and transmits its cosmic energy, then the human being is itself cosmic.

These ideas are further developed in philosopher Evald Ilyenkov's *Cosmology of the Spirit* (ca. 1950). Ilyenkov tried to answer an ambitious question at the intersection of evolutionary biology and philosophy: What is the function of life at the scale of the universe? "Matter constantly possesses thought, constantly thinks itself," he writes. "Since the universe is infinite,

139. Philip Goff, *Consciousness and Fundamental Reality* (New York: Oxford University Press, 2017). Goff elaborates on a variant of panpsychism he calls cosmopsychism. For him, cosmopsychism is nothing else than an alternative to the "multiverse theory" as a solution to the problem of the universe's "fine tuning."

probabilistically, there will always be another instance of matter that develops thought in some other time and space. Thus, the 'thinking brain' always emerges and reproduces somewhere in the cosmos. It is in this specific sense that 'matter constantly thinks itself.'"[140]

In Ilyenkov's view, as in Tsiolkovsky's, mind emerges from matter. But, in a dialectical moment, as philosopher Alexei Penzin explains, a subtler materialism would also have it the other way: mind is necessary for matter. Indeed, Ilyenkov writes, "Matter cannot exist without thought." Using philosopher Baruch Spinoza's language, what Ilyenkov says could be stated thus: if mind (the highest form of matter) were only accidental, it would be merely a "mode" and not an "attribute." The radical proposition of cosmopsychism is reconciling Spinoza with Darwin in a cosmos where the ultimate goal of mind is not self-perfection or absolute knowledge, as suggested by idealistic or religious teleologies, but something "endlessly greater—a vision of cosmology where the destinies of mind and matter are inexorably intertwined."[141] To the "the great

140. Alexei Penzin, "Contingency and Necessity in Evald Ilyenkov's Communist Cosmology," in *e-flux* 88 (February 2018).

141. Penzin, "Contingency and Necessity in Evald Ilyenkov's Communist Cosmology."

question of whether man is of nature or above her" once formulated by conservationist George Perkins Marsh, the cosmist answers: mind is of nature, except nature is not what we think it is.

Cosmology is the study of the universe, its origin, and its evolution. As physicist Freeman Dyson recounts, up until the 1940s, "the early universe was not a fit subject for experimental or theoretical effort" (before the inflationary theory, the prevalent view was that the universe had no beginning).[142] The beginning of the universe became a respectable field of scientific inquiry thanks to the courageous speculations of a few scientists. Similarly, Dyson argued in the 1970s, the turn should come for the end of the universe. The physical eschatology Dyson outlines is remarkable for the role he believes life could play in the evolution of the universe.[143] After all, if the universe has existed for some 13 billion years—of which Earth has been around for 4.5 billion—and the current stelliferous era is supposed to last for 100 *trillion*, who is to say the

142. Freeman Dyson, "Time without End: Physics and Biology in an Open Universe," in *Reviews of Modern Physics* 51, no. 3 (July 1979): 447–460.

143. Milan M. Ćirković, "Resource Letter: PEs-1: Physical Eschatology," *American Journal of Physics* 71, no. 2 (February 2003): 122–133. Secular or physical eschatologies include the Big Rip, the Big Crunch, and, more recently, thermal death. None of these considers the role life could play in the evolution of the universe.

milestone of the emergence of intelligent life could not mark another era, a "cosmic Anthropocene" of sorts?

Indeed, the realization that we live at the very beginning of time in an embryo universe raises the question of whether life could play a role in its future evolution. One of the earliest modern figures to ponder this question formally was astrophysicist Iosif Shklovsky in his *Universe, Life, Intelligence* (1962). Chapter 34 of the English version—coauthored by astronomer Carl Sagan—is titled "Intelligent Life as a Factor of the Cosmic Scale." It presents these questions:

> Are any of the phenomena which we observe in the universe inexplicable in terms of the physics of non-living matter? Can some phenomena be understood only if we invoke the intervention of living organisms in technical civilizations? We cannot yet answer this question.[144]

144. Iosif Samuilovich Shklovsky and Carl Sagan, *Intelligent Life in the Universe*, trans. Paula Fern (San Francisco: Holden-Day, 1966).

These are not idle musings. Such questions have had bearing on scientific programs. Consider *Project Cyclops* (1971), a preliminary study for a SETI project coauthored by NASA and Stanford University, states under the header "Biocosmology":

> So long as we are limited to physical cosmology and to geocentric biology, many enormously exciting and very fundamental questions will remain unanswered. Does life itself serve a role in the evolution of the physical universe, perhaps modifying it in some way; or does it exist completely at the mercy of the latter?[145]

Darwinian evolution theory might have disenchanted terrestrial nature, but as the "evolutionary turn" in cosmology shows, it has certainly been a great source of re-enchantment for cosmic nature. The question of what the role of life could be in the evolution of the cosmos might perhaps be the purview of a speculative bio-cosmological program.[146]

---

145. NASA, Ames Research Center, and Stanford University, "Project Cyclops," 1971, https://ntrs.nasa.gov/archive/nasa/casi.ntrs. nasa.gov/19730010095.pdf, 30.

146. James N. Gardner, *Biocosm* (Makawao, HI: Inner Ocean, 2003). Sagan, *Cosmic Apprentice*, 239. For Sagan, recovering teleology is central to contemporary scientific program that aimed toward a unified understanding of nature that didn't dismiss consciousness. He writes:

> Understanding ourselves as exponents of a natural, rather than a special teleology is, I would argue, a scientific satori that gets to the root of the connectedness of all things. It brings together Darwin and Spinoza, Gaia and microbial ecology, phenomenology and materialism.

While on the subject of evolution and eschatology, turning our attention back to the "terrestrial," a most pressing matter is left unanswered by Latour. Where does his worldview lead *in the end*?[147] He speaks of "destiny," but he refuses to go "faster than history."[148] Is his hypothesis for a "political fiction" of any use if the conclusions lead us nowhere new? Is his insistence on the "new materialism" of the terrestrial a call for a "minimal bioeconomic program" like the one economist Nicholas Georgescu-Roegen proposed? Or is his formulation open to the unaccountable, excess energy—the "accursed share" of writer Georges Bataille's cosmic economy?[149] Latour insists that the view from outside is an impossible view from nowhere. But physicist and philosopher of cosmology Milan Ćirković suggests that the view is not *from*, but

147. Bruno Latour, *Down to Earth*, 85. "What the New Climate Regime calls into question is not the central place of the human; it is its composition, its presence, its figuration, in a word, *its destiny*." Emphasis mine. Latour also recognizes that ultimately the question of political ecology raised by the current crisis is that of the role and future of (human) consciousness.

148. Latour, 89.

149. Allan Stoekl, *Bataille's Peak* (Minneapolis: University of Minnesota Press, 2007), ##. Georgescu-Roegen's minimal bioeconomic program was more radical than the steady state economy of his student, Herman Daly. Georgescu-Roegen recognized mineral wealth is finite, and therefore the only way forward is minimizing its consumption to maximize its duration. For Bataille, the problem is the opposite: "The world is sick of wealth, and the apparent scarcity is only a sign of the misuse of energy."

toward, and that outside functions like a "magic mirror" that forces us to see ourselves *into our future*.[150]

At the end of his text, Latour writes, "The point of this essay is not to disappoint, but one cannot ask it to go faster than the history that is underway." Except that that is precisely the most urgent task at hand. If the "decisive discovery of political ecology" is that we ought to change our territories rather than our attitudes, then the popular saying "think global, act local" should be rephrased as "think cosmic, act global"—or, as Latour would have it, "terrestrial."

Having briefly explored the genealogies, metaphors, and myths of different ecological imaginaries, it is time to return to the question of "the desolate junction of poetics and political economy." The next chapter outlines the contours for series of syntheses between politics, aesthetics, nature, and design.

---

150. Milan M. Ćirković, *The Great Silence* (Oxford, UK: Oxford University Press, 2018). Ćirković takes on the various possible solutions formulated thus far for the "Fermi paradox"—the apparent contradiction between the age and size of the universe and the lack of other observable civilizations. Instead of proposing yet another taxonomic system to the more than 150 solutions, Ćirković identifies four preconditions any acceptable solution should comply with.

Page left intentionally blank.

CHAPTER 4 CONCLUSIONS

First Synthesis: Aesthetics and Politics

Every day we are reminded we live in times of unprecedented crisis. Nevertheless, the nature of the crisis is contested.[1] This dissertation has explored four different layers in which this singular but manifold crisis needs to be understood.[2] The first is the layer of the litany, the mainstream or institutional discourse. In the case of the environmental crisis, the diagnosis offered at this level is that the problem is overpopulation and resource scarcity, and the solutions lie in better policies and the development of appropriate technologies. The second layer corresponds to social causation. Here, the problem is understood to be the result of the internal

1. Jason W. Moore, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital* (New York: Verso, 2015). Moore declares that the contemporary ecological crisis is singular but multifaceted with origins in the internal contradictions of capitalism.

2. Inayatullah, "Causal Layered Analysis: Poststructuralism as Method." Following the Causal Layered Analysis framework described in the introduction.

contradictions of capitalism and neoliberal politics. Accordingly, the solution lies in the transition to a different politico-economic system. The third layer is that of worldview and discourse. Depending on the author, here the problem is framed as stemming from either the erosion of enlightenment values or, the opposite, enlightenment values themselves. Nevertheless, the source of the problem lies in a worldview or cultural paradigm that encompasses more than the politico-economic system. Finally, the fourth layer corresponds to the myth and the metaphor or the very ontology of things which confers meaning to discourse. Here, the problem lies in a disenchanted conception of nature which limits the horizons of the politics of the real as much as the politics of the possible. The solution is a reconstruction or reorientation of the concept of nature—what Smith calls re-enchantment. For him, such project began at what he referred as the "desolate junction between poetics and political economy." Analytical antisepticism alone would not suffice.[3]

Smith suggests that the project for an "anti-ideology of nature" is as much a politico-ecologic problem as it is an aesthetic one which leads us to ask, what is the Left's aesthetic

3. Neil Smith, "Nature at the Millennium: Production and Re-Enchantment," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree (London: Routledge, 1998), 280.

project? Hippie communes steeped in new age mythologies; romanticized images of the local and the vernacular; pre-modern idealizations, pastoral fantasies, or luddite utopias modeled after the writings of John R. R. Tolkien or William Morris; Disney-style simulacra of New Urbanism; the neo-traditionalism promoted by Prince Charles; the ad hoc bricolages and pastiches of participatory or everyday urbanisms or, in extreme cases, the perverse fetishization of poverty in slum-aesthetics or the Calvinist austerity of minimalism? Come to think of these examples, they are all either conservative or reactionary. Even the utopian aesthetics of pre-neoliberal, radical practices of the sixties and seventies can only inspire "retrotopian" visions resulting in "archaeologies of the future." The Left does not really have a radical, progressive aesthetic project.

Future aesthetics belong to capitalism because, regardless of how much it has been vilified, its visions of ever-increasing exuberance and progress (even if unevenly distributed) are an unbeatable utopian proposition. Ironically, the fact that its unevenness is a feature and not a bug, makes its visions even more utopian.

The exhaustion of our political imagination is symptomatic of this aesthetic vacuum. We used to be trapped between a narrative of growth and progress and one of precaution and care. Now consider: First, that after decades of being relentlessly sharpened by the brute force of capitalism, the prowess of the Left's analytical apparatus—armed to the teeth with all sorts of neo-Marxist, poststructuralist, and postmodern theories, concepts and philosophies—is as awesome as ever; second, that the Global Financial Crisis (GFC) of 2007-9 unmasked the neoliberal project as a morally bankrupt ideology and socio-ecologically unsustainable politico economic system; third, that the ensuing indignation and sense of political disenfranchisement led to a period of global protests the likes the world had not seen since 1968. In other words, the tools, the facts, and the will were all there, and yet, instead of moving forward, the world fell back. After the GFC, democracies experienced a period of worldwide regression according to studies. In the absence of a progressive, agreeable alternative project, societies have opted to retrench into ethno-nationalism, authoritarianism, unilateralism, and xenophobia in what

amounts to a worryingly accelerating process of erosion of the liberal values of the Enlightenment.[4]

A joke based on the Arabian tales of Nasreddin tells the story of an encounter between two men. One, visibly drunk, is looking for something under a streetlamp. The other, curious, asks the first what is he doing, to which the first responds that he is looking for his keys. "Are you sure you lost them here?," asks the curious. "No," replies the drunk, "I lost them across the street, but I'm looking for them here because there is no light over there."

The Left has repeatedly recognized its shortcomings.[5] However, like the drunk man looking for his keys, it seems uncapable of searching beyond its habitual horizons. When Smith wrote that the project for an effective "anti-ideology of nature" begins at the "desolate junction of

4. Nick Land, "The Dark Enlightenment," Blog, http://www.thedarkenlightenment.com, 2012; Marina Garcés, *Nueva Ilustración Radical* (Barcelona: Anagrama, 2017).

5. Bruno Latour, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225–48.

poetics and political economy, he was offering that observation as a blueprint.[6] But it can also be understood as a diagnosis.

The poverty of the political and aesthetic imaginaries stems, in part, from their separation. In the foundational essay "Art in the Age of Mechanical Reproduction" (1936), philosopher Walter Benjamin described fascism as the aesthetization of politics and, communism as the politization of art. The essay's recognition is well deserved: Its warnings regarding the effects of (social) media on the subjective construction of reality and the militarization of culture are as timely now as when it was written. However, Benjamin's conception of the relationship between art and politics leaves us with a rudimentary formulation, a self-excluding dichotomy between politized art and aestheticized politics. To this end, the notion of "aesthetic regimes" developed by philosopher Jacques Rancière offers a more nuanced dialectic.[7] For him, politics, as something that is experienced, takes place in spaces aesthetically constituted. As critic Libero Andreotti explains, more than opposing art to politics, Rancière suggests that it is easier to

6. Neil Smith, "Nature at the Millennium: Production and Re-Enchantment," in *Remaking Reality: Nature at the Millennium*, ed. Bruce Braun and Noel Castree (London: Routledge, 1998), 271–85.

7. Jacques Rancière and Peter Engelmann, *Politics and Aesthetics* (Cambridge: Polity Press, 2019).

explore interrelations: how certain political ideas are linked to "artistic visions, style conventions, and modes of representation." Just like some aesthetic regimes are "recruited for certain political ends, every political act necessarily operates within or generates its own aesthetic." This is what philosopher Slavoj Zizek calls the discovery of the 'inherent aesthetic within the political' in Rancière.[8]

If Smith is right, before an effort to reconstitute the natural can be undertaken, first the political and the aesthetic must be understood as immanent aspects of every phenomenon un-hierarchically nested within each other.

Second Synthesis. Politics and Ecology

Most of the literature in political ecology has been more concerned with the uncovering of the political moment in ecology than the other way around.[9] It is fair then to look for the

8. Andreotti, Libero (2014) "*Unfaithful Reflections: Re-actualizing Benjamin's Aestheticism Thesis*" in *Architecture against the Post-Political* Nadir Lahiji editor. London: Routledge.

ecological moment in the political. However, given ecology's evolving meanings, it is important to distinguish between the image of ecology as a cultural metaphor shaped after cybernetics and the more recent image of ecology as a relational, non-dualistic mental model and worldview. The ecologization of politics under cybernetic-ecology, as one of many instances of the naturalization of ideology, led to a post-political cultural moment that even had an echo within design during the so-called post-critical debate.[10] The ecologization of politics means something very different.

On one hand, it has the effect of expanding the political beyond the sphere of human affairs to include the non-human and extra-human—a worldview that is neither anthropocentric nor biocentric, but anthropo*de*centered, as Morton explains (not the notion that humans are not the center, but that their center does not lie within them because there are no more stipulative dualist distinctions such as inside/outside, organism/environment, object/subject). If this move

9. Peter A. Walker, "Political Ecology: Where Is the Ecology?," *Progress in Human Geography* 29, no. 1 (2005): 73–82.

10. Kevin Kelly, *Out of Control: The New Biology of Machines, Social Systems, and the Economic World* (Reading, Mass.: Perseus Books, 1994); Richard Barbrook and Andy Cameron, "The Californian Ideology," *Mute*, September 1995; Adam Curtis, "All Watched Over by Machines of Loving Grace," TV Mini-Series (United Kingdom: BBC, 2011); Anselm Franke and Diedrich Diederichsen, *The Whole Earth: California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013).

has an effect on the politics of the real, the next move has an effect on the politics of the possible.[11] It has to do with infecting politics with the traits of a new image of ecology.

The traits of the new image of ecology proposed here are three. Each one finds its pair in politics. The three pairs are considered as a new scale, vision, and attitude. What in ecology is a material scale—the cornucopian—becomes a temporal scale in politics, the futural. What in ecology is a vision from the cosmos, in ecology becomes a vision from totality. And finally, what in ecology is an attitude of re-enchantment, in politics, it translates as an attitude of re-enlightenment. These are not original proposals. They are found among the works surveyed and gathered here because they are repeated in authors that do not cite each other. In other words, they seem to constitute the traits of a new "cosmodern" sensibility.[12] They have never been gathered together before, much less as a cohesive politico-ecologic program. Therefore, they are proposed as an "emergent" manifesto.

---

11. We expand the sphere of the political to include non-humans and suddenly we are having very real conversations about animal rights and lab grown meat.

12. Christian Moraru, *Cosmodernism: American Narrative, Late Globalization, and the New Cultural Imaginary* (Ann Arbor: The University of Michigan Press, 2011); Christian Moraru and Amy J. Elias, *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century* (Evanston, Illinois: Northwestern University Press, 2015),

	Ecology	Politics
Scale	*Cornucopian*	*Futural*
Vision	*Cosmic*	*Total*
Attittude	*Re-enchanted*	*Re-enlightened*

Figure 3. Ecological and political concepts.

In what follows, the chapter elaborates on each pair, its timeliness, and its sources.

Scales: Cornucopian Ecology and Futural Politics

In their "Manifesto for an Accelerationist Politics" (2013), scholars Alex Williams and Nick Srnicek, explain how the "paralysis of the political imaginary" amounts to the effective

cancellation of the future.[13] Capitalism accelerates the pace of change except it keeps us running on a treadmill. The relationship it establishes with nature is more insidious than the simple split between the human and the natural. There is a second moment where it then presents itself as the natural—capitalist realism. Under T.I.N.A. (there is no alternative), the "utopian" has acquired a pejorative connotation meant to disparage any attempts of dissent. Acquiescing to such cognitive effects leads to a form of political impossibilism or "neoliberal melancholia."[14]

The postmodern dismantling of grand narratives turned the arrow of time into a bowl of spaghetti—"heterochronia." Like in the ever-repeating Buddhist parable of *The Groundhog Day*, every day may seem superficially different, but is the same. Compound this with global warming, and the situation becomes far more dire. The present is now locked in an asymptotical trajectory toward collapse. History in the Anthropocene is reduced to a countdown. How can we reject

13. Alex Williams and Nick Srnicek, "#Accelerate: Manifesto for an Accelerationist Politics," Critical Legal Thinking: Law and the Political, May 14, 2013, http://criticallegalthinking.com/2013/05/14/accelerate-manifesto-for-an-accelerationist-politics/.

14. Mark Fisher, *Ghosts of My Life: Writings on Depression, Hauntology, and Lost Futures* (London: Zero Books, 2014).

grand narratives when the grandest unfolds before our eyes? Ironically, the end of the world means the re-opening of (human) history, paraphrasing Marx.

"Futurability" requires we set aside the paralyzing "hermeneutics of suspicion" of postmodernity and ask (and perhaps even dare answer) the tough teleological questions of meaning and purpose.[15] As geographer David Harvey put it in a rare moment of speculation:

> The grand debate that we now have is over what is 'meaningful' about a particular use. And here, the huge unanswered question mark that still animates innumerable passions is simply this: 'what can the true nature of human nature truly become...[16]

The cancelation of the future and the myth of scarcity stem from the same capitalist affect. In the same way that futural politics seeks to remedy the naturalization of history, a cornucopian ecology seeks to remedy the naturalization of limits.

15. Franco Berardi, *Futurability: The Age of Impotence and the Horizon of Possibility* (New York: Verso, 2017).

16. David Harvey, *Spaces of Hope* (Berkeley: University of California Press, 2000).

In *Austerity Ecology and the Collapse-porn Addicts*, Leigh Phillips observes that what all left environmental movements have in common is a worldview defined by scarcity.[17] Different schools of thought may vary broadly on their strategies or degree of pessimism, but all agree there are some practical, hard natural limits to human flourishing. It is inconsequential where these limits are believed to be. Further, he notes:

> The anti-consumerist, back-to-the-land, small is beautiful, civilization-hating, progress-questioning ideology of degrowth, limits, and retreat is hegemonic not just on the green left, but across the political spectrum. […] It is time for progressives to remind themselves of the dark origins of anti-modernism, and understand that however well-meaning, this ideology is reactionary with respect to social progress and ultimately won't 'save the planet' anyway.[18]

---

17. James Howard Kunstler, *The Long Emergency* (New York: Grove Pr, 2006); Paul Kingsnorth, *Uncivilization: The Dark Mountain Manifesto* (England: The Dark Mountain Project, 2019); John Zerzan, *Against Civilization: Readings and Reflections* (Eugene: Uncivilized Books, 1999); Derrick Jensen, *Endgame: The Collapse of Civilization and the Rebirth of Community* (New York; London: Seven Stories, 2005); William R. Catton, *Overshoot* (Urbana; London: University of Illinois Press, 1980). Paul R. Ehrlich, *The Population Bomb* (Rivercity: Rivercity Press, 1968). He makes a scathing indictment of figures like makes a scathing indictment of figures like activists Naomi Klein and Bill McKibben, naturalist Sir David Attenborough, inventor James Lovelock, economist Lester Brown, historian Jared Diamond, ecological economists Serge Latouche and Herman Daly, and public figures like Prince Charles and Al Gore.

18 Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015), 44.

Phillips insight is crucial because it reveals the extent to which the co-optation of ecological thinking by scarcity narratives entangles environmentalism, and subsequently the green Left, with conservatism.

In *The Ecological Thought,* philosopher Timothy Morton also shares his skepticism against the meagerness of environmental austerity:

> There is a "less is more" argument that ecological social policy is always about limits. You hear it frequently, especially when it comes to the fear that there are too many humans on Earth. This is one of the central platforms of deep ecology. […] Beyond the disturbing racism of the "population debate," what bothers me is that the language of limits edits questions of pleasure and enjoyment out of the ecological picture. Marx's criticism of capitalism was not so much that it is overrun with evil pleasures, […] but that it is nowhere near enjoyable enough. […] If the ecological thought is about thinking big as much as or more than "small is beautiful," then it must expand upon existing pleasures.[19]

In other words, as an unevenly distributed utopia, capitalism is attractive because it offers a vision of exuberance and abundance. Perversely, its effect is artificial scarcity. There is no fundamental reason for capitalism to have a monopoly on exuberance and pleasure.

---

19. Timothy Morton, *The Ecological Thought* (Cambridge, Massachusetts: Harvard University Press, 2010), 38.

Seeking to overcome the epistemic conservatism of hard natural limits, some schools of thought have resorted to talking about historically contingent, politically defined limits. But whether contingent or hard, limits still dominate the tenor of the debate. Thinking of natural resources and social forms of organizing their production and consumption as means foregrounds the ethical blind spot at the center of the "politics of limits" shared by the Left and the Right alike. "Democracy cannot be defined simply by its means […]." Williams and Srnicek write. "Real democracy must be defined by its goal: collective self-mastery."[20]

Growth and degrowth pose a false choice. Sustainability and the politics of limits conceal the class struggle within ecology. This means, for instance, that more than anti-consumption, we should be pro-workers' rights and more than talking about sustainability, we should focus on re-distribution. Further, Phillips echoes Harvey, Morton, Srnicek and Williams regarding self-mastery and scale when he writes that

> beyond the dead end of trying to distinguish what constitutes a want and what a need for each individual, we should define democratically the conditions of collective emancipation. The enemy therefore is not scale (the big, the global), but capital. The

20. Williams and Srnicek, "#Accelerate: Manifesto for an Accelerationist Politics."

enemy is not growth, but growth under capital's need for self-valorization, irrational growth, lack of planning.[21]

Rejection of growth is either a rejection of progress or a belief that we can expand, but only in non-material forms.[22] But the dialectics of the life-process imply that knowledge will always be inextricably linked to the material. As the notion of unsustainability captures it, "new knowledge depends on old technologies, old stuff, and gives rise to new technologies, new stuff."[23]

Instead of the negative biopolitics of limits, the ecological should be reformulated corresponding to an affirmative cosmopolitics where a human gain is not a natural loss in a zero-sum world-game or where the life process itself, with its increased order, is not antagonistic to the entropic cosmic inertia, as the ideas of Sagan and Prigogine exposed in "Chapter 3" suggested.

---

21. Leigh Phillips, *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff* (Winchester: Zero Books, 2015), 65.

22. See the discussion on Georgescu-Roegen's minimal bioeconomic program in "Heliopolitics."

23. David Deutsch, *The Beginning of Infinity: Explanations That Transform the World*, Reprint edition (London; New York: Penguin Books, 2012).

Visions: Total Ecology and Cosmic Politics

By 2050, the world's population will be somewhere between nine and ten billion, Matteo Ghidoni reminds us in the introduction to San Rocco's journal volume on ecology. He proposes ecology to be understood as the discipline in charge of the long-term survival of the human species. This requires ecology to become a form of global planning which, as a prerequisite, must consider the world as a "totality." The alternative is apocalypse.

Ghidoni is aware that invoking the idea of totality might make some uncomfortable. But he clarifies we should not make the common error of mistaking totality for totalitarianism. If politics is the art of the possible and the possible is defined by the real, then "ecology is realism starting from the totality," a form of "reasonable socialism." Such a theory does not exist yet, and even though we have piecemeal notions of what it should consist of, it will not be fully articulated if it is not developed from "the point of view of the totality."[24]

24. György Lukács, *History and Class Consciousness: Studies in Marxist Dialectics* (Cambridge, Mass.: MIT Press, 1968). According to [Gyorgy] Lukács' formula, Ghidoni clarifies.

Ghidoni's program for a such a new ecology would require remedying certain "miseries" in contemporary theory beginning with "any spoiled irritation about realism, any nihilistic criticism of the universal, and any unnecessary distrust of the common"—all hallmarks of the corruption of postmodern critical theory.[25]

The concept of totality is also invoked by Morton who argues that big challenges should compel big thinking. "Any thinking that avoids this totality [modern economic structures] is part of the problem."[26]

Lukacs interpretation of totality in Marx is what bridges the very narrow gap between politics and ecology in this category. For Lukacs, the point of view of totality is the decisive difference between Marxism and bourgeois thought. Here, "bourgeois thought" arises from studying different subjects in isolation which requires the specialization giving rise to disciplinary siloes. In contrast, the historical dialectic lens of Marxism does not create artificial separations between phenomena. We can either choose between disciplinary autonomy or studying the

25. Matteo Ghidoni, ed., *San Rocco: Ecology*, vol. 10 (Venice: San Rocco, 2014).

26. Morton, *The Ecological Thought*, 86.

evolution of society as a whole (totality) which unavoidably confronts us with capitalism. If ecology has been called a subversive science, it is for the same reason that totality makes Marx's historical dialectic revolutionary.[27]

In Srnicek and Williams, the point of view from totality manifests in their rejection of localism in politics. For them, the most important break in the contemporary Left is between those who latch hold on to "parochial politics of localism, direct action, and horizontalism," and a new group of so-called accelerationists who are "at ease with a modernity of abstraction, complexity, globality, and technology."

Their rejection of localism is to politics what Morton's rejection of place is to ecology. For him, this fixation on "place" as the real, independent locus where the effects of capitalism, modernity or technology can be truly felt is what impedes an ecological view. The arbitrary circumscription of ecology to a terrestrial horizon is proper of Western thought. Morton traces this fixation to Heidegger for whom the act of thinking was an "environmental presence." For

27. Paul B. Sears, *The Ecology of Man* (Washington, D.C.: Smithsonian Institution, 1959); Timothy W. Luke, *Capitalism, Democracy, and Ecology: Departing from Marx* (Urbana: University of Illinois Press, 1999); John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York: Monthly Review Press, 2000).

Heidegger, thinking dwelt upon the Earth, in other words, it was Earthbound. Instead, Morton ponders whether we "could we have a progressive ecology that was big, not small; spacious, not place-ist; global, not local […]; not embodied, but displaced, spaced, outer spaced."[28]

Ecology is constrained by the narrow conception of nature as defined by environmentalism. Ideas like "local" or "organic" provide small spaces of resistance against globalization. But what about "global" warming? Wouldn't it require an equally "global" answer? Ecology is restrained by the smallness and restriction of environmental language. "Seeing the Earth from space is the beginning of ecological thinking"—just ask any astronaut that has experienced the "overview effect."[29]

Attitudes: Re-enlightenment Politics / Re-Enchanted Ecology

28. Morton, *The Ecological Thought*, 23.

29. Morton, *The Ecological Thought*, 25; Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Boston: Houghton Mifflin, 1987).

At a first glance, re-enchantment and re-enlightenment would seem opposite projects. We have learned to associate enlightenment with modernity, progress, reason, technology, science, and control—traits corrupted into ends-in-themselves by capitalism. In contrast, enchantment, first in Goethe then in Webber, has been associated with the magical and animistic thinking of the premodern as idealized by the romantics. Therefore, re-enchantment tends to be coupled, by association, to the postmodern. But indexing one-to-one enlightenment to modernity and re-enchantment to postmodernity misses some important nuance.

Philosopher Hannah Arendt speaks of the almost simultaneous invention of the microscope and the telescope around the sixteenth century. The realization of the existence of vast new realms had simultaneous disenchanting and re-enchanting effects on culture. They led to disenchantment because suddenly humans could no longer see themselves as the center of creation. But at the same time, they led to re-enchantment because the newly discovered worlds presented themselves as vast unknown domains ripe for exploration.

Besides the importance of Arendt's illustration of re-enchantment and disenchantment as two moments in the same process, her account highlights the crucial role played by technology.

As philosopher Walter Benjamin noted, what technology achieves is not direct control over nature, but rather control *of the relationship* between humans and nature—a small but important difference. Philosopher Yuk Hui refers to this technologically mediated relationship with nature "cosmotechnics." The postmodern predisposition against technology is a key obstacle in the project of the re-enchantment of nature. As Morton and Sagan argue throughout their writing, we do not need magical thinking to feel awe from nature when "reality is stranger than fiction." Re-enchantment and re-enlightenment are complementary attitudes, not mutually exclusive as we would believe. It is useful to understand the origins of their wrongful associations with modernity and postmodernity, respectively.

Philosopher Marina Garcés commences her book *New Radical Enlightenment* (2017) with the statement "our contemporary world is radically anti-enlightenment." The origins of this anti-enlightenment sentiment can be traced to the pivotal *Dialectic of Enlightenment* (1947).[30] Written by philosophers Theodor Adorno and Max Horkheimer, its deep distrust on the narratives of progress, reason, and mastery ought to be understood in the context of the

30. Theodor Adorno and Max Horkheimer, *Dialectic of Enlightenment* (Amsterdam: Querido Verlag, 1947).

immediate aftermath of the hellish horrors of "industrialization of death" brought upon by World War II. Sentiments against enlightened reason, science, and the grand narrative of progress went on to become hallmarks of the postmodern sensibility. Furthermore, the revalorization of non-Western values implied by the rejection of Enlightened reason brought with it a new interest in magical or enchanted thinking.

Aware of the failures of its European precedent, Garcés formulates her new "planetary enlightenment" more as a shared attitude than the search to crystallize a historical project. However, decidedly against postmodern sentiments, she states that only a Promethean politics of maximal mastery over society and its environment is capable of either dealing with global problems or achieving victory over capital. The terms under which this control is conceived are different from those of the thinkers of the original Enlightenment:

> The clockwork universe of Laplace, so easily mastered given sufficient information, is long gone from the agenda of serious scientific understanding. But this is not to align ourselves with the tired residue of postmodernity, decrying mastery as proto-fascistic or authority as innately illegitimate.[31]

31. Garcés, *Nueva Ilustración Radical,* 35.

Today, neither postmodernity nor modernity are sources of re-enchantment. Postmodernity is disenchanted because any grand narrative, any source of meaning, needs to be questioned and dismantled. Modernity is disenchanted because Darwinian materialism purged teleology from reason, as discussed in "Cosmopolitics." The random, contingent, and indifferent picture of nature painted by Darwinism makes a naturalist ethic impossible.[32] Paraphrasing the poet William Shakespeare: "Nature is neither good nor bad but thinking makes it so."[33] But there are other traditions in materialism which make room for purpose and meaning without giving up modern reason. Dorion Sagan seeks to reach one such synthesis between materialism and metaphysics:

> understanding ourselves as exponents of a natural rather than a special teleology is, I would argue, a scientific satori that gets to the root of the connectedness of all things. It

32. Brian Snyder, "The Darwinian Nihilist Critique of Environmental Ethics," *Ethics & the Environment* 22, no. 2 (2017): 59–78.

33. Shakespeare, *Hamlet*.

brings together Darwin and Spinoza, Gaia and microbial ecology, phenomenology, and materialism.[34]

In other words, recognizing nature itself as being stranger than fiction is enough for it to become a source of re-enchantment. There is no need for pre-modern magical thought. A simultaneously re-enlightened and re-enchanted attitude would mean understanding the purpose of reason not as reaching perfection or absolute knowledge, but an ethical vision of cosmology where "the destinies of mind and matter are inexorably intertwined."[35] Even if scientific knowledge settled the matter that the universe does not pose a gran existential question we ought to answer, there would still exist a tantalizing prospect for re-enchantment. In *A Different Kind of Theory of Everything* theoretical physicist Nima Arkani-Hamed suggests, in a Jeopardy!-style question-answer reversal, that perhaps "the ascension to the tenth level of intellectual heaven would be if we found the *question* to which the universe is the *answer*, and the nature of that question in and of itself explained why it was possible to describe it in so many different ways."

34. Sagan, Dorion. *Cosmic Apprentice: Dispatches from the Edges of Science*. Minneapolis: University of Minnesota Press, 2013.

35. Alexei Penzin, "Contingency and Necessity in Evald Ilyenkov's Communist Cosmology," *E-Flux* 88 (February 2018).

Comparative literature analyses detect common patterns in particular bodies of literature to tease out new trends or sensibilities. The concepts gathered here repeat throughout the diverse bodies of literature surveyed. They converge on a rejection of certain aspects of postmodern critique different authors found counterproductive vis-à-vis the current climate. Since they are neither fully modern or postmodern (some even explicitly rejecting certain aspects of modernism or postmodernism), it is tempting to give them a name. In "Cosmopolitcs," the term cosmodernism was borrowed from the work of Moraru (who in turn took it from Nicolescu), and it was expanded to include other notions. Naming matters aside, the point here is that any properly politico-ecologic and aesthetic program should address these six modifiers: cornucopian, futural, cosmic, total, re-enlightened, and re-enchanted

Third Synthesis. Ecology and Design

Addressing the articulations between aesthetics and politics first on one hand and politics and ecology on the other sets the stage for the revisiting the opening question of the dissertation: what the relationship between design and ecology should be. If stating this question has required the redefinition of ecology, redefining design is also in order.

The dissertation has argued for the importance of understanding the role of metaphors in the definition of what is real and what is possible. This does mean that metaphors are the most important or deeper level neither does it negate the dialectic between different layers of analysis: from the material configurations, to the social configurations of power relations and (re)production forces, to discourses and worldviews to the ontological myths they are based on. The dissertation simply wishes to bring attention to the role imagination, creativity, and aesthetics play in this process. All these notions are hallmarks of design. Foregrounding them eases re-articulating the relationship between design and those other fields.

In *An Aesthetic Education,* Gayatri Spivak elaborates on her "Imperative to Re-Imagine the Planet." She proposes "planetarity" to counter or "overwrite the globe."[36] "Globalization," she

36. Gayatri Chakravorty Spivak, "Imperative to Re-Imagine the Planet," in *An Aesthetic Education in the Era of Globalization* (Cambridge, MA: Harvard University Press, 2012), 335.

says, "is achieved by the imposition of the same system of exchange everywhere." The image of the globe is a platonic sphere subdivided by a rational grid that gives the illusion of control. The homogeneity of this idealized globe is achieved through exclusion and erasure. In contrast, the figure of the planet stands in for the species and spaces of alterity that belong to a plurality of systems which "we inhabit, and indeed *are it*." Spivak's notion of "planetarity" recognizes the urgent correction that the Left's discourses around localism require. The planet is the image through which a different radical imagination can claim the space of political possibility of the whole world. Crucially, by calling to undertake this task through the imagination, Spivak highlights the aesthetic starting point of this project.

The parallelism between Spivak's imperative and Frederic Jameson's famous quote is obvious. "It is easier to imagine the end of the world than the end of capitalism." As Robinson, a student of Jameson observers, perhaps we have been too fixated with imagining the end of capitalism and misunderstood the meaning of imagining the end of the world. Spivak gives us a shortcut around capitalism's formidable capacity to neuter, absorb, naturalize, and weaponize any and all narratives of resistance—any critical theory. Perhaps this is a back door to the impasse of critical theory.

Not all forms of imagination are equal, however. Myth, fantasy, utopia, all behave differently. Imagining another world should not be an exercise in negation or escapism. On the matter of imagination and world making, science fiction (SF) theory could teach a thing or two (as shown in "The Metaphor of the Flag").

Traditionally, SF has played a peripheral social role, seen as one of the lesser forms of literature. Since the seventies, however, a growing body of scholarship around science fiction theory has sought to legitimize it based on its cultural effects. In the seminal essay "The Poetics of the Science Fiction Genre" (1972), literary theorist Darko Suvin notes the genre's contemporary rise in relevance as well as historic kinships with "the Greek and Hellenistic "blessed island" stories, the "fabulous voyage" from Antiquity on, the Renaissance and Baroque "utopia" and "planetary novel"—all literary tropes that remind us of the motifs of the island, the ship, and the flag explored earlier.[37]

37. Suvin, Darko. "On the Poetics of the Science Fiction Genre." *College English* 34, no. 3 (December 1972): 372–82.

Though SF shares with other fantasy sub-genres an opposition to naturalist or empirical literary traditions, it differs significantly in terms of its approach and social function. Suvin's main thesis is that these sociological and methodological differences define SF's poetics of "cognitive estrangement."[38] Suvin borrows "estrangement," understood as an attitude, from playwright Bertolt Brecht who described it as: "A representation which estranges is one which allows us to recognize its subject, but at the same time makes it seem un-familiar."[39] In other words, by confronting fictional with normative systems, estrangement achieves the cognitive effect opposite to "naturalization." This dissertation has examined how metaphors, through their deployment in myths, play a role in the process of naturalization. This is the mechanism through which ideology defines what is taken for real. The importance of cognitive estrangement as an antidote to naturalization cannot be underscored.

Moreover, the social effect of cognitive estrangement helps us distinguish between mythical, fantastic, and fictional imaginations. Fiction differs from myth in that it recognizes the norms of any time period, specially its own, as historically contingent which opens them to the

38. Suvin, 376.

39. Suvin, 377.

"cognitive glance." In opposition, the myth conceives human relations as unchanging, supernaturally determined, and universal which precludes the same process of cognition from taking place.

Cognitive estrangement also differentiates fiction from fantasy. Like fiction, fantasy challenges the empirical world, but it does so by escaping its horizon into a "closed, collateral world." This separation also prevents the process of cognitive estrangement. The fantastic imagination is not a means to understand reality, but an end in itself. This indulgent quality means that anything is possible in fantasy precisely because defying impossibility is what defines the genre. Considering the differences between myth and fantasy shows that SF is the only "non-naturalistic" or "meta-empirical" genre that is not also metaphysical.

Suvin's conceptualization of the conditions that define SF's engagement with the world results in an imagination that is not only creative, but also plays the role of critique thanks to its capacity to de-naturalize. On this basis, literary scholar Carl Freeman, a student of Jameson, makes the case for the affinity between SF and critical theory. In *Critical Theory and Science Fiction* (2000), Freeman argues that SF's "cognitive estrangement" works in the same way as

"dialectical thought" works in critical theory.[40] Though SF and critical theory act on different subjects, they serve the same social function through almost identical methodological means. Similarly, the case could be made for a "projective criticality" in design. Placed between SF and critical theory, design shares their social function while having the advantage of working directly with visual and spatial media.

Following the de-naturalizing function of cognitive estrangement and dialectical thought, the role of design's projective criticality vis-à-vis ecology becomes the de-naturalization of nature. This function stands in stark contrast with the current role as vehicle for the aesthetization of ideology. Put differently, design should recognize and embrace its synthetic nature in both of its acceptations: in the dialectical sense as the result from the opposition of a thesis and an antithesis and in the artificial sense as a practice concerned not with the way things are (nature) but the way they could be.

In his *Sciences of the Artificial* (1969), Nobel economist Herbert Simon makes this very distinction between the sciences which are concerned with how things are and design which is

40. Carl Freeman, *Critical Theory and Science Fiction* (Middletown: Wesleyan University Press, 2000), 2.

concerned with *how things ought* to be.[41] A close reading of Simon suggests that design is at once that which allows overcoming fragmentation without suppressing plurality. "Many of us have been unhappy about the fragmentation of society into two cultures. […] If we regret that fragmentation, then we must look for a common core of knowledge that can be shared by […] of all cultures." For him, the science of design is nothing else than "the proper study of mankind" which, from an evolutionary point of view, is tasked with "keeping open the options for the future."[42] In other words, as a futuring practice (to borrow the term from design theorist Tony Fry) design does not aim for the *singularity* of techno evangelical accelerationism, but a cosmopolitical *pluriverse*.[43]

The accelerating rate of change of the Anthropocene "has come to override evolutionary time" meaning our need to adapt is ever more urgent. Except now, rather than thinking about

41. Herbert A. Simon, *The Sciences of the Artificial* (Cambridge: The MIT Press, 1969).

42. Simon, *The Sciences of the Artificial*, ##.

43. Ray Kurzweil, *The Singularity Is Near: When Humans Transcend Biology* (New York: Viking Books, 2005); Kevin Kelly, *What Technology Wants* (New York: Viking, 2010). The techno evangelical accelerationism of Kelly, Kurzweil and other Silicon Valley types should not be mistaken by the more recent accelerationist faction coming from the Left.

adaptation in the human/nature frame, "the only available option to adapt is by artificial means."[44] In other words, evolution in the Anthropocene needs to be properly understood in terms of natural selection, self-organization, and design.[45] Instead of shying away from this anthropocentrism, Fry opts for a self-conscious and responsible anthropocentrism that, by necessity, has to invent its own posthuman notion of the human. This goal does not mean we are omnipotent, nor that we are able to design our existence at will. "What it means is that we are historically thrown into our designedness, with particular acuity at present."[46]

In *Designs for the Pluriverse*, anthropologist Arturo Escobar writes about the idea of a cultural "bifurcation" taking place regarding the question of posthuman futures. The bifurcation involves two paths he calls "the return to Earth" and "the human beyond biology."[47] The return to Earth implies "matristic, convivial, futuring, and, broadly speaking, relational visions that

44. Tony Fry, *Becoming Human by Design* (London; New York: Berg, 2012), 61.

45. Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (London: Duke University Press, 2018), 120.

46. Escobar, *Designs for the Pluriverse*, 119.

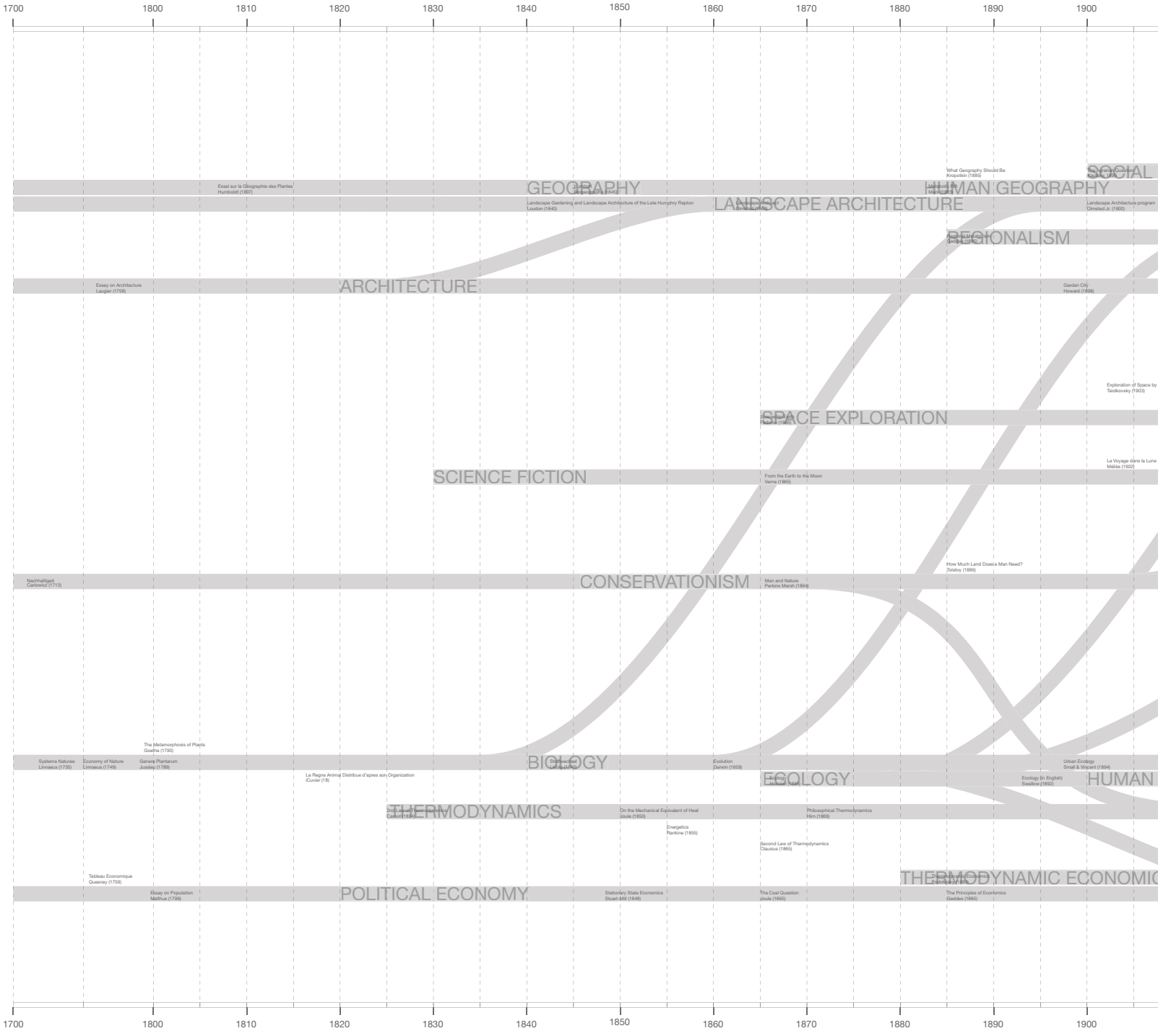
47. Escobar, *Designs for the Pluriverse*, 219.

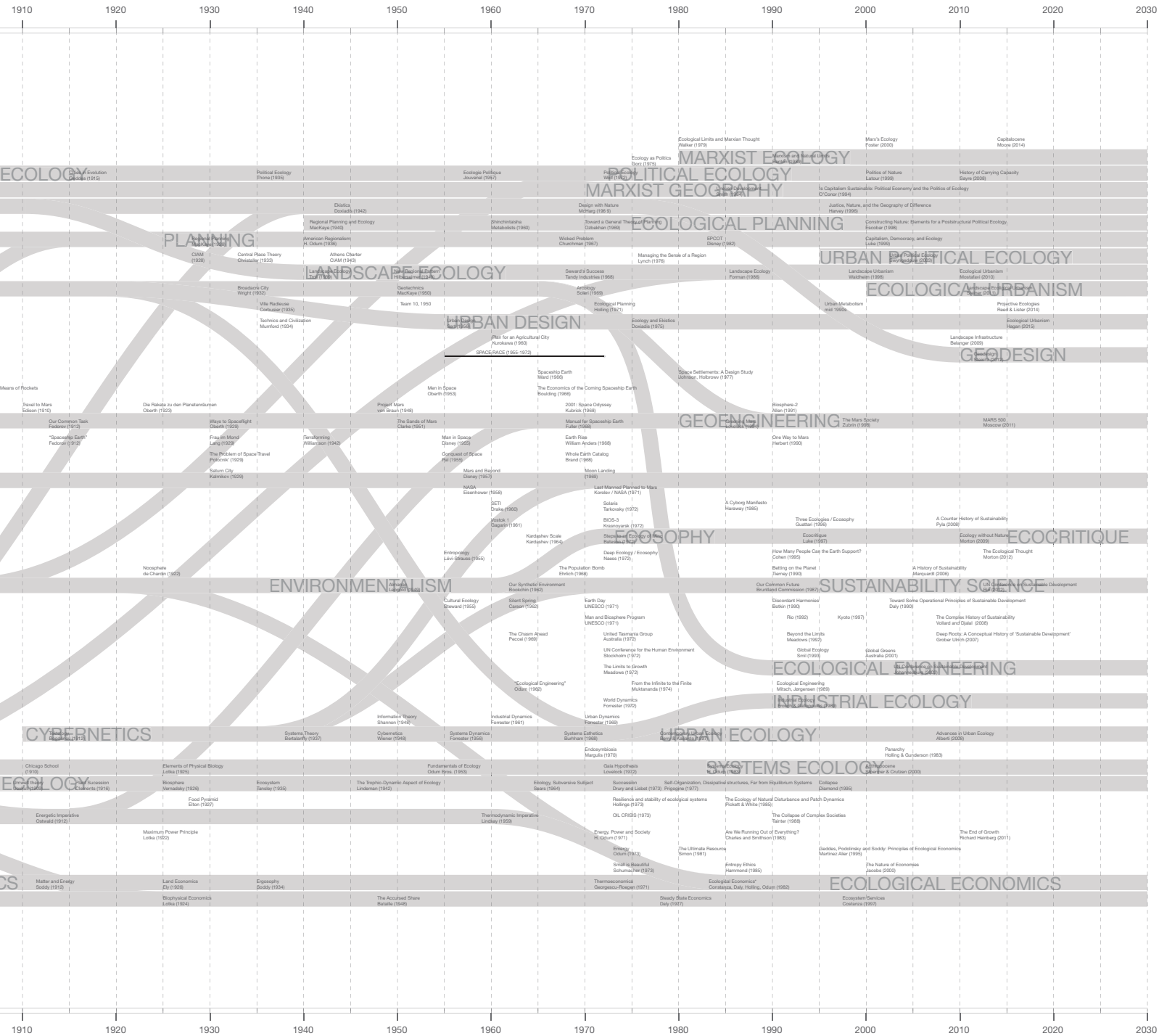
highlight the re/creation of worlds based on the horizontal relation with all forms of life, respecting the human embeddedness in the natural world."[48] The human beyond biology, by most counts the most likely scenario to gain the upper hand in Escobar's own words, is the world of synthetic biology, of booming techno-alchemies for genetic enhancement and the prolongation of life; of robotics, space travel, and nanotechnology… a world driven by the teleology of the great singularity, the religion of the atheists of Silicon Valley.

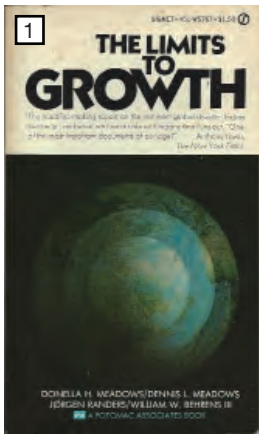
There is a third alternative, of course, that of "synthetic ecologies" were returning to Earth does not mean abandoning the cosmos and the possibilities for technologically mediated re-enchantment it offers, were teleology does not converge in a singularity but multiplies into pluriverses, and were design, beyond an aesthetic and politico-ecologic practice of world-making, becomes a never-ending process of rendering imaginable the previously unimaginable.

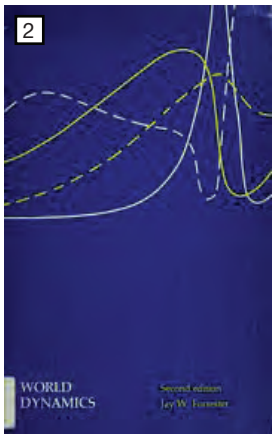
48. Escobar, *Designs for the Pluriverse*, 17.

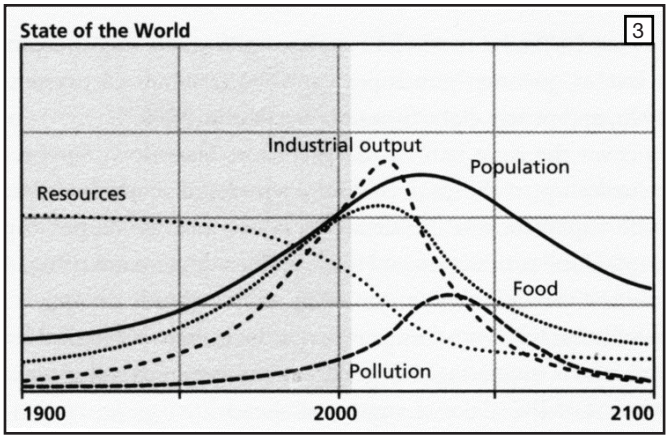
Appendix 1. Ecological Timeline

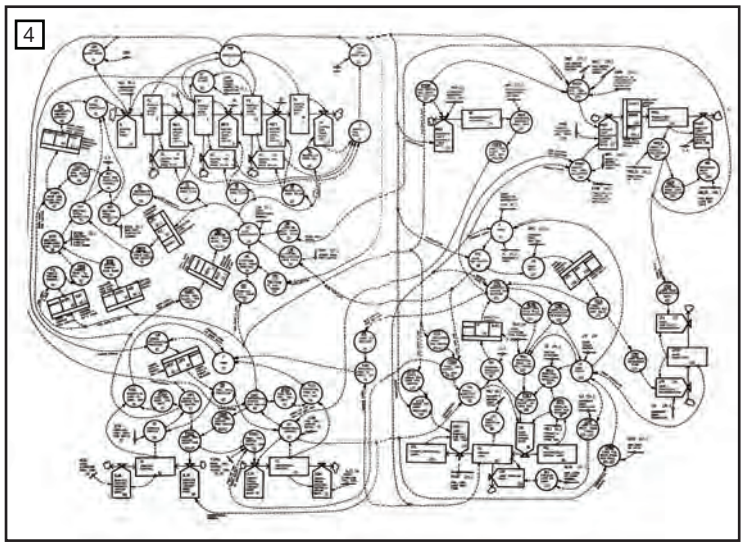



1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
ECOLOGY
PLANNING
LANDSCAPE ECOLOGY
URBAN DESIGN
ENVIRONMENTALISM
CYBERNETICS
ECOLOGY
SYSTEMS ECOLOGY
ECONOMICS
MARXIST ECOLOGY
POLITICAL ECOLOGY
MARXIST GEOGRAPHY
ECOLOGICAL PLANNING
URBAN ECOLOGY
ECOLOGICAL URBANISM
GEODESIGN
GEOENGINEERING
ECOSOPHY
ECOCRITIQUE
SUSTAINABILITY SCIENCE
ECOLOGICAL ENGINEERING
INDUSTRIAL ECOLOGY
ECOLOGICAL ECONOMICS
Means of Rockets
Travel to Mars
Edison (1910)
Die Rakete zu den Planetenräumen
Oberth (1923)
Our Common Task
Fedorov (1912)
"Spaceship Earth"
Fedorov (1912)
Ways to Spaceflight
Oberth (1929)
Frau im Mond
Lang (1929)
The Problem of Space Travel
Potocnik (1929)
Saturn City
Kalmikov (1929)
Noosphere
de Chardin (1922)
Project Mars
von Braun (1948)
The Sands of Mars
Clarke (1951)
Terraforming
Williamson (1942)
Men in Space
Oberth (1953)
Man in Space
Disney (1955)
Conquest of Space
Ley (1955)
Mars and Beyond
Disney (1957)
NASA
Eisenhower (1958)
SETI
Drake (1960)
Vostok 1
Gagarin (1961)
Kardashev Scale
Kardashev (1964)
Entropology
Lévi-Strauss (1955)
The Population Bomb
Ehrlich (1968)
Spaceship Earth
Ward (1966)
The Economics of the Coming Spaceship Earth
Boulding (1966)
2001: Space Odyssey
Kubrick (1968)
Manual for Spaceship Earth
Fuller (1968)
Earth Rise
William Anders (1968)
Whole Earth Catalog
Brand (1968)
Moon Landing
(1969)
Last Manned Planned to Mars
Korolev / NASA (1971)
Solaris
Tarkovsky (1972)
BIOS-3
Krasnoyarsk (1972)
Steps Toward Ecology of Mind
Bateson (1972)
Deep Ecology / Ecosophy
Naess (1972)
Our Synthetic Environment
Bookchin (1962)
Cultural Ecology
Steward (1955)
Silent Spring
Carson (1962)
Earth Day
UNESCO (1971)
Man and Biosphere Program
UNESCO (1971)
United Tasmania Group
Australia (1972)
UN Conference for the Human Environment
Stockholm (1972)
The Limits to Growth
Meadows (1972)
From the Infinite to the Finite
Muktananda (1974)
World Dynamics
Forrester (1972)
Urban Dynamics
Forrester (1969)
The Chasm Ahead
Pecoel (1969)
"Ecological Engineering"
Odum (1962)
Industrial Dynamics
Forrester (1961)
Information Theory
Shannon (1948)
Systems Theory
Bertalanffy (1937)
Cybernetics
Wiener (1948)
Systems Dynamics
Forrester (1958)
Systems Esthetics
Burkhart (1968)
Endosymbiosis
Margulis (1970)
Gaia Hypothesis
Lovelock (1972)
Ecology, Subversive Subject
Sears (1964)
Succession
Drury and Liebet (1973)
Self-Organization, Dissipative structures, Far from Equilibrium Systems
Prigogine (1977)
Resilience and stability of ecological systems
Hollings (1973)
OIL CRISIS (1973)
Energy, Power and Society
H. Odum (1971)
Emergy
Odum (1973)
Small is Beautiful
Schumacher (1973)
Thermoeconomics
Georgescu-Roegen (1971)
Ecological Economics"
Constanza, Daly, Holling, Odum (1982)
Steady State Economics
Daly (1977)
Ecological Limits and Marxian Thought
Walker (1979)
Ecology as Politics
Gorz (1975)
Political Economy
Watt (1982)
Nature's Metropolis
Cronon (1991)
Urban Political Economy
Smith (1984)
Design with Nature
McHarg (196 9)
Toward a General Theory of Planning
Ozbekhan (1969)
Wicked Problem
Churchman (1967)
Managing the Sense of a Region
Lynch (1976)
Seward's Success
Tandy Industries (1968)
Arcology
Solari (1969)
Ecological Planning
Holling (1921)
Ecology and Ekistics
Doxiadis (1975)
Plan for an Agricultural City
Kurokawa (1960)
SPACE/RACE (1955-1972)
Space Settlements: A Design Study
Johnson, Holbrow (1977)
Biosphere-2
Allan (1991)
A Cyborg Manifesto
Haraway (1985)
Three Ecologies / Ecosophy
Guattari (1996)
How Many People Can the Earth Support?
Cohen (1995)
Betting on the Planet
Tierney (1990)
Our Common Future
Brundtland Commission (1987)
Discordant Harmonies
Botkin (1990)
Rio (1992)
Kyoto (1997)
Beyond the Limits
Meadows (1992)
Global Ecology
Smil (1993)
Ecological Engineering
Mitsch, Jorgensen (1989)
Industrial Ecology
Frosch & Gallopoulos (1989)
Panarchy
Holling & Gunderson (1983)
Anthropocene
Schwerter & Crutzen (2000)
The Ecology of Natural Disturbance and Patch Dynamics
Pickett & White (1985)
The Collapse of Complex Societies
Tainter (1988)
Are We Running Out of Everything?
Charles and Smithson (1983)
The Ultimate Resource
Simon (1981)
Entropy Ethics
Hammond (1985)
Ecosystem Services
Costanza (1997)
Man's Ecology
Foster (2000)
Capitalocene
Moore (2014)
Politics of Nature
Latour (1999)
Is Capitalism Sustainable: Political Economy and the Politics of Ecology
O'Connor (1994)
Justice, Nature, and the Geography of Difference
Harvey (1996)
Constructing Nature: Elements for a Poststructural Political Ecology
Escobar (1998)
Capitalism, Democracy, and Ecology
Luke (1999)
Urban Political Ecology
Swyngedouw and Kaika (2003)
Landscape Urbanism
Waldheim (1998)
Urban Metabolism
mid 1990s
History of Carrying Capacity
Sayre (2008)
Ecological Urbanism
Mostafavi (2010)
Landscape Ecological Urbanism
Steiner (2011)
Projective Ecologies
Reed & Lister (2014)
Ecological Urbanism
Hagan (2015)
Landscape Infrastructure
Belanger (2009)
Geodesign
Steinitz (2012)
The Mars Society
Zubrin (1998)
MARS 500
Moscow (2011)
A Counter History of Sustainability
Pyle (2008)
Ecology without Nature
Morton (2009)
The Ecological Thought
Morton (2012)
A History of Sustainability
Marquardt (2006)
Toward Some Operational Principles of Sustainable Development
Daly (1990)
The Complex History of Sustainability
Vollard and Quiatal (2008)
Deep Roots: A Conceptual History of 'Sustainable Development'
Grober Ulrich (2007)
UN Conference on Environment & Development
Rio (1992)
Advances in Urban Ecology
Alberti (2008)
Chicago School
(1910)
Elements of Physical Biology
Lotka (1925)
Fundamentals of Ecology
Odum Bros. (1953)
Climax Theory
Clements (1916)
Plant Succession
Clements (1916)
Biosphere
Vernadsky (1926)
Ecosystem
Tansley (1935)
The Trophic-Dynamic Aspect of Ecology
Lindeman (1942)
Food Pyramid
Elton (1927)
Energetic Imperative
Oswald (1912)
Maximum Power Principle
Lotka (1922)
Matter and Energy
Soddy (1913)
Land Economics
Ely (1926)
Ergosophy
Soddy (1934)
Biophysical Economics
Lotka (1924)
The Accursed Share
Bataille (1948)
Thermodynamic Imperative
Lindsay (1959)
Geddes, Podolinsky and Soddy: Principles of Ecological Economics
Martinez Alier (1995)
The Nature of Economies
Jacobs (2000)
The End of Growth
Richard Heinberg (2011)

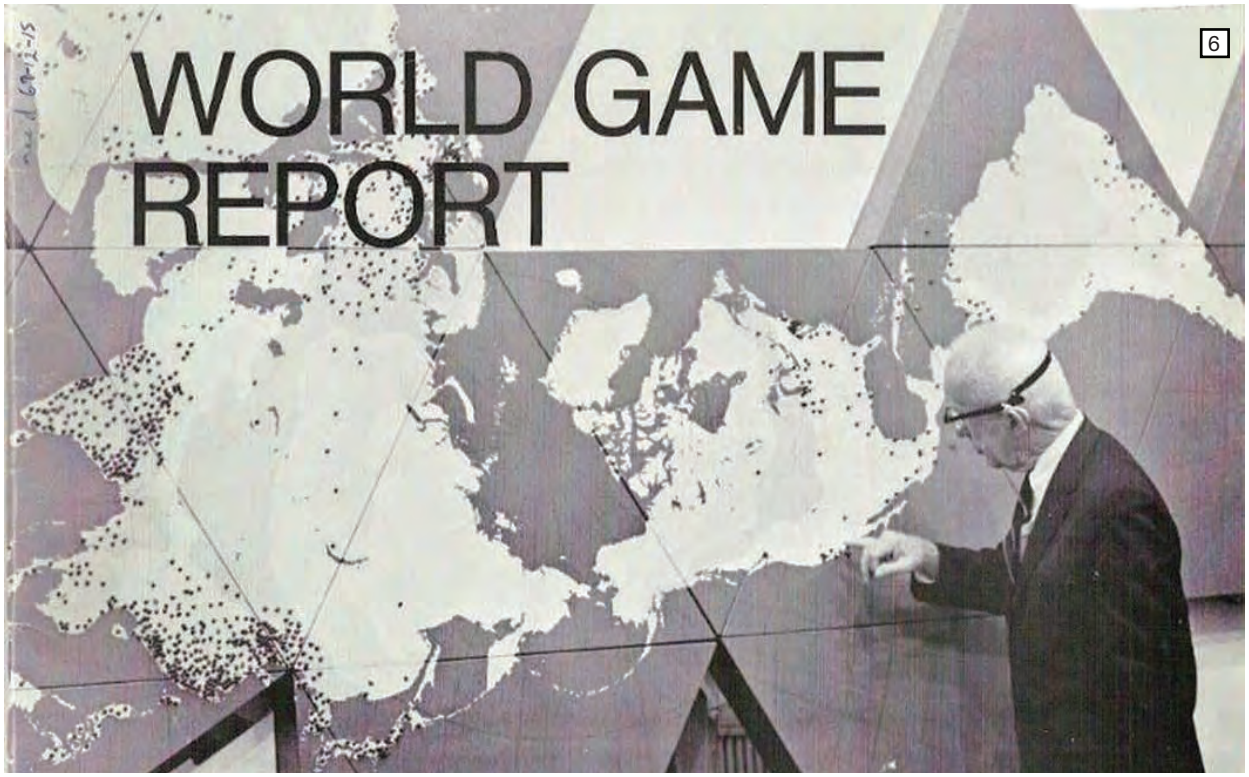

1
THE LIMITS TO GROWTH
DONELLA H. MEADOWS/DENNIS L. MEADOWS
JØRGEN RANDERS/WILLIAM W. BEHRENS III
A POTOMAC ASSOCIATES BOOK


2
WORLD DYNAMICS
Second edition
Jay W. Forrester


State of the World
3
Industrial output
Population
Resources
Food
Pollution
1900
2000
2100


4


5
MIT
DIGITAL COMPUTER LAB
WNAC-TV
Channel 7

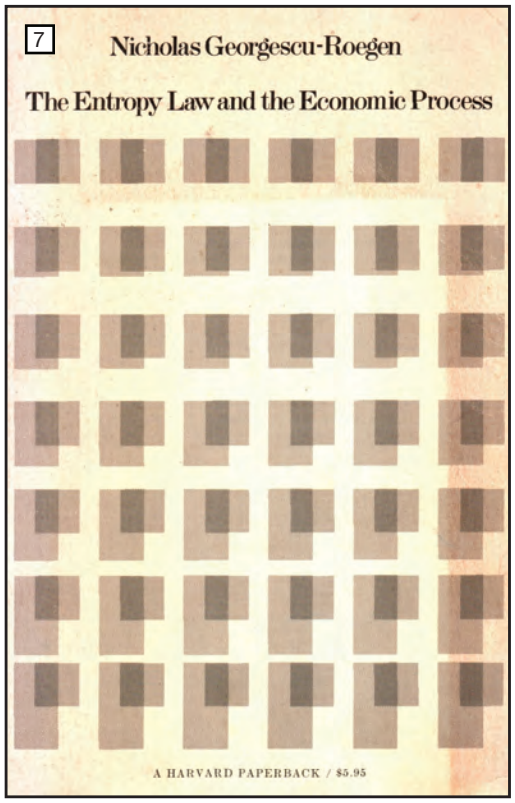

6
WORLD GAME REPORT

Cybernetic Ecology

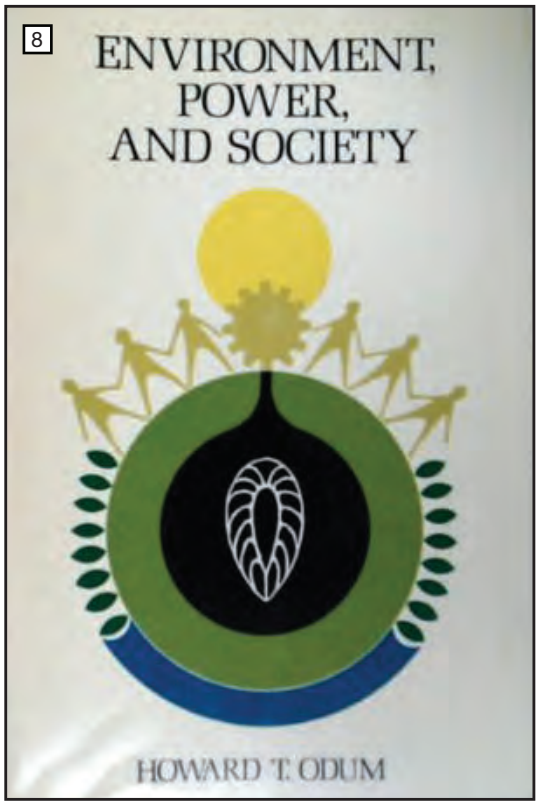
The Limits to Growth was published in 1972 coinciding with the first World Conference for the Human Environment celebrated in Sweden. Though engineer Jay Forrester is not listed as one of the authors, the book was based on his work on systems dynamics—a technique for modeling systems to run non-linear simulations with the aid of super computers. Though many others had begun adopting a systems approach to planetary environmentalism (including designer Buckminster Fuller who popularized the Spaceship Earth metaphor with his "operating manual" and later founded the World Game Institute in 1972), the Limits to Growth was arguably the single most important contribution towards the cybernetization of ecology.

Previous page:
Figure 1. Book cover of Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972).
Figure 2. Book cover of Jay Wright Forrester, *World Dynamics* (Cambridge: Wright-Allen Press, 1972).
Figure 3. State of the World graph. From Donella H. Meadows, et al., *The Limits to Growth*, (New York: Universe Books, 1972).
Figure 4. World3 System model diagram. From Donella H. Meadows, *The Dynamics of Growth in a Finite World,* (Cambridge, Massachusetts: Write-Allen, 1974).
Figure 5. Jay W. Forrester posing next to Whirlwind I supercomputer during an interview with Edward R. Murrow for CBS News on December 16th, 1951. (Source: https://infinite.mit.edu/video/edward-murrows-see-it-now%E2%80%94jay-forrester-and-whirlwind-computer-1951)
Figure 6. Howard Brown, Medard Gabel, and Richard Buckminster Fuller founded the World Game Institute in 1972. From David McConville, "The Consequences of Various World Plans," *Ubiquity: The Journal of Pervasive Media* 1, no. 1 (2012): 65–80, https://doi.org/10.1386/ubiq.1.1.65_1.

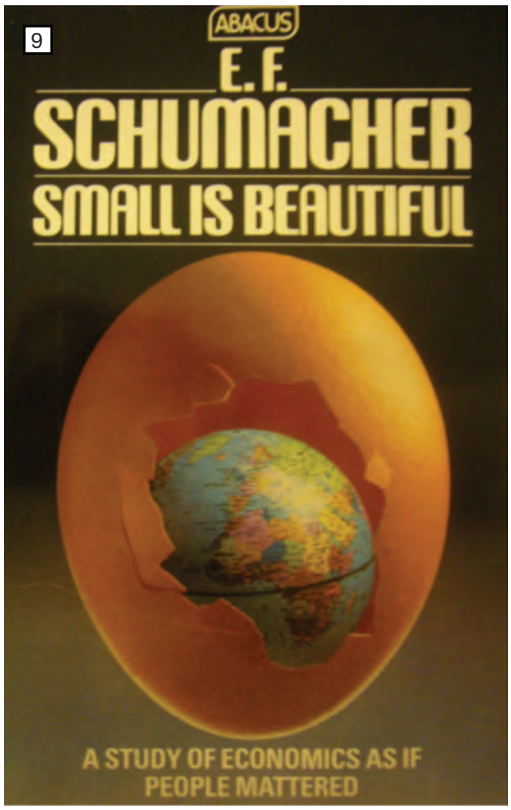
7


Nicholas Georgescu-Roegen
The Entropy Law and the Economic Process
A HARVARD PAPERBACK / $5.95

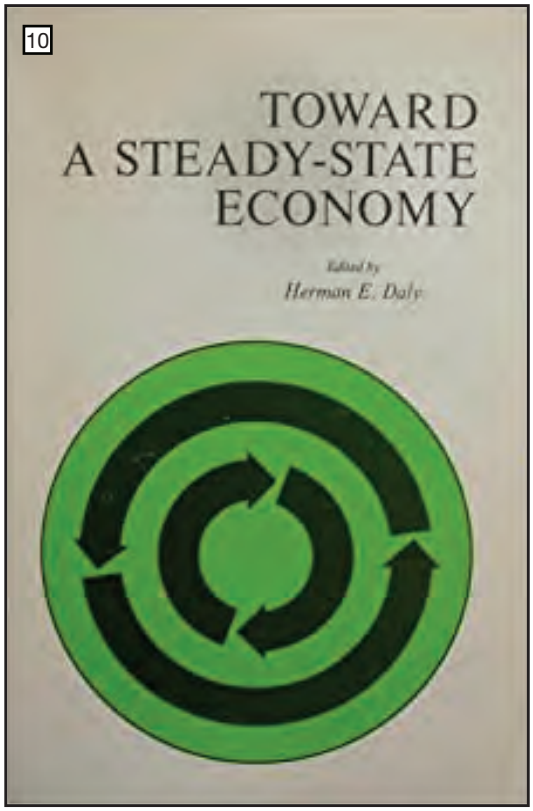
8


ENVIRONMENT, POWER, AND SOCIETY
HOWARD T. ODUM

9


ABACUS
E. F. SCHUMACHER
SMALL IS BEAUTIFUL
A STUDY OF ECONOMICS AS IF PEOPLE MATTERED

10


TOWARD A STEADY-STATE ECONOMY
Edited by
Herman E. Daly

Ecological Economics

The idea of there being hard limits to growth meant that a system reliant on endless growth such as capitalism was in direct odds with the environment. It is no surprise then that a crop of economic texts popped up proposing "a prosperous way down" or a steady-state economy. Though ecological economics was formally consolidated in Sweden in the eighties, several seminal publications by its main proponents including systems ecologist Howard Odum and economist Herman Daly first appeared in or around 1972. They all sought to ground the economic process in the laws of physics and the energetic basis of the environment. Their alleged adherence to natural law further cemented the neo-Malthusian argument of scarcity.

Previous page:
Figure 7. Book cover of Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, Massachusetts: Harvard University Press, 1971).
Figure 8. Book cover of Howard T. Odum, *Environment, Power, and Society* (New York: Wiley-Interscience, 1971).
Figure 9. Book cover of Ernst F. Schumacher, *Small Is Beautiful: Economics as If People Mattered*, (New York: Harper & Row, 1973).
Figure 10. Book cover of Herman E. Daly, *Toward a Steady-State Economy* (San Francisco: W.H. Freeman, 1973).

11

12

UTG

13

OWNERSHIP AND POLITICAL ECOLOGY

ERIC WOLF
City University of New York

The studies presented in this symposium demonstrate how sophisticated anthropologists have become in following through the connective linkages in local ecosystems and in specifying the parameters of economic change. The Alps, of course, offer a magnificent laboratory to the ecological anthropologist interested in the ramifications, at any given time and over time, of microvariations in altitude, slope, soil, precipitation, temperature, wind, and in the incidence of sunshine and shade. The papers presented here document the importance of these variations on the distribution of men, animals and plants over the landscape, and on the specification and scheduling of work sites and work tasks. All the papers demonstrate how important it is, for any one household at any one time, to achieve a balance between unimpeded access to an effective combination of resources characterized by such heterogeneity, and the operation of the jural rules concerning who owns what. In fact, much of the data on cultural ecology in the Alps could be phrased as the outcome of a continuing game against a centrifugally organized environment by populations equipped with two sets of ambiguous and often contradictory rules. To survive in such an environment, a population must organize its resources into viable resource bundles, whatever the requirements of property and inheritance. It does so largely, to adopt the parlance used by Robert Netting in his paper, through the development of long-range strategies of expansion, intensification, and regulation. At the same time, the dynamics of ownership by individual households often run counter to these long-range strategies by favoring short-term realignments of resources according to another set of rules, the rules of property and succession to rights in property.

The symposium papers take us a long way on the road towards a better understanding of the phenomena involved. Eschewing a static analysis of jural rights, they offer a processual view of ownership, in its varied ecological and social parameters. They thus also point the direction in which analysis must go, adumbrated perhaps most clearly in Berthoud's paper. The property connection in complex societies is not merely an outcome of local or regional ecological processes, but a

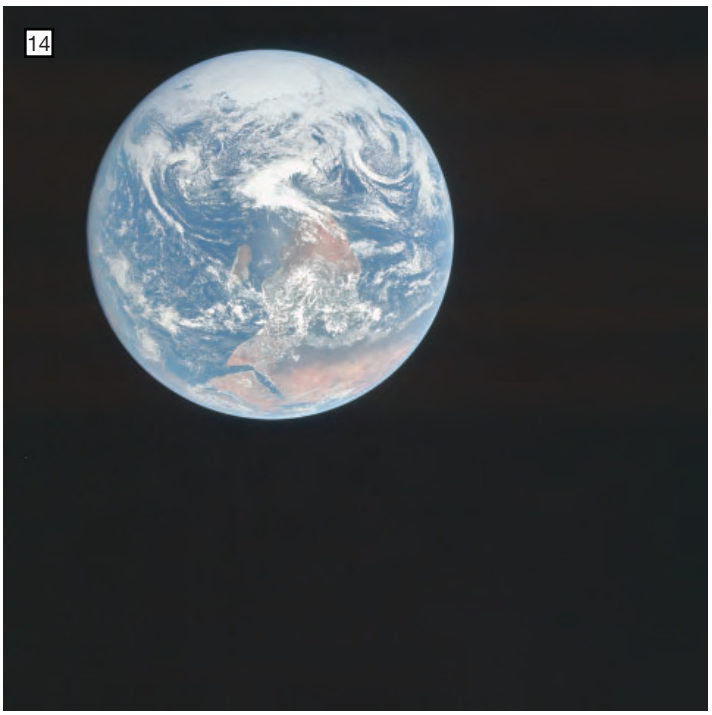
201

Political Ecology

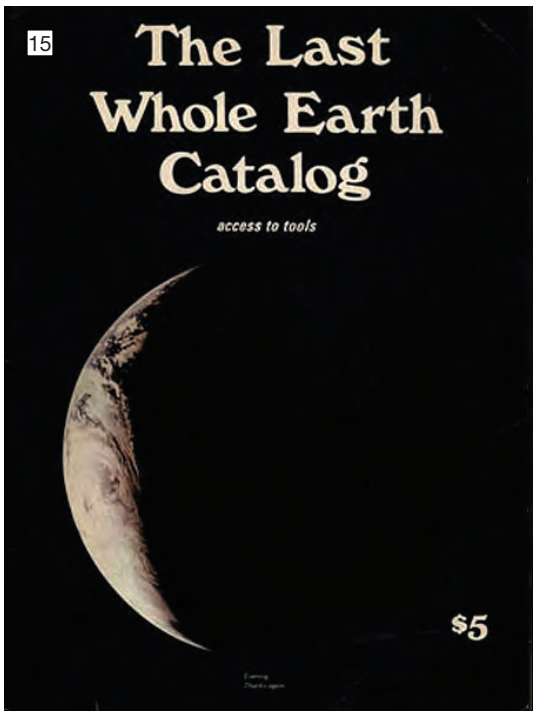
The World Conference for the Environment in Stockholm in 1972 was the first major global coordinated effort to produce an international legislative framework (coincidentally, the world's first green party—The United Tasmania group—was also founded in 1972). But the rising prominence and urgency of environmentalist concerns in political agendas worldwide prompted scrutiny of the techno-managerial discourse behind it. A 1972 essay by anthropologist Eric Wolf, recovered the term "political ecology" facilitating the coalescence of ecological scholarship produced by the social sciences. Political ecology posits that not all environmental challenges are purely technological or scientific and seeks to clarify the socio-political embeddedness and causation of environmental crises.

Previous page:
Figure 10. Secretary General United Nations First World Conference for the Human Environment in Stockholm, Sweden, 1972 (Image source: United Nations Multimedia).
Figure 12. Logo of the United Tasmania Party, world's first Green Party, which was formed on March 23, 1972, during a meeting of the Lake Pedder Action Committee (LPAC) at the Hobart Town Hall in order to field political candidates in the April 1972 state election. From Pamela Walker, The United Tasmania Group, Honors thesis, (University of Tasmania, 1987).
Figure 13. Title page of Eric Wolf, "Ownership and Political Ecology," *Anthropological Quarterly* 45, no. 3 (July 1972): 201–5.

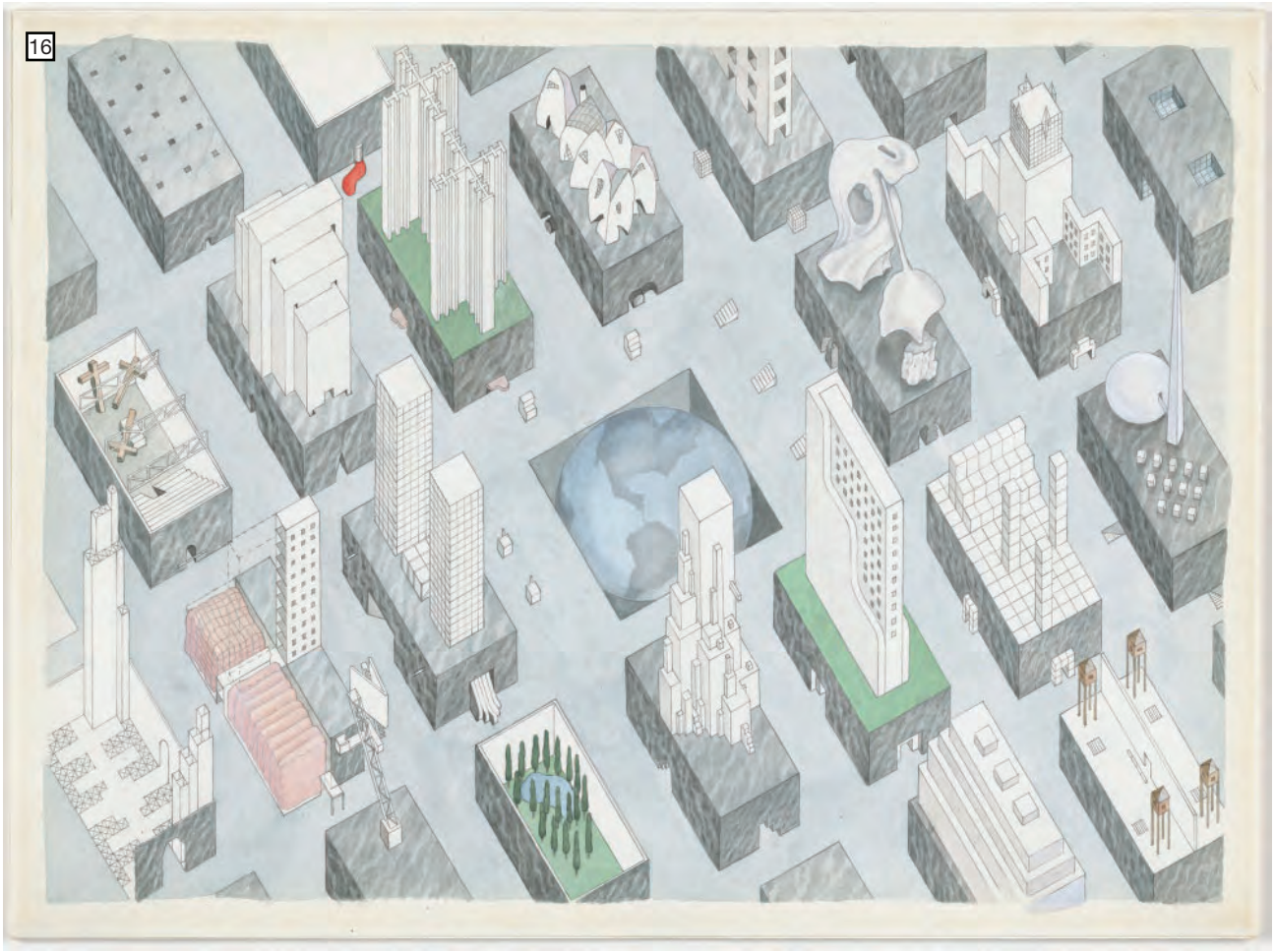
14



15



16



Modern and Postmodern Ecologies

Just a few years before the publication of the iconic "Blue Marble" photo obtained during NASA's final Apollo program mission, Steward Brand had reproduced Jud Yakult's piece "Why Haven't Seen a Photograph of the Whole Earth Yet?" in his Whole Earth Catalog (which saw its last edition printed in 1972). When it was finally obtained, the photo helped catalyze the planetary stage of the environmental movement. It was reproduced endlessly in book and magazine covers taking permanent hold in the collective imagination.

As a mechanical artifact, rendered through the eye of a camera put in space through one of humanity's greatest technological achievements, the photo represents a modernist conception of ecology—the world as unfiltered, natural fact accessed through science and technology. However, other instances of the image suggest different readings.

In "The City of the Captive Globe" painting by Madelon Vriesendorp (illustrating a 1972 theoretical project by Rem Koolhaas), the Earth is seen, not as a singular, isolated, natural fact, but at the center of an urban grid where each block represents a different ideology, all partaking in the pluralist, social construction of the world—that is, a postmodern conception of ecology.

Previous page:
Figure 14. The Blue Marble photo. Captured on December 7, 1972, at 5:39 a.m. EST (10:39 UTC). Earth as seen by Apollo 17 en route to the moon at a distance of about 29,000 kilometers, taken by either Harrison Schmitt or Ron Evans.
Figure 15. Magazine cover of Steward Brand, *The Last Whole Earth Catalog,* (New York: Random House, 1972).
Figure 16. Madelon Vriesendorp and Rem Koolhaas, *The City of the Captive Globe* project, 1972.

17

18

Planetary Engineering on Mars

CARL SAGAN

19

20

On the Poetics of the Science Fiction Genre

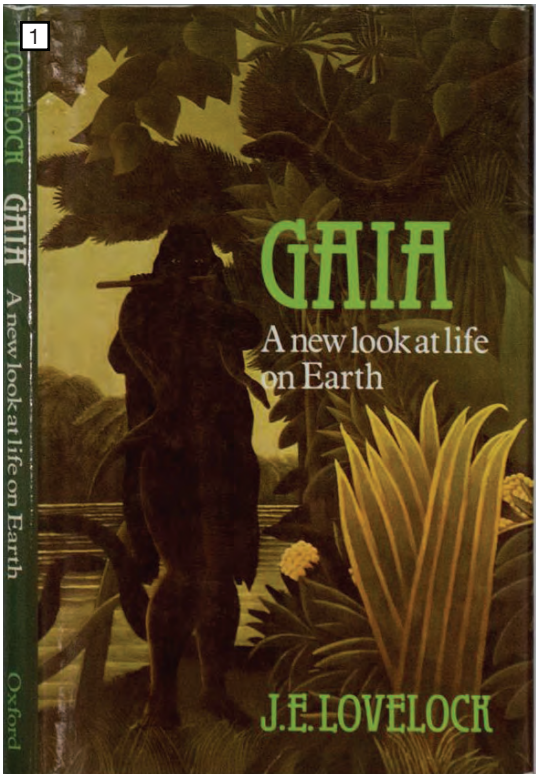
A Cosmic Ecology

The end of the Apollo space program in 1972 did not represent the end of the extraterrestrial sway over ecological thinking. That same year, an initiative sponsored by astronomer Carl Sagan resulted in a plaque which was carried on-board several space probes (first as a plaque in the Pioneer probes, then as the famous Golden Disk on-board the Voyager probes accompanied by a letter from president Jimmy Carter addressed to whomever found them).

Beyond symbolic interstellar offerings, extra-planetary science pushed the limits of ecology. A 1972 paper on "planetary engineering on Mars" was one of the first serious considerations to terraform the planet into an Earth replica anticipating science fiction writer Kim Stanley Robinson's illuminating Mars Trilogy by over two decades. Arguably, the extraterrestrial perspective is the realm where the dialectic between science and science fiction yields the most radical ecological insights.

Previous page:
Figure 17. Carl Sagan holding the design for the Pioneer probes plaque in front of Government Center, Boston, 1972. (Photo by Santi Visalli/Getty Images).
Figure 18. Title page of Carl Sagan, "Planetary Engineering on Mars," *Icarus* 20 (1972): 513–14.
Figure 19. Book cover of Carl Sagan, T*he Cosmic Connection: An Extraterrestrial Perspective* (New York : Garden City, 1972).
Figure 20. Title page of Darko Suvin, "On the Poetics of the Science Fiction Genre," *College English* 34, no. 3 (December 1972): 372–82.

1



2

Inquiry, 16, 95–100

The Shallow and the Deep, Long-Range Ecology Movement. A Summary*

Arne Naess
University of Oslo

Ecologically responsible policies are concerned only in part with pollution and resource depletion. There are deeper concerns which touch upon principles of diversity, complexity, autonomy, decentralization, symbiosis, egalitarianism, and classlessness.

The emergence of ecologists from their former relative obscurity marks a turning-point in our scientific communities. But their message is twisted and misused. A shallow, but presently rather powerful movement, and a deep, but less influential movement, compete for our attention. I shall make an effort to characterize the two.

1. *The Shallow Ecology movement:*

Fight against pollution and resource depletion. Central objective: the health and affluence of people in the developed countries.

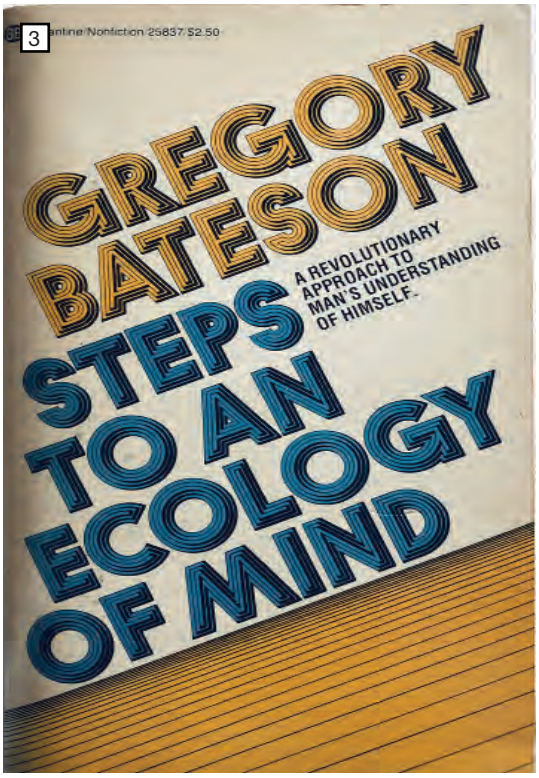
2. *The Deep Ecology movement:*

(1) Rejection of the man-in-environment image in favour of *the relational, total-field image*. Organisms as knots in the biospherical net or field of intrinsic relations. An intrinsic relation between two things *A* and *B* is such that the relation belongs to the definitions or basic constitutions of *A* and *B*, so that without the relation, *A* and *B* are no longer the same things. The total-field model dissolves not only the man-in-environment concept, but every compact thing-in-milieu concept — except when talking at a superficial or preliminary level of communication.

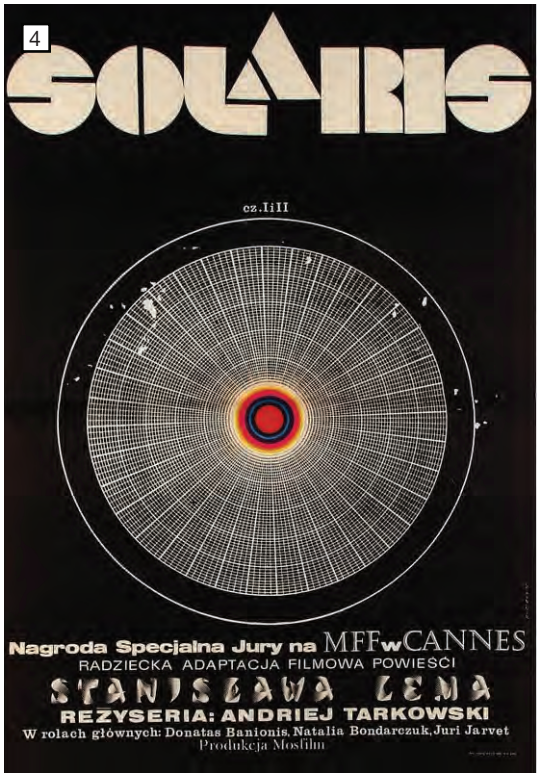
(2) *Biospherical egalitarianism* — in principle. The 'in principle' clause is inserted because any realistic praxis necessitates some killing, exploitation, and suppression. The ecological field-worker acquires a deep-seated respect, or even veneration, for ways and forms of life. He reaches an understanding from within, a kind of understanding that

* Summary of an Introductory Lecture at the 3rd World Future Research Conference, Bucharest, 3–10 September 1972. The lecture itself will be published as part of the Proceedings of the meeting.

3



4

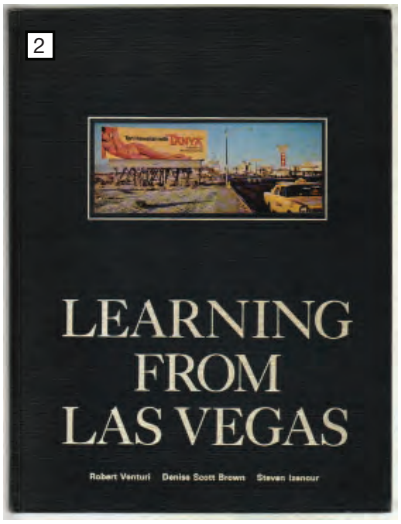


Ecologies of Self

At the same time ecology expanded its limits past the terrestrial envelope, another set of works used ecology as a heuristic to look inwards, deconstructing the notion of the organism or the "self." Philosopher Arne Naess, "deep ecology" tried to capture the idea that ecology should be conceived not as the study of "things-in-milieus" but as a "total relational field." Scientist James Lovelock's "Gaia hypothesis," first explained in a 1972 paper inspired by his experience collaborating with NASA planning the first Mars probes in search for life, proposes understanding the entirety of the planet's living systems as a single organism. Film director Andrei Tarkovsky's adaptation of science fiction writer Stanislaw Lem's novel *Solaris*, which depicts the struggle a crew faces when trying to communicate with a planet-sized organism, sought to place more emphasis on the inner lives of the scientists rather than the conflicts of man in nature and man's role in the universe highlighted by Lem. For anthropologist Gregory Bateson, ecology serves as a metaphor for understanding man's understanding of himself—what philosopher Felix Guattari later referred to as "egology" in his seminal book *The Three Ecologies*.

Previous page:
Figure 21. Book cover of James Lovelock, *Gaia: A New Look at Life on Earth*. (Oxford: Oxford University Press, 1979).
Figure 22. Title page of Arne Næss, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary," *Inquiry* 16 (1972): 95–100.
Figure 23. Book cover of Gregory Bateson, *Steps to an Ecology of Mind* book cover. (Chicago: Chicago University Press, 1972).
Figure 24. Polish version of the Solaris movie poster directed by Andrei Tarkovsky, 1972.

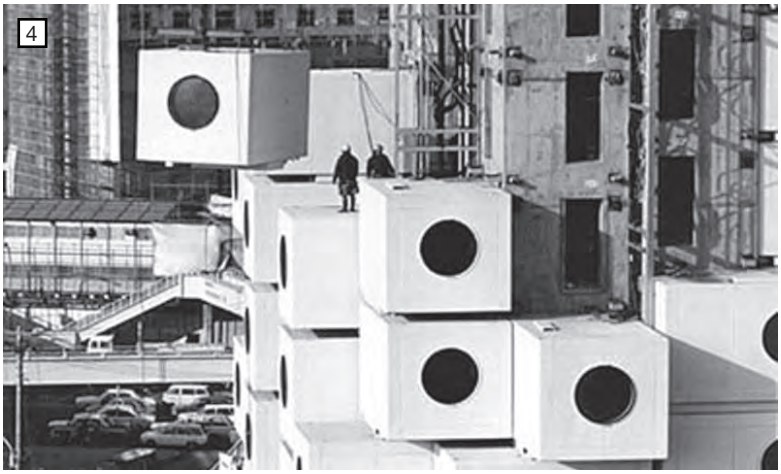
1


LEARNING
FROM
LAS VEGAS
Robert Venturi Denise Scott Brown Steven Izenour

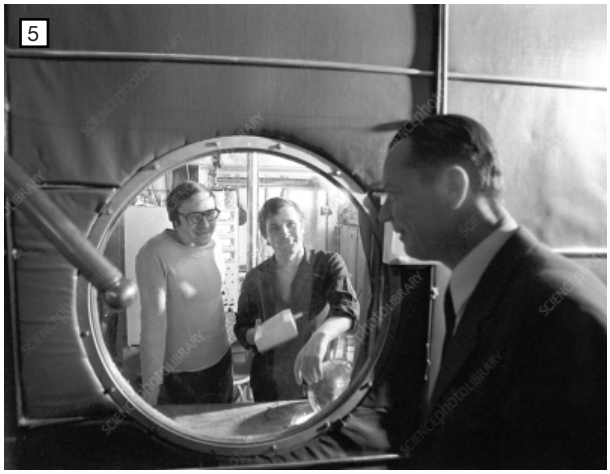
2


SAGGI TASCABILI LATERZA
TAFURI
Progetto e utopia

3



4



5

Architecture, (Ecology), and Utopia

The debates held at the turn of the millennium around criticality—in which ecology as a metaphor helped naturalizing neoliberal ideology—can be traced back at least to 1972. The same year that the demolition of Pruitt-Igoe marks the end of the modernist movement according to historian Charles Jencks, architects Denise Scott Brown and Robert Venturi publish *Learning from Las Vegas*. The book is postmodern manifesto celebrating the ugly and mundane forms of lowbrow culture. Almost simultaneously, historian Manfredo Tafuri's *Progetto e Utopia* (translated in English as Architecture and Utopia) went beyond an analysis of form to understand architecture's broader relation with society. Both books indicted modern architecture, but whereas Scott Brown and Venturi called for acceptance, Tafuri (even if at times pessimistically) called for resistance.

While the West debated the end of modernity, the East witnessed a climatic moment in what Rem Koolhaas has called the last modernist avant-garde of the twentieth century: Japanese metabolism. Kisho Kurokawa's Nakagin capsule tower, completed in 1972, represented the closed system principles of the "capsule ecology" approach that characterized eco-architecture for most part of the twentieth century from Ken Yeang's green skyscrapers to Buckmister Fuller's Spaceship Earth.

Previous page:
Figure 25. Demolition of Pruitt-Igoe housing complex in St. Louis, Missouri "on July 15th, 1972, at 3:32 pm or thereabouts." (Image source: U.S. Department of Housing and Urban Development.)
Figure 26. Book cover of Robert Venturi, Denise Scott Brown, and Steven Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (Cambridge, Massachusetts: The MIT Press, 1972).
Figure 27. Book cover of Manfredo Tafuri, *Progetto e Utopia* (Rome: Laterza, 1973).
Figure 28. Kisho Kurokawa's Nakagin capsule tower nearing completion in Tokyo, Japan, 1972. (Image source: http://www.iromegane.com/japan/culture/nakagin-capsule-towers-demolition-yea-or-nay/).
Figure 29. Historical image of scientists in the Russian BIOS-3 station during a closed ecosystem experiment, while one of the experiment leaders, Vladimir Okladnikov, observes from the outside. The BIOS-3 facilities consisted of a 315-cubic-meter sealed habitat and were used to conduct manned experiments–the longest lasting 180 days (1972-1973). Chlorella algae were used to recycle the air breathed by the human inhabitants and two chambers were used to grow wheat and vegetables. Photographed on 30th January 1985. (Image source: RIA NOVOSTI/Science Photo Library.)

Appendix 3. Bibliographic Timelime

1960

Hilberseimer, Ludwig. The New Regional Pattern (1949)

Doxiadis, Constantinos. Architecture in Transition (1963)

Banham, Reyner. Architecture of the Well-tempered environment (1964)

Buckminster Fuller, Richard. Operating Manual for Spaceship Earth (1968)

McHarg, Ian. Design with Nature (1969)

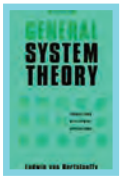
Giedion, Siegfried. Mechanization Takes Command (1948)

Gottmann, Jean. Megalopolis (1964)

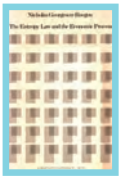
Lefebvre, Henri. La Revolution Urbaine (1970)

Bookchin, Murray. Our Synthetic Environment (1962)

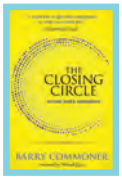
Baran, Paul. The Political Economy of Growth (1968)



von Bertalanffy, Ludwig. General System Theory (1969)

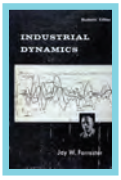


Georgescu-Roegen, Nicholas. The Entropy Law and the Economic Process (1971)



Commoner, Barry. The Closing Circle (1971)

Vernadsky, Vladimir. La Biosphere (1926)

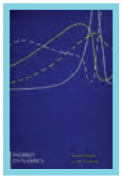


Forrster, Jay. Industrial Dynamics (1961)

Carson, Rachel. Silent Spring (1962)

Ward, Barbara. Spaceship Earth (1966)

Ehrlich, Paul. The Population Bomb (1968)



Forrester, Jay - World Dynamics (1971)

Bataille, Georges. L'anus_solaire (1931)

Bataille, Georges. La Part Maudite (1949)

Odum, Eugene. Fundamentals of Ecology (1961)

Brand, Stewart. The Last Whole Earth Catalog (1972)

Environmentalism

Technomanagerialism

Political Ecology

Ecological Philosophy

Design Theory

Wiener, Norbert. Cybernetics (1961)

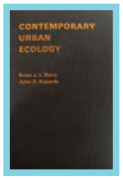
Shklovsky, Iosif. Intelligent Life in the Universe (1963)

1970

1985

1990

Dahinden, Justus. Urban Structures for the Future (1972)



Berry, Joe and John Kasarda. Contemporary Urban Ecology (1977)

Fernandez Galiano, Luis. Fire and Memory (1991)

Venturi, Robert et al. Learning from Las Vegas (1972)

Haraway, Donna. Simians, Cyborgs, and Women, The Reinvention of Nature (1991)

Merchant, Carolyn. Radical Ecology (1992)

Cronon, William. Uncommon Ground (1995)

Bateson, Gregory. Steps to an Ecology of Mind (1972)

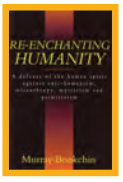
Merchant, Carolyn. The Death of Nature (1980)

Prigogine, Ilya and Isabelle Stengers. Order Out of Chaos (1984)

Guattari, Felix. The Three Ecologies (1989)

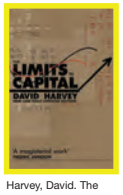
Latour, Bruno. We Have Never Been Modern (1991)

Merchant, Carolyn. Ecology, Key Concepts in Critical Theory (1994)



Bookchin, Murray. Re-enchanting Humanity (1995)

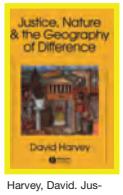
Ward, Barbara and Rene Dubos. Only One Earth (1972)



Harvey, David. The Limits to Capital (1982)

Smith, Neil. Uneven Development (1984)

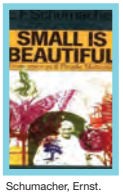
Harvey, David. The Urbanization of Capital (1985)



Harvey, David. Justice, nature and the geography of difference (1996)

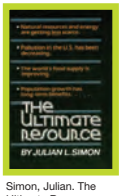
Lash, Scott et al. Risk, Environment and Modernity (1996)

Meadows, Dinella. The Limits to Growth(1972)

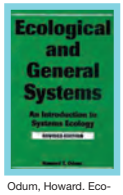


Schumacher, Ernst. Small Is Beautiful (1973)

Daly, Herman. Steady-State Economics (1977)

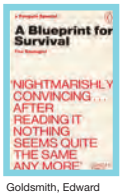


Simon, Julian. The Ultimate Resource (1981)



Odum, Howard. Ecological and General Systems (1983)

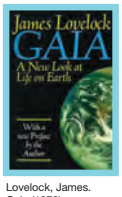
Botkin, Daniel. Discordant Harmonies, A New Ecology for the Twenty-first Century (1990)



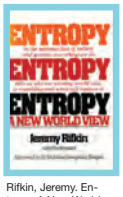
Goldsmith, Edward and Robert Allen. A Blueprint for Survival (1972)

Odum, Howard and Elisabeth Odum. Energy Basis for Man and Nature (1976)

Worster, Donald. Nature's Economy (1977)



Lovelock, James. Gaia (1979)



Rifkin, Jeremy. Entropy, A New World View (1980)

Sagan, Carl. Cosmic Connection (1973)

Allen, John and Mark Nelson. Space Biospheres (1989)

Sagan, Dorion. Biospheres (1990)

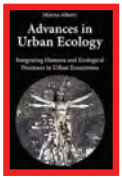
Allen, John. Biosphere 2 The Human Experiment (1991)

Kelly, Kevin. Out of Control (1994)

1995 2000 2005

Koolhaas, Rem. S, M, L, XL (1996)

Gissen, David. Subnatures (2005)



Alberti, Marina. Advances in Urban Ecology (2008)


Abalos, Inaki. Naturaleza y Artificio (2010)

Mohsen, Mostafavi and Gareth Doherty. Ecological Urbanism (2010)

Waldheim, Charles. The Landscape Urbansim Reader (2006)


Saunders, William. The New Architectural Pragmatism (2007)

Anker, Peder. From Bauhaus to Ecohouse (2010)


Hagan, Sussanah. Ecological Urbanism (2010)

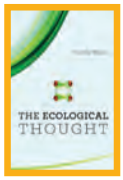

Spivak, Gayatri. Imperatives to Re-Imagine the Planet (1999)

Latour, Bruno. Politics of Nature (1999)

Stengers, Isabelle. Cosmopolitics (2003)

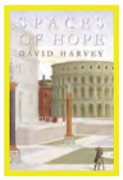
Morton, Timothy. Ecology without Nature (2007)


Bennett, Jane. Vibrant Matter, A Political Ecology of Things (2010)

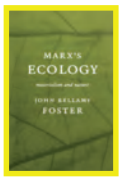


Morton, Timothy. The Ecological Thought (2010)

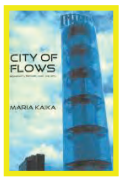
Braun, Bruce and Noel Castree. Remaking Reality (1998)



Harvey, David. Spaces of Hope (2000)



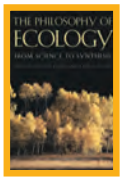
Bellamy Foster, John. Marx's Ecology (2000)



Kaika, Maria. City of Flows (2005)

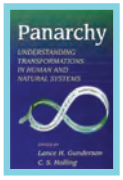
Swyngedouw, Erik et al. In the Nature of Cities, Urban Political Ecology and the Politics of Urban Metabolism (2006)

Costanza, Robert. An Introduction to Ecological Economics (1997)9



Keller, David and Frank Golley. The Philosophy of Ecology (2000)

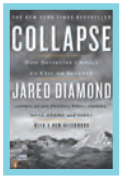
Odum, Howard and Elisabeth Odum. A Prosperous Way Down (2001)



Holling, C.S. and Lance Gunderson. Panarchy (2002)

Gitelson, I. I., et al. Manmade Closed Ecological Systems (2003)

Latouche, Serge. Farewell to Growth (2004)



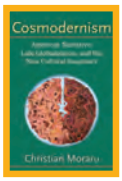
Diamond, Jared. Collapse (2005)

Lynas, Mark. Six Degrees (2008)

Brand, Stewart. Whole Earth Discipline (2009)

Cohen, Joel. How Many People Can the Earth Support (1995)

Wilbert, Chris and Damian White. Technonatures (2009)



Moraru, Christian. Cosmodernism (2011)

Mensvoort, Koert van and Jan Grievink. Next Nature (2012)

Grober, Ulrich. Sustainability, A Cultural History (2012)

Robinson, Kim Stanley. Red Mars (1995)

Zubrin, Robert. The Case for Mars (1996)


Nagel, Thomas. Mind and Cosmos (2012)

2010 2015 2020


Duany, Andres. Landscape Urbanism and its Discontents (2013)

Lahiji, Nadie. Architecture Against the Post-political (2014)

Moe, Kiel. Insulating Modernism (2014)

Lahiji, Nadir. Can Architecture Be an Emanciptory Project (2016)


Spencer, Douglas. The Architecture of Neoliberalism (2016)


Hertwerk, Florian and Nikos Katsikis. Positions on Emancipation (2018)

Foster Gage, Mark. Aesthetics Equals Politics (2019)

Reed, Chris and Nina-Marie Lister. Projective Ecologies (2013)

Corner, James - The Landscape Imagination (2014)

Yaneva, Albena and Alejandro Zaera-Polo. What is Cosmopolitical Design (2015)

Orff, Kate. Toward an Urban Ecology (2016)

Abalos, Inaki and Renata Sentkiewicz. Essays on Thermodynamics (2015)

Waldheim, Charles. Landscape as Urbanism (2016)

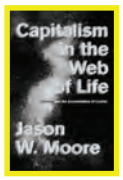
Ghosn, Rania and El Hadi Jazairy. Geostories (2018)

Morton, Timothy. Hyperobjects (2013)

Latour, Bruno. Down to Earth (2017)

Horl, Erich. General Ecology (2017)

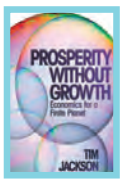
Brenner, Neil. Planetary Urbanization (2014)



Moore, Jason. Capitalism in the Web of Life (2015)

Srnicek, Nick and Alex Williams. Inventing the Future (2015)

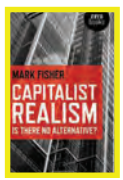

Malm, Andreas. The Progress of this Storm (2017)



Jackson, Tim. Prosperity without Growth (2009)

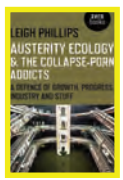
Emmott, Stephen 10 Billion (2013)

Nordhaus, Ted at al. Ecomodernist Manifesto (2015)

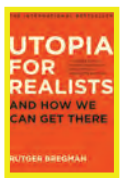


Fisher, Mark. Capitalist Realism (2013)

Klein, Naomi. This Changes Everything (2014)



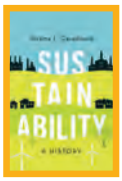
Phillips, Leigh. Austerity Ecology (2015)



Bregman, Rutger. Utopia for Realists (2016)


Mason, Paul. Postcapitalism (2018)

Franke, Anselm. California and the Disappearance of the Outside (2013)



Caradonna, Jeremy. Sustainability, A History (2014)

MacKay, Robin. Accelerationist Reader (2014)

Moraru, Christian. Reading for the Planet (2015)

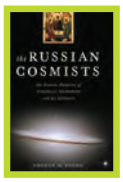
Elias, Amy and Christian Moraru. The Planetary Turn (2015)

Garces, Marina. Nueva Ilustracion Radical (2017)

Demos, T.J. Decolonizing Nature (2016)

Demos, T.J. Against the Anthropocene (2017)

Berardi, Franco. Futurability (2019)



Young, George. Russian Cosmists (2012)

Sagan, Dorion.The Cosmic Apprentice(2013)

Hohler, Sabine. Spaceship Earth in the Environmental Age (2015)

Groys, Boris. Russian Cosmism (2018)

Circovik, Milan. The Great Silence (2018)

BIBLIOGRAPHY

Introduction

Ábalos, Iñaki. "Introducción," in *Naturaleza y Artificios: El Ideal Pintoresco en la Arquitectura y el Paisajismo Contemporáneos*, edited by Iñaki Ábalos, 7–18. Barcelona: Gustavo Gili, 2009.

Anker, Peder. *From Bauhaus to Ecohouse: A History of Ecological Design*. Baton Rouge: Louisiana State University Press, 2010.

Bastani, Aaron. *Fully Automated Luxury Communism: A Manifesto*. New York: Verso, 2020.

Berardi, Franco. *Futurability: The Age of Impotence and the Horizon of Possibility*. New York: Verso, 2017.

Bregman, Rutger. *Utopia for Realists*. London: Bloomsbury, 2018.

Bookchin, Murray. *Re-Enchanting Humanity: A Defense of the Human Spirit Against Antihumanism, Misanthropy, Mysticism, and Primitivism*. 1st ed. New York: Cassell, 1995.

Carson, Rachel. *Silent Spring*. Boston: Houghton Mifflin, 1962.

Commoner, Barry. *The Closing Circle: Nature, Man, and Technology*. New York: Alfred A. Knopf, 1971.

Demeritt, David. "Science, Social Constructivism and Nature." In *Remaking Reality: Nature at the Millennium*, edited by Bruce Braun and Noel Castree, 173–93. London; New York: Routledge, 1998.

Dyson, Freeman. "Time without End: Physics and Biology in an Open Universe." *Reviews of Modern Physics* 51, no. 3 (July 1979): 447–60.

Ehrlich, Paul R. *The Population Bomb*. Rivercity: Rivercity Press, 1968.

Fernández-Galiano, Luis. *Fire and Memory: On Architecture and Energy*. Cambridge, Mass.: MIT Press, 2000.

Fuller, R. Buckminster. *Operating Manual for Spaceship Earth*. Carbondale: Southern Illinois University Press, 1969.

Forrester, Jay Wright. *System Dynamics*. New York: Elsevier, 1980.

Garcés, Marina. *Nueva Ilustración Radical*. Barcelona: Anagrama, 2017.

Harris, Samuel B. 2010. "Science Can Answer Moral Questions." TED talk presented at the TED Conference, Long Beach, California, March 22.

Harvey, David. *Spaces of Hope*. Berkeley: University of California Press, 2000.

Hight, Christopher. "Designing Ecologies." In *Projective Ecologies*, edited by Chris Reed and Nina-Marie E. Lister, 1st Edition., 84–105. New York: Actar, 2014.

Inayatullah, Sohail. "Causal Layered Analysis: Poststructuralism as Method." Futures 30 (8): 815–29.

Kallipoliti, Lydia. *The Architecture of Closed Worlds, or: What Is the Power of Shit?* Zürich: Lars Müller Publishers, 2018.

Lakoff, George. *Moral Politics: How Liberals and Conservatives Think*. Chicago: University of Chicago Press, 1996.

Lakoff, George, and Mark Johnson. *Metaphors We Live By*. Chicago: The University of Chicago Press, 1980.

Landy, Joshua, and Michael T. Saler. *The Re-Enchantment of the World: Secular Magic in a Rational Age*. Stanford, Calif.: Stanford University Press, 2009.

Latour, Bruno. We Have Never Been Modern. Cambridge, Massachusetts: Harvard University Press, 1993.

Latour, Bruno. "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30 (2004): 227.

Latour, Bruno. Politics of Nature. Harvard University Press, 2009.

Latour, Bruno. *Down to Earth: Politics in the New Climatic Regime.* 1st ed. Cambridge, UK: Polity Press, 2018.

Lukács, György. *History and Class Consciousness: Studies in Marxist Dialectics.* Cambridge, Mass.: MIT Press, 1968.

Mälm, Andreas. *The Progress of This Storm: Nature and Society in a Warming World.* London; New York: Verso, 2018.

Mason, Paul. *Postcapitalism: A Guide to Our Future.* London: Penguin Books, 2016.

Moore, Jason W. *Capitalism in the Web of Life: Ecology and the Accumulation of Capital.* New York: Verso, 2015.

Moraru, Christian, and Amy J. Elias. *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century.* Evanston, Illinois: Northwestern University Press, 2015.

Odum, Howard T. *Systems Ecology: An Introduction.* New York: Wiley, 1983.

Phillips, Leigh. *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff*. Winchester: Zero Books, 2015.

Phillips, Leigh, and Michal Rozworski. *People's Republic of Walmart: How the World's Biggest Corporations Are Laying the Foundation for Socialism*. New York: Verso, 2019.

Prieto, Eduardo. *Historia Medioambiental de la Arquitectura*. Madrid: Cátedra, 2019.

Tipler, Frank. "There Are No Limits to the Open Society." *The Critical Rationalist* 03, no. 02 (September 23, 1998).

Schön, Donald. *Generative Metaphor: A Perspective on Problem-Setting in Social Policy*. Cambridge University Press, 1979.

Sabin, Paul. *The Bet: Paul Ehrlich, Julian Simon, and Our Gamble over Earth's Future*. New Haven: Yale University Press, 2014.

Scharmen, Fred. *Space Settlements*. New York: Columbia Books on Architecture and the City, 2019.

Schumacher, Ernst F. *Small Is Beautiful: Economics as if People Mattered*. New York: Harper & Row, 1973.

Simon, Julian Lincoln. *The Ultimate Resource.* Princeton: Princeton University Press, 1981.

Smith, Neil. "Nature at the Millennium: Production and Re-Enchantment." In *Remaking Reality: Nature at the Millennium*, edited by Bruce Braun and Noel Castree, 271–85. London: Routledge, 1998.

Srnicek, Nick, and Alex Williams. *Inventing the Future: Postcapitalism and a World without Work.* London: Verso, 2016.

Tetreault, Darcy. "Three Forms of Political Ecology." *Ethics & the Environment* 22, no. 2 (2017): 1–23.

Vidler, Anthony. "Whatever Happened to Ecology? John McHale and the Bucky Fuller Revival." *Log*, no. 13/14 (2008): 139–46.

Walker, Peter A. "Political Ecology: Where Is the Ecology?" *Progress in Human Geography* 29, no. 1 (2005): 73–82.

Watts, Michael. "Political Ecology." In *Companion to Economic Geography*, edited by Trevor Barnes and Eric Sheppard, 257–75. Oxford: Blackwell, 2003.

Chapter 1

Allen, Stan, Hal Foster, and Kenneth Frampton. "Stocktaking 2004: Questions about the Present and Future of Design." In The New Architectural Pragmatism: A Harvard Design Magazine Reader, edited by William S. Saunders, 150–61. Minneapolis: University of Minnesota Press, 2007.

Baird, George. "'Criticality' and Its Discontents." *Harvard Design Magazine*, Fall 2004.

Berrizbeitia, Anita. "The Limits of Process: The Case for Precision in Landscape Architecture." In *New Geographies 8: Island*, edited by Daniel Daou and Pablo Perez-Ramos. Cambridge, MA: Harvard University Graduate School of Design, 2016.

Bookchin, Murray. *Our Synthetic Environment.* New York: Knopf, 1962.

Corner, James. "Not Unlike Life Itself." In *The Landscape Imagination: Collected Essays of James Corner, 1990-2010*, edited by Alison Bick Hirsch. New York, New York: Princeton Architectural Press, 2014.

Curtis, Adam. "All Watched Over by Machines of Loving Grace." TV Mini-Series. United Kingdom: BBC, 2011.

Daou, Daniel, and Pablo Pérez-Ramos. "Editorial." In *New Geographies 8: Island.* Cambridge, MA: Harvard University Graduate School of Design, 2016.

Dunham-Jones, Ellen. "The Irrational Exuberance of Rem Koolhaas." *Places Journal*, April 2, 2013.

Franke, Anselm, and Diedrich Diederichsen. *The Whole Earth: California and the Disappearance of the Outside*. Berlin: Sternberg Press, 2013.

Glaister, Dan. 2009. "Architect Frank Gehry's Projects Hit Hard by Economic Downturn." The Guardian, March 3, 2009, sec. Art and design. http://www.theguardian.com/artanddesign/2009/mar/03/frank-gehry-economy-architecture.

Guattari, Félix. *The Three Ecologies*. London: Athlone Press, 2000.

Haeckel, Ernst. *Generelle Morphologie der Organismen*, 1866.

Hagan, Susannah. *Ecological Urbanism: The Nature of the City*. New York, New York: Routledge, 2015.

Hickey, Dave. "On Not Being Governed." Harvard Design Magazine, Fall 2007.

Koolhaas, Rem. "Exodus or The Voluntary Prisoners of Architecture." In *S, M, L, XL*. Rotterdam: 010 Publ., 1995.

Koolhaas, Rem. "Whatever Happened to Urbanism?" In *S, M, L, XL*, edited by Bruce Mau and Jennifer Sigler. Rotterdam: 010 Publ., 1995.

Koolhaas, Rem, Jeffrey Inaba, Chuihua Judy Chung, and Sze Tsung Leong, eds. *Great Leap Forward*. Harvard Design School Project on the City. Köln: Taschen, 2002.

Koolhaas, Rem, and Hans-Ulrich Obrist, eds. 2011. Project Japan: Metabolism Talks. Köln: Taschen.

Lefebvre, Henri. *La Révolution Urbaine*. Paris: Gallimard, 1970.

Fisher, Mark. *Capitalist Realism: Is There No Alternative?* Winchester, UK; Washington [D.C.]: Zero Books, 2009.

Fisher, Mark. "Capitalist Realism." *STRIKE!*, June 3, 2013. http://strikemag.org/capitalist-realism-by-mark-fisher/

Martin, Reinhold. "Critical of What? Toward a Utopian Realism." In The New Architectural Pragmatism: A Harvard Design Magazine Reader, edited by William S. Saunders, 150–61. Minneapolis: University of Minnesota Press, 2007.

Merchant, Carolyn. *American Environmental History: An Introduction*. New York: Columbia Univ. Press, 2007.

Moore, Jason W. *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. New York: Verso, 2015.

Moore, Rowan. 2012. "Pruitt-Igoe: Death of an American Housing Dream." The Guardian, February 26, 2012, sec. Art and design. http://www.theguardian.com/artanddesign/2012/feb/26/pruitt-igoe-myth-film-review.

Morton, Timothy. *The Ecological Thought*. Cambridge, Massachusetts: Harvard University Press, 2010.

Morton, Timothy. *Hyperobjects: Philosophy and Ecology after the End of the World*. Minneapolis: University of Minnesota Press, 2013.

Mostafavi, Mohsen. "Why Ecological Urbanism? Why Now?" In *Ecological Urbanism*, edited by Gareth Doherty and Mohsen Mostafavi. Baden, Switzerland: Lars Müller Publishers, 2010.

Mumford, Lewis. "The Natural History of Urbanization." In *Man's Role in Changing the Face of the Earth*, edited by William L. Thomas Jr., 382–98. Chicago: University of Chicago Press, 1956.

Nin, Anaïs. *Seduction of the Minotaur.* Chicago: Swallow Press, 1961.

Ouroussoff, Nicolai. 2008. "City on the Gulf: Koolhaas Lays Out a Grand Urban Experiment in Dubai." The New York Times, March 3, 2008, sec. Art & Design.

Pyla, Panayiota. "The Counter Histories of Sustainability." Volume 18 (2008): 77–79.

Reed, Chris, and Nina-Marie E. Lister. *Projective Ecologies.* New York, New York: Actar Publishers, 2014.

Sachs, Wolfgang. "No Sustainability Without Development." Brussels: The Ecumenical Association for Church and Society, 1995.

Saunders, William S., ed. *The New Architectural Pragmatism: A Harvard Design Magazine Reader.* Minneapolis: University of Minnesota Press, 2007.

Scott Brown, Denise. "Learning from Pop." In *Architecture Theory since 1968*, edited by K. Michael Hays. Cambridge, Mass: The MIT Press, 1998.

Smil, Vaclav. *Making the Modern World: Materials and Dematerialization.* 1st ed. New York: Wiley, 2013.

Smith, Neil. "Nature at the Millennium: Production and Re-Enchantment." In *Remaking Reality: Nature at the Millennium*, edited by Bruce Braun and Noel Castree, 271–85. London: Routledge, 1998.

Somol, Robert, and Sarah Whiting. "Notes around the Doppler Effect and Other Moods of Modernism." Perspecta 33, no. Mining Autonomy (2002): 72–77

Speaks, Michael. "Design Intelligence: Or Thinking After the End of Metaphysics." In *Versioning: Evolutionary Techniques in Architecture*, edited by Sharples Holden Pasquarelli SHOP. Chichester: Wiley-Academy, 2002.

Speaks, Michael. "Design Intelligence: Part 1, Introduction." *A+U*, December 2002, 10–18.

Speaks, Michael. "Intelligence after Theory." *Perspecta* 38, April 2006, 103–6.

van Toorn, Roemer. "No More Dreams? The Passion for Reality in Recent Dutch Architecture... and Its Limitations." In *The New Architectural Pragmatism: A Harvard Design Magazine Reader*, edited by William S. Saunders, 54–74. Minneapolis: University of Minnesota Press, 2007.

Varnelis, Kazys. "The Post-Critical Collapse." Blog. Varnelis.net, November 3, 2008. http://varnelis.net/blog/the_postcritical_collapse.

Robert Venturi, Denise Scott Brown, and Steven Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (Cambridge, Massachusetts: The MIT Press, 1972).

Waldheim, Charles. "Foreword. Ecologies: Plural and Projective." In *Projective Ecologies*, edited by Chris Reed and Nina-Marie E. Lister. New York, New York: Actar Publishers, 2014.

Walker, Peter A. "Political Ecology: Where Is the Ecology?" *Progress in Human Geography* 29, no. 1: 73–82.

White, Frank. *The Overview Effect: Space Exploration and Human Evolution.* Boston: Houghton Mifflin, 1987.

Williams, Raymond. 1974. "On High and Popular Culture." The New Republic, November 22, 1974.

Wolf, Eric. "Ownership and Political Ecology." *Anthropological Quarterly* 45, no. 3 (July 1092): 201–5.

Worster, Donald. *Nature's Economy: The Roots of Ecology.* San Francisco: Sierra Club Books, 1977.

Chapter 2

Arrhenius, Svante. "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground." *Philosophical Magazine and Journal of Science*, 5, 41 (April 1896): 237–76.

Bartlett, Jamie. "Meet the Dark Enlightenment: Sophisticated Neo-Fascism That's Spreading Fast on the Net." *The Daily Telegraph*. January 20, 2014.

Bendell, Jem. "Deep Adaptation." *IFLAS Occasional Paper*, July 27, 2018.

Blaser, Mario. 2016. "Is Another Cosmopolitics Possible?" Cultural Anthropology 31 (4): 545–70.

Bookchin, Murray. *Toward an Ecological Society*. Montréal; Buffalo: Black Rose Books, 1980.

Daou, Daniel, and Mariano Gómez-Luque. "Wilderness and Utopia: On Postcapitalist Urbanization and the Extraterrestrial Imaginary. Interview with Kim Stanley Robinson by Daniel Daou and Mariano Gomez-Luque." In *New Geographies: Extraterrestrial*, edited by Jeffrey Nesbit and Guy Trangoš, 11:169–80. New York, NY: Actar, 2020.

Fluss, Harrison, and Landon Frim. "Aliens, Antisemitism, and Academia." Jacobin Magazine, March 2017.

Harvey, David. *Spaces of Hope*. Berkeley: University of California Press, 2000.

Lahiji, Nadir, ed. *Can Architecture Be an Emancipatory Project? Dialogues on the Left*. Winchester, UK; Washington [D.C.]: Zero Books, 2016.

Land, Nick. 2012. "The Dark Enlightenment." Blog. http://www.thedarkenlightenment.com

Latour, Bruno. 2004. "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30: 225–48.

Lefebvre, Henri. *La production de l'espace*. Paris: Éditions Anthropos, 1974.

Lefebvre, Henri. *Toward an Architecture of Enjoyment*. Edited by Łukasz Stanek. Minneapolis, Minnesota: Minnesota University Press, 2014.

Lent, Jeremy. "Steven Pinker's Ideas About Progress Are Fatally Flawed. These Eight Graphs Show Why." www.resilience.org, May 18, 2018.

Mälm, Andreas. *The Progress of This Storm: Nature and Society in a Warming World*. London; New York: Verso, 2018.

Robinson, Kim Stanley. "Power and the Space of the Planet." Lecture, Columbia Graduate School of Architecture, Planning and Preservation, New York, NY, April 20, 2016.

Hertweck, Florian, and Nikos Katsikis, eds. *Positions on Emancipation Architecture between Aesthetics and Politics*. Baden, Switzerland: Lars Müller Publishers / University of Luxembourg, 2018.

Hollings, C. S. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics* 4 (1973): 1–23.

Marcuse, Herbert. *The Aesthetic Dimension: Toward a Critique of Marxist Aesthetics*. Boston, MA: Beacon Press, 1978.

Monbiot, George. 2016. "Neoliberalism—the Ideology at the Root of All Our Problems." The Guardian, April 15, 2016, sec. Books. http://www.theguardian.com/books/2016/apr/15/neoliberalism-ideology-problem-george-monbiot.

Morton, Timothy. *The Ecological Thought*. Harvard University Press. Cambridge, Massachusetts and London, England, 2010.

Pinker, Steven. 2018. *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress*. New York, NY: Penguin Random House.

Shaviro, Steven. 2005. "The Pinocchio Theory: Cosmopolitics." Blog. May 28, 2005. http://www.shaviro.com/Blog/?p=401.

Sigl, Matt. "The Dark Enlightenment: The Creepy Internet Movement You'd Better Take Seriously." *Vocativ*, December 2, 2013.

Smil, Vaclav. *Making the Modern World: Materials and Dematerialization.* 1st ed. New York: Wiley, 2013.

Smith, Neil. "Nature at the Millennium: Production and Re-Enchantment." In *Remaking Reality: Nature at the Millennium*, edited by Bruce Braun and Noel Castree, 271–85. London: Routledge, 1998.

Spivak, Gayatri Chakravorty. "Imperative to Re-Imagine the Planet." In *An Aesthetic Education in the Era of Globalization*, 335–50. Cambridge, MA: Harvard University Press, 2012.

Stoekl, Allan. *Bataille's Peak: Energy, Religion, and Post-Sustainability*. Minneapolis, Minnesota: University of Minnesota Press, 2007.

Thayer, Robert L. *Gray World, Green Heart*. New York: Wiley, 1994.

The Economist. 2017. Populism Is Reshaping Our World. https://www.youtube.com/watch?v=ekc5EAPPPgko

Wark, McKenzie. *Molecular Red: Theory for the Anthropocene*. London and New York: Verso, 2015.

Watts, Jonathan. "Concrete: The Most Destructive Material on the Planet." *The Guardian*. February 25, 2019.

Weiss, Bari. 2018. "Opinion | Meet the Renegades of the Intellectual Dark Web." *The New York Times*, May 8, 2018, sec. Opinion. https://www.nytimes.com/2018/05/08/opinion/intellectual-dark-web.html.

Zaera-Polo, Alejandro. "Ya bien entrado el Siglo XXI, ¿las arquitecturas del Post-Capitalismo?" *El Croquis* 187 (2016).

Chapter 3

Barthes, Roland. *Mythologies*. Paris: Editions du Seuil, 1957.

Bataille, Georges. *La Part Maudite: Essai d'Économie Générale*. Paris: Les Éd. de Minuit, 1949.

Bauman, Zygmunt. *Liquid Life*. Cambridge, UK; Malden, MA: Polity Press, 2005.

Beck, Ulrich. "Risk Society's Cosmopolitan Moment." In *New Geographies: Zero*, edited by Neyran Turan, 1:24–34. Cambridge, MA: Harvard University Graduate School of Design, 2008.

Benton, Ted. "Marxism and Natural Limits: An Ecological Critique and Reconstruction." *New Left Review* 1, no. 178 (1989).

Bostrom, Nick. "The Future of Humanity." edited by Jan-Kyrre Berg, Evan Selinger, and Soren Riis. New Waves in Philosophy of Technology. New York: Palgrave McMillan, 2009.

Brand, Stewart. *Whole Earth Discipline: An Ecopragmatist Manifesto*. New York: Viking, 2009.

Caradonna, Jeremy L. *Sustainability: A History*. New York: Oxford University Press, 2014.

Ćirković, Milan M. "Resource Letter: PEs-1: Physical Eschatology." *American Journal of Physics* 71, no. 2 (February 2003): 122–33.

Ćirković, Milan M. *The Great Silence: Science and Philosophy of Fermi's Paradox*. Oxford, UK; Oxford University Press, 2018.

Clark, Gregory. *A Farewell to Alms: A Brief Economic History of the World.* Princeton: Princeton University Press, 2007.

Clark, Nigel. *Inhuman Nature: Sociable Life on a Dynamic Planet.* London: SAGE Publications, 2010.

Cohen, Joel E. *How Many People Can the Earth Support?* New York: Norton, 1995.

Commoner, Barry. *The Closing Circle: Nature, Man, and Technology.* New York: Alfred A. Knopf, 1971.

Cosgrove, Denis. *Geography and Vision: Seeing, Imagining and Representing the World.* London: I.B. Tauris, 2008.

Daly, Herman E. *Steady-State Economics: The Economics of Biophysical Equilibrium and Moral Growth.* San Francisco: W.H. Freeman, 1977.

Daly, Herman E. *Beyond Growth: The Economics of Sustainable Development.* Boston: Beacon Press, 1996.

Davenport, Christian. *The Space Barons: Jeff Bezos, Elon Musk, and the Quest to Colonize the Cosmos.* New York: Public Affairs, 2019.

Deleuze, Gilles. "Causes and Reasons of Desert Islands." In *Desert Islands and Other Texts, 1953–1974*, edited by David Lapoujade, translated by Michael Taormina. Los Angeles: Semiotext(e), 2004.

Deleuze, Gilles, and Félix Guattari. "Introduction: Rhizome." In *A Thousand Plateaus*, translated by Brian Massumi. Minneapolis: University of Minnesota Press, 1987.

Dennet, Daniel Clement. *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. New York: Simon & Schuster, 1995.

Derrida, Jacques. *The Beast and the Sovereign*. Translated by Geoffrey Bennington. Vol. II. Chicago: Chicago University Press, 2011.

Deutsch, David. *The Beginning of Infinity: Explanations That Transform the World*. Reprint edition. London; New York: Penguin Books, 2012.

Dyson, Freeman. "Time without End: Physics and Biology in an Open Universe." *Reviews of Modern Physics* 51, no. 3 (July 1979): 447–60.

Ehrlich, Paul R., and Anne Ehrlich. *The Population Explosion*. New York: Simon and Schuster, 1990.

Ellis, Erle. "Overpopulation Is Not the Problem." *New York Times.* September 14, 2013, sec. Op-Ed.

Emmott, Stephen. *10 Billion.* New York: Random House, 2013.

Fernández-Galiano, Luis. *Fire and Memory: On Architecture and Energy.* Cambridge, Mass.: MIT Press, 2000.

Foster, John Bellamy. *Marx's Ecology: Materialism and Nature.* New York: Monthly Review Press, 2000.

Gardner, James N. *Biocosm: The New Scientific Theory of Evolution*. Inner Ocean, 2003.

George, Henry. *Progress and Poverty: An Inquiry into the Cause of Industrial Depressions, and of Increase of Want with Increase of Wealth--The Remedy.* San Francisco: W.M. Hinton & Co., printers, 1879.

Georgescu-Roegen, Nicholas. *The Entropy Law and the Economic Process.* Cambridge, Mass.: Harvard University Press, 1971.

Goff, Philip. *Consciousness and Fundamental Reality.* New York, NY: Oxford University Press, 2017.

Goodheart, Adam. "The Island of the Lost Savages." *The American Scholar* 69, no. 4 (2000): 13–44.

Groys, Boris. *Russian Cosmism.* Cambridge, MA: The MIT Press, 2018.

Höhler, Sabine. *Spaceship Earth in the Environmental Age, 1960–1990.* Routledge, 2015.

Hornborg, Alf. "Cornucopia or Zero-Sum Game? The Epistemology of Sustainability." *Journal of World-Systems Research* 9, no. 2 (2003): 205–16.

Humboldt, Alexander von. *Reise Auf Dem Rio Magdalena, Durch Die Anden Und Mexico.* Edited by Margot Faak. Vol. I. Berlin: Akademie Verlag, 1986.

Jevons, William Stanley. *The Coal Question; an Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines.* Cambridge, MA: Macmillan, 1865.

Journal of Design and Science, http://jods.mitpress.mit.edu/

Kalen, San. "Ecology Comes of Age: NEPA'S Lost Mandate." *DUKE Environmental Law and Policy Forum* 21, no. 113 (Fall 2010).

Kant, Immanuel. *Critique of Pure Reason.* Translated by F. Max Müller. London: Macmillan, 1881.

Latour, Bruno. "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30 (2004): 225–48.

Latour, Bruno. "To Modernize or to Ecologize." edited by N. Castree and B. Willems-Braun, 221–42. Remaking Reality: Nature at the Millennium. London and New York: Routledge, 1998.

Latour, Bruno. "Waiting for Gaia. Composing the Common World through Arts and Politics." Lecture, French Institute, London, November 2011.

Latour, Bruno. "On Some of the Affects of Capitalism." Lecture, Danish Royal Academy of Science, February 26, 2014.

Latour, Bruno. "A Tale of Seven Planets–An Exercise in Gaiapolitics." Harvard University, Cambridge, MA, October 16, 2018.

Latour, Bruno. *Down to Earth: Politics in the New Climatic Regime.* 1st ed. Cambridge, UK: Polity Press, 2018.

Lindblom, Jon. "Techno Cultural Acceleration: A Few Initial Remarks." Accelerationism: Cosmism, Prometheanism, New Enlightenment, May 15, 2013.

Lovelock, James. *Gaia: A New Look at Life on Earth.* Oxford; New York: Oxford University Press, 1979.

Lukács, György. *History and Class Consciousness: Studies in Marxist Dialectics.* Cambridge, Mass.: MIT Press, 1968.

Lyotard, Jean-François. *The Postmodern Condition: A Report on Knowledge.* Minneapolis: University of Minnesota Press, 1979.

Mackay, Robin, and Armen Avanessian. *#Accelerate#.* Falmouth, United Kingdom; Berlin: Urbanomic Media Ltd. in association with Merve, 2014.

Mälm, Andreas. *The Progress of This Storm: Nature and Society in a Warming World.* London; New York: Verso, 2018.

Malthus, Thomas R., and James Bonar. *First Essay on Population, 1978*. New York: A. M. Kelley, 1965.

Markley, Robert. *Dying Planet: Mars in Science and the Imagination.* Duke University Press, 2005.

Marx, Karl, and Friedrich Engels. *Collected Works*. New York: International Publishers, 1987.

Meadows, Donella H., Dennis L. Meadows, Jørgen Randers, and William W. Behrens III. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books, 1972.

Mebratu, Desta. "Sustainability and Sustainable Development: Historical and Conceptual Review." *Journal of Environmental Impact Assessment Review* 18 (1998).

Mill, John Stuart. "Of the Stationary State, Book IV, Chapter VI." In *Principles of Political Economy: With Some of Their Applications to Social Philosophy*. London: J. W. Parker, 1848.

Moore, Jason W. *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. New York: Verso, 2015.

Moraru, Christian. *Cosmodernism: American Narrative, Late Globalization, and the New Cultural Imaginary*. Ann Arbor: The University of Michigan Press, 2011.

Moraru, Christian, and Amy J. Elias. *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century*. Evanston, Illinois: Northwestern University Press, 2015.

Moreno, Gean. "Editorial—'Accelerationist Aesthetics,'" in *e-flux* 46, no. 6 (2013).

Morowitz, Harold J. *Energy Flow in Biology: Biological Organization as a Problem in Thermal Physics*. New York: Academic Press, 1968.

Nancy, Jean-Luc. *La Création Du Monde Ou La Mondialisation*. Paris: Galilée, 2002.

NASA, Ames Research Center, and Stanford University. "Project Cyclops: A Design Study of a System for Detecting Extraterrestrial Intelligent Life." NASA, 1971.

Nicolescu, Basarab. *Théorèmes Poétiques*. Monaco: Ed. du Rocher, 1994.

Nicolescu, Basarab. *From Modernity to Cosmodernity: Science, Culture, and Spirituality*. Albany: SUNY Press, 2015.

Nietzsche, Friedrich. *The Gay Science*. Edited by Bernard Williams. Translated by Josephine Nauckhoff and Adrián Del Caro. Cambridge: Cambridge University Press, 2001.

Odum, Howard T., and Elisabeth C. Odum. *A Prosperous Way Down: Principles and Policies.* Boulder: University Press of Colorado, 2001.

Penzin, Alexei. "Contingency and Necessity in Evald Ilyenkov's Communist Cosmology." *E-Flux* 88 (February 2018).

Pisani, Jacobus Du. "Sustainable Development: Historical Roots of the Concept." *Environmental Sciences* 3, no. 2 (2006): 83–96.

Phillips, Leigh. *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff.* Winchester: Zero Books, 2015.

Popper, Karl R. "Natural Selection and the Emergence of Mind." Lecture, Darwin College, Cambridge, November 8, 1977.

Prigogine, Ilya, and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature.* Toronto; New York, N.Y.: Bantam Books, 1984.

Rao, Mohan. "Abiding Appeal of Neo-Malthusianism: Explaining the Inexplicable." *Economic and Political Weekly* 39, no. 32 (August 7, 2004): 3599–3604.

Riley, Terence. "Drawn into a Collection: A Context of Practices." In *Envisioning Architecture: Drawings from The Museum of Modern Art*, edited by Matild McQuaid. New York: Museum of Modern Art, 2002.

Sagan, Carl. "The Planet Venus." *Science* 133 (March 1, 1961): 849–58.

Sagan, Carl. "Planetary Engineering on Mars." *Icarus* 20 (1973): 513–14.

Sagan, Dorion. *Cosmic Apprentice: Dispatches from the Edges of Science*. Minneapolis: University of Minnesota Press, 2013.

Schumacher, Ernst F. *Small Is Beautiful: Economics as If People Mattered*. Harper Torch books, 1778. New York: Harper & Row, 1973.

Smith, Merritt Roe, and Leo Marx. *Does Technology Drive History?: The Dilemma of Technological Determinism*. Cambridge, Mass.: MIT Press, 1994.

Snyder, Brian. "The Darwinian Nihilist Critique of Environmental Ethics." *Ethics & the Environment* 22, no. 2 (2017): 59–78.

Stengers, Isabelle. *Cosmopolitics*. Minneapolis: University of Minnesota Press, 2010.

Stoekl, Allan. *Bataille's Peak: Energy, Religion, and Post-Sustainability*. Minneapolis, Minnesota: University of Minnesota Press, 2007.

Tierney, John. "Betting on the Planet." *The New York Times*. December 1990.

Tipler, Frank. "There Are No Limits to the Open Society." *The Critical Rationalist* 03, no. 02 (September 23, 1998).

Thanki, Nathan. "Sustainable: A Philological Investigation." *HumJournal*, 2011.

Toulmin, Stephen Edelston. *The Return to Cosmology: Postmodern Science and the Theology of Nature*. Berkeley: University of California Press, 1985.

Venturi, Robert. *Complexity and Contradiction in Architecture*. New York: The Museum of Modern Art, 1966.

Vernadskiĭ, Vladimir I. *La Biosphère*. Paris: Librairie Félix Alcan, 1929.

Vernadskiĭ, Vladimir I. "Some Words About the Noösphere." Translated by George Vernadskiĭ. *American Scientist*, January 1945, 16–21.

Vogel, Steven. *Thinking Like a Mall: Environmental Philosophy after the End of Nature.* Cambridge, Massachusetts: MIT Press, 2015.

Walker, K. J. "Ecological Limits and Marxian Thought." *Politics* 14, no. 1 (1979): 29–46.

Ward, Barbara. *Spaceship Earth.* New York: Columbia University Press, 1966.

Ward, Barbara, and René J Dubos. *Only One Earth: The Care and Maintenance of a Small Planet.* New York: Norton, 1972.

Wark, McKenzie. *Molecular Red: Theory for the Anthropocene.* London and New York: Verso, 2015.

Weber, George. *Lonely Islands: The Andamanese.* Liestal, Switzerland: The Andaman Association, 1998.

Young, George M. *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers.* Oxford; New York: Oxford University Press, 2012.

Yuk, Hui. "Cosmotechnics as Cosmopolitics." *E-Flux* 86 (November 2017).

Conclusions

Deutsch, David. *The Beginning of Infinity: Explanations That Transform the World.* Reprint edition. London; New York: Penguin Books, 2012.

Escobar, Arturo. *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. London: Duke University Press, 2018.

Foster, John Bellamy, and Paul Burkett. "Metabolism, Energy, and Entropy in Marx's Critique of Political Economy: Beyond the Podolinsky Myth." *Theory and Society* 35, no. 1 (2006): 109–56.

Freeman, Carl. *Critical Theory and Science Fiction*. Middletown: Wesleyan University Press, 2000.

Fry, Tony. *Becoming Human by Design.* London; New York: Berg, 2012.

Garcés, Marina. *Nueva Ilustración Radical*. Barcelona: Anagrama, 2017.

Ghidoni, Matteo, ed. *San Rocco: Ecology*. Vol. 10. Venice: San Rocco, 2014.

Harvey, David. *Spaces of Hope*. Berkeley: University of California Press, 2000.

Lukács, György. *History and Class Consciousness: Studies in Marxist Dialectics*. Cambridge, Mass.: MIT Press, 1968.

Luke, Timothy W. *Capitalism, Democracy, and Ecology: Departing from Marx*. Urbana: University of Illinois Press, 1999.

Morton, Timothy. *The Ecological Thought*. Cambridge, Massachusetts: Harvard University Press, 2010.

Phillips, Leigh. *Austerity Ecology & the Collapse-Porn Addicts: A Defense of Growth, Progress, Industry and Stuff*. Winchester: Zero Books, 2015.

Sagan, Dorion. *Cosmic Apprentice: Dispatches from the Edges of Science*. Minneapolis: University of Minnesota Press, 2013.

Sears, Paul B. *The Ecology of Man*. Washington, D.C.: Smithsonian Institution, 1959.

Simon, Herbert A. *The Sciences of the Artificial*. Cambridge: The MIT Press, 1969.

Spivak, Gayatri Chakravorty. "Imperative to Re-Imagine the Planet." In *An Aesthetic Education in the Era of Globalization*, 335–50. Cambridge, MA: Harvard University Press, 2012.

Suvin, Darko. "On the Poetics of the Science Fiction Genre." *College English* 34, no. 3 (December 1972): 372–82.

Williams, Alex, and Nick Srnicek. "#Accelerate: Manifesto for an Accelerationist Politics." Critical Legal Thinking: Law and the Political, May 14, 2013.

Wolchover, Natalie. "A Different Kind of Theory of Everything." *New Yorker*, 2017.

Yuk, Hui. "Cosmotechnics as Cosmopolitics." *E-Flux* 86 (November 2017).