On the Matter of Life

Towards an Integral Economics

Deep Ecology by Daniel Mirante

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Table of Contents

Preface

The relative *success* of the human endeavor, measured in terms of population[1] and technological mastery, has been won at the cost of widespread *suffering* for much of the rest of the community of life on Earth. Life is not just a quantitative affair, but is everywhere striving to deepen the qualitative intensity of its existence. Industrial civilization has emerged amidst this vital striving, violently shifting the biosphere into the terminal phase of the Cenozoic era by initiating the first mass extinction event in 65 million years.[2] In the deep geological past, saurian giants and cycads flourished where long stretches of highway now carry automobiles fueled by their fossilized remains. Should our species continue to ignore the psycho-spiritual wounds responsible for instituting and maintaining our ritualized techno-industrial sacrifice of future generations, we will soon find ourselves joining the dinosaurs.

This essay is my attempt to reveal the metaphysical causes and energetic effects of industrial capitalism such that its inhumane and ecologically ignorant foundations are brought fully into consciousness. Consciousness is our most creative human capacity, but in its fragmented and anxiety-ridden deficient mental mode, it has become the agent of the most powerful strategy of thermodynamic gradient dissipation the planet has ever known. Should human consciousness fail to awaken in time to forestall the inevitable conclusion of the industrial process, not only will capitalist profits continue to be squeezed out of the alienated labor of workers and commoditization continue to homogenize cultural expression, but Earth will become a toxic

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[1] ~6,798,504,820 on Nov. 21st, 2009 according to the US Census Bureau. High population is hardly an adequate measure of success, just a reflection of unsustainable rates of resource consumption. And even if population were the true gauge of success, surely insects and bacteria would be the real winners in this world.

[2] The International Union for the Conservation of Nature (IUCN.org) estimates that 21 percent of all known mammals, 30 percent of all known amphibians, 12 percent of all known birds, 28 percent of reptiles, 37 percent of freshwater fishes, 70 percent of plants, 35 percent of invertebrates assessed so far are under serious threat of extinction.

wasteland eaten alive from the inside out by the mechanical transformation of extropy[3] into the fetishized value of money and use-and-dispose consumables.

The emergence of life on earth around 4 billion years ago can be understood as an expression of the same natural tendency to dissipate free energy that is driving the extractive economy of industrialism. The complex activities of living creatures on Earth's surface work to bring the extreme temperature gradient between sunlight and space toward equilibrium by radiating back more heat than would an inert planet, as per the 2nd law of thermodynamics (p. 46, Margulis, 2002). The industrial organism has brought this process of gradient reduction to new heights by technologically freeing exergy trapped in places no other form of life could reach (like hydrocarbons and radioactive elements).[4] But as has been learned from the many identity crises to come before on this planet (i.e., five prior mass extinctions) more of the same leads eventually to extinction because conditions are always evolving: humanity must mutate or perish. Our industrial presence to the biosphere represents a deficient and so unsustainable relationship between mind and life, culture and nature, humanity and Earth.

Unless the as yet unrealized spirit of integration lying dormant in human consciousness can blossom, our species will continue to instinctually play by the entropic rules of thermodynamics[5] by devouring the remaining resources of the Earth. Like the ever-optimistic Pierre Teilhard de Chardin, I am hopeful that we will learn to "give [our lives] to [being and to knowing], rather than to [possession]," because though "human vision is still diffuse in its operation, mixed up

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[3] i.e., energy available to do work.

[4] Lynn Margulis goes so far as to argue that "[Technological evolution], whether [expressed in the] human, bower bird, or nitrogen-fixing bacterium, becomes the extension of the second law to open systems" (p. 47, 2002). She means to imply that the proliferation of entropy producing techno-industrial products and their social ramifications is the result of natural law. I will argue in this paper that she is correct only if consciousness fails to become integrally transparent to itself, liberating humanity from the tamasic impulse toward increasing entropy production.

[5] Ilya Prigogine defines thermodynamics as "the study of the macroscopic properties of a system and their relations without regard to the underlying dynamics" (p. 205, 1996).

with industrial activity and war…it will not be long now before the noösphere finds its eyes" (p. 280, 1955). Only with the full emergence of the noösphere can humanity become integral with the Earth, achieving what Jean Gebser has referred to as a transparent aperspectival a-waring of human and universe together in a space-time-free presentiation of origin (p. 312, 1985).

Human societies are not inherently exploitative and selfish, nor is the rest of the biosphere a pitiless struggle for existence guided only by the invisible hand of natural selection. We have not always been capitalists. As Alf Hornborg has argued, "…there are undoubtedly social metaphors that transfer meanings from relations in the human world to relations with the nonhuman one, committing societies to specific trains of thought" (p. 197, 2001).

I will argue in this essay that our integral potential has been ideologically distorted by the dualistic ontology and fetishized mythology intrinsic to the industrial mode of consciousness. Powerful forces of cultural habit have deceived us into tirelessly slaving and ruthlessly competing for the alienating and spiritually empty ends of techno-industrial accumulation. This ideological distortion of our natural capacity for empathic relationality is the psycho-social precursor that primed modern scientific consciousness for its reductionistic study of living systems and their evolution, and which consequently led to the mechanistic study of the "rational animal," the human consumer, as scientific metaphors migrated back into economic theory.

The mechanization of biology is typical of the deficient mental mode of consciousness. So long as our understanding of life remains deficient, our planetary civilization will continue to ignore humanity's integral relationship with the Earth, and probably destroy itself within a century. In the chapters to follow, I argue that modern science's mechanical theory of life is inseparable from the economic ideology of modern capitalism. The hegemonic industrial parade noisily marching our planet's living population to the edge of extinction is given ideological steam by the mechanistic theory of life. My purpose in writing this book is to break through the biological

bulwarks guarding the economic status quo and to plant the seeds of an alternative, *living* biology. I hope these seeds will aid humanity in our Great Work of becoming integral with the Earth, a partner in Gaia's dance through the heavens.

Introduction: What is Life?

Life, for Sri Aurobindo, is the mutual commerce connecting matter and mind in the manifest universe, an

> "intermediate energizing of conscious being [that] liberates into sensitive action and reaction a form of the creative force of existence which was working subconsciently or inconsciently, absorbed in its own substance; it supports and liberates into action the apprehensive consciousness of existence called mind and gives it a dynamic instrumentation so that it can work not only on its own forms but on forms of life and matter" (p. 186-187, *The Life Divine*).

The knowing mind is always supported by embodied experience. Any scientific stories told to explain the cosmos must have some relation to our personal and inter-personal experience of living and dying as earthlings. Philosophers since Plato and Aristotle have struggled to adequately articulate a clear concept of life, which ambiguously straddles the apparent boundary between matter and spirit. The conscious human being is always already *in* life, *thrown* between matter and mind, and so cannot entirely breach the eternal realm of unchanging ideas, nor totally fathom the depths of material flux and impermanence—at least this side of death. But Aurobindo is not wrong when he writes that "the natural opposition we make between death and life, and between matter and spirit, is an error of our mentality" (p. 176, ibid.). He urges us to become aware of a more integral life, which

> "is nothing else than the Force that builds and maintains and destroys the forms in the world…that manifests itself in the form of earth as much as in the plant that grows upon the earth and the animals that support their existence by devouring the life-force of the plants or of each other" (177, ibid.).

Death is a part of life's dynamic wholeness, a life present "everywhere, secret or manifest, organized or elemental, involved or evolved, but universal, all-pervading, imperishable; only its forms and organizings differ" (p. 179, ibid.).

But how are we to conceive of life's wholeness or integrality? An overly reductive definition distorts life's cosmic import, painting too tragic and meaningless a picture of existence, while an overly triumphant definition obscures life's fragile beauty, ignoring the fact of death given by the birth of every living creature.

My exploration of the issues surrounding the pursuit of an organic ontology will require a thorough critique of mechanistic biology, whose aim is the reverse of my own: to define life such that it is reducible to a "mindless, purposeless, algorithmic process" (p. 320, Dennett).[6] This definition will be shown to be entirely inadequate. It makes of our human experience an aberration, severing all connection whatsoever between human consciousness and the evolutionary adventure that generated it. If we are going to attempt a scientific account of life, it must recursively include the knowing mind of the living scientist in its explanations.

My critique of mechanistic biology and industrial capitalism and reconstruction of an alternative conception of life on planet Earth draws upon the process-relational ontology of Alfred North Whitehead and the phenomenological biology of Francisco J. Varela. Varela's

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[6] For Dennett, an algorithm is any set of conditions tending to produce a certain outcome. He sees Darwin's conditions (random variation under natural selection) as completely explanatory of the present state of the biosphere. Dennett argues that a "cascade of mere purposeless, mechanical causes" is entirely responsible for the "gradual emergence of meaning" (p. 412).

account of life in terms of autopoiesis will be compared with Whitehead's analysis of the process of concrescence in the hopes that the affinity of their ideas becomes clear. It will be argued that Varela's science demands a new metaphysical scheme not available within the confines of mechanistic materialism. Whitehead's philosophy of organism, I suggest, is up to the task.

The approach of these two thinkers is an expression of what cultural phenomenologist Jean Gebser has called the "irruption of time consciousness" (p. 380). The time element, repressed by the deficient mental structure's exclusively spatial orientation, burst into consciousness in various ways during the past few centuries, including Hegel and Marx's dialectical theory of history, Darwin's theory of evolution, and Einstein's relativity theory. But the mental structure, convinced it has reached the pinnacle of our species' evolution, has not relinquished its hold on our consciousness. Now in its deficient phase, mental consciousness retards the emergence of the integral by continuing to falsely spatialize time, thereby reducing its qualitative creative intensity to a measurable quantity. The ideology of modern capitalism is an expression of the deficient mental structure's repression of the time element, of *creative becoming*. Instead of recognizing the importance of the dialectic of history and the ongoing and entangled processes of natural and social transformation, capitalist economic theory insists that the present arrangement represents the "end of history" (as Francis Fukuyama has claimed): no revolutions in or improvements to social relations or in human-earth relations are necessary. Capitalist economists thus search for invariant laws supposed to apply universally to all human societies in all historical epochs. In contrast, an ecologized Marxist economic theory, building on the dialectical acuity of Hegel's historical method, is better prepared to integrate the time element into its understanding of human society and the wider economy of Earth within which our economy is embedded. As the eco-Marxists Foster, Clark, and York describe it, Marx's approach invites us to

> "highlight the dramatic changes in social structures and patterns that have occurred throughout human history and [argues] that what appear to be invariant laws to observers in any particular period, may in fact be transient tendencies unique to that historical era,

> emerging from the dialectical interaction of an ensemble of social and natural processes" (The Ecological Rift, p. 27).

In addition to the repression of time, Eco-Marxists also critique the techno-optimistic "human exemptionalism" that leads to fantasies about a future "dematerialization" of economic production such that "the capitalist economy can then walk on air (or create a 'weightless society'), thereby continuing its relentless expansion—but with a rapidly diminishing effect on the environment" (The Ecological Rift, p. 34, 43). Such fantasies ignore both the zero-sum thermodynamic reality of the Earth system (thereby "[going] against the basic laws of physics" [ibid., 43]) and the inequality of human society (thereby going against the democratic principles of life, liberty, and happiness).

Gebser also points to the need to heal the rift, both ideological and metabolic, between humanity and the Earth. In the chapters to follow, I offer the beginnings of a more integral biology whose account of the biosphere includes human society as one of its expressions. "The supersession of dualism in biology begins to occur," according to Gebser, "at the moment when the 'time' factor is taken into consideration" (*The Ever-Present Origin*, p. 384). The time element can only be authentically grasped by an integral consciousness. Gebser's account of the evolution of consciousness and in particular the irruption of time in the mutation from deficient mental to integral consciousness thus provides the context for much of the discussion to follow.

I. The Irruption of Time

In *The Ever-Present Origin*, Gebser eloquently enacts a still nascent structure of human consciousness, the integral, and distinguishes it through comparison to the other structures uncovered in his phenomenological study of the evolutionary history of human consciousness. The structures he discovered include the archaic, magic, mythic, and mental, each with its own

dimensional and sensory emphases. Most important for my task—that of bringing forth a living cosmology to replace the still dominant mechanistic cosmology underlying capitalism—is the ongoing mutation from the deficient mental to the integral structure, with special attention paid to the resulting transformed awareness of time.

The efficient mental structure of consciousness is described by Gebser as having been "already shaped in the Mediterranean world of late antiquity" (p. 11) by such figures as Parmenides, Plato, and especially Aristotle. The full mutation from psyche to mind[7], however, did not take place until 13th century Europe, revealed in the intensely personal poems of the Troubadours and the revival of Aristotle in the work of Thomas Aquinas. In his account of the mental structure, Gebser suggests it was responsible for producing "the visualization of…time with a quantifiable, spatial character" (p. 12), and offers as an example of this new attitude toward time the construction of the first public clock in 1283 in the courtyard of Westminster Palace.[8] Time is here considered only abstractly, its concrete creative potency reduced to an easily determinable set of angles on a mechanical clock-face.

Gebser is clear that this rising of time into consciousness is both a gain and a loss: a gain because it allowed humanity to think, to understand, to reflect, to calculate—in short, to recognize its capacity for rationality (p. 74); a loss because, with the invention of clocks, time became falsely spatialized, thereby occluding the transparency of the whole for the sake of

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[7] Gebser characterizes the mythic structure as predominantly psychic and spaceless, as the intimate bond between soul and nature had not yet been severed. As a result, "Man's lack of spatial awareness is attended by a lack of ego-consciousness, since in order to objectify and qualify space, a self-conscious 'I' is required that is able to stand opposite or confront space, as well as to depict or represent it by projecting it out of his soul or psyche" (p.10).

[8] In the closing centuries of the 2nd millennium, the mechanical clock would become the dominant model used by science to understand the physical world (quantitative, symmetrical time), the biological world (organisms are gene survival/propagation machines), and the economic world ("Time is money" –Ben Franklin). See also p. 122, Hornborg: "The clock has been advanced as the prototype for all machines…The idea of the machine has… generated a web of cross-references by which nature and the machine are engaged in a reciprocal metaphor."

rampant quantification of the parts. For example, clocks played a crucial role in rationalizing human labor during the Industrial Revolution.

As Gebser puts it,

> "…our fathers [dominated by the mental structure] had no sensorium for the phenomenon of time. Living in a spatially frozen world, they considered the temporal world to be a disturbing factor which was repressed, either by being ignored, or by being falsified by measurement into a spatial component" (p. 284).

The implications of the obsession with measurement in a world experienced as "spatially frozen" will be explored in depth in subsequent chapters, but it suffices to say for now that such factors played a central role in the formulation and widespread acceptance of the substance dualism that continues to plague much of mainstream mechanistic biology (whether it be the dualism between humanity and the rest of the Earth community, or that between genetic information and somatic realization). Only once the mutation into integral consciousness commenced could humanity begin to appreciate time, not as a quantity or magnitude, but as a qualitative intensity (p. 285).

Before exploring the crucial significance of qualitative time in an integral biology of economics, I must first examine the beginnings of biology itself during the birth and development of the mental structure.

II. Ancient Biology

"Biologists cannot study their subject in abstraction from matter, since nature always acts for the sake of an end, which involves studying the relation of what is potentially something to its full realization" – p. 641, Aristotle, *De Partibus Animalium*

Gebser recognizes Aristotle as among the first in antiquity to display an unquestionable tendency toward mental, as opposed to mythic, consciousness (p. 408). It is not surprising then that Aristotle is widely seen as the originator of both the science and philosophy of biology (p. xx, Lennox). Whitehead, however, famously wrote that philosophy "consists of a series of footnotes to Plato," (p. 39, 1978), and indeed, Aristotle is indebted to Plato, even where he diverges. Whitehead credits Aristotle with correcting Plato's tendency to "separate a static spiritual world from a fluent world of superficial experience" (p. 209, ibid.). In *Timaeus*, Plato lays out a cosmology one interpretation of which is structurally similar to what would today be called intelligent design. The universe is described as something made, though is imbued with intelligence and soul by its designer, a divine craftsman, who orders it based upon a changeless, ideal model to bring about the most beauty and goodness possible (p. 228, Lennox). Aristotle, on the other hand, tried to find a less theological middle ground between atomistic reductionism and Plato's still mythic conception of the cosmos as an artifact, being careful not to scrub away nature's purposes in the process. Though he still made use of the metaphor of the craftsman to understand organic form, Aristotle recognized an important difference between artifact and organism that was blurred by some interpretations of Plato's cosmology (despite the fact that in *Timaeus* Plato describes the cosmos as a living thing, he also says its soul was inserted from outside). Aristotle writes:

> "For the artist is source and form of what comes to be, but in another; whereas the movement of nature is in what is coming to be" (p. 735, *Generation of Animals*).

Aristotle here distinguishes the work of an artist from the form of an organism by pointing out that artists shape their crafts from the outside, while organisms form themselves from within. The core difference between Plato's understanding of life and Aristotle's is that Plato finds it necessary to import purpose into nature from beyond nature (by demiurgic design), while Aristotle finds it immanent in the movement of natural things themselves.

It might be helpful here to introduce Aristotle's four "*αιτίες"* (roughly translated as *causes,* or *reasons*) for the sake of which every living organism exists. I will revisit these causes in Chapter VII on Whitehead, where a reworking of them will aid our understanding of concrescence. The material cause is the potentiality necessary for formation, and the efficient cause this formative movement's agent of initiation. The formal cause is movement directed toward an end, the final cause being the attainment of that end. Aristotle viewed the matter and form of a creature as intimately related: matter provides the potential for the actualization of form. The difference between Aristotle's immanent and Plato's demiurgic understanding of teleology is extremely significant, as this distinction has influenced nearly every philosopher of biology since, as well as every economist.

The separation and valuation of humans and their labor over and above the surrounding natural environment goes hand in hand with the separation and valuation of a divine architect allied with eternity over and above a created world that is a mere imitation, "a thing that has come to be as a shrine for the everlasting gods" (37d, *Timaeus*). The mythic enchantment still informing Plato's cosmology would eventually be cleansed and anthropocentrized by more modern thinkers, who used its logical structure in support of what Donna Haraway has called "productionism": "Productionism and its corollary, humanism, come down to the story line that 'man makes everything, including himself, out of the world that can only be resource and potency to his project and active agency'" (p. 297, 1992). I will discuss productionism in connection with mind/ matter dualism again in Chapter VIII.

III. Modern Biology

"…if one accepts the evolutionary perspective, attempts to discuss science (or any other sort of conceptual activity) become much more difficult, so difficult as to produce paralysis." – p. 299, David Hull, *The Naked Meme*

Charles Darwin, idolized by many contemporary materialists as the slayer of teleology and champion of the mechanistic paradigm, was a student of William Paley, whose natural theology and argument from design can be traced back directly to Plato (p. 228, Lennox). Paley held that certain artifacts, including organisms, could not be explained without recourse to an intelligent artificer due to their obviously designed features. Darwin was inspired to respond to Paley, and so devised the theory of natural selection to explain how the apparent design of organisms could be the result of a purely mechanical process working over immense geological time (p. 68, Dennett). Darwin's response to Paley is difficult to disprove by weight of empirical evidence alone,[9] but when one realizes the implicit assumptions that both make, it becomes clear they are working from within the same paradigm: both Darwin and Paley understood organisms to be nothing more than especially sophisticated machines. They differ only in the reasons given for this sophistication. Paley's argument from design required a transcendent deity for nature to have any purposes. Once Darwin called the logical necessity of that deity into question, the biological world was left sterile and purposeless, the result of chance, necessity, and an unfathomable amount of time.[10] Plato's demiurge and the wisdom it had ensouled the universe with was vanquished, leaving only the purposeless flux of nature in its stead.

This is not the whole story, however. Darwin's was a biology constructed to comply with and reduce to Newtonian physics. Newton conceived of the universe in a way reminiscent of (demythologized) Plato: nature was a clockwork machine constructed by God according to certain transcendent laws. Darwin was compelled to find a place for life within this framework, a framework Whitehead describes as "the doctrine of Imposed Law" (p. 113, 1967). The only way to make room for life in Newton's universe was to erect a radical division between the contingency of biological evolution and the necessity of physical law. While Darwin correctly

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[9] Darwin's book, *The Origin of Species*, is littered with observational evidence in support of the plausibility of his theory. No scientists can deny what Darwin found without first reworking his metaphysical assumptions.

[10] Time, in this context, is to be understood as the falsely spatialized time of the mental structure: as quantitative magnitude, rather than qualitative intensity.

replaced Paley's deist natural theology of creation with his evolutionary narrative, he failed to recognize that the laws of physics themselves also had to be evolutionized.[11] But because he was still firmly rooted within the mechanistic paradigm, Darwin could not understand how the biosphere's miraculous beauty and harmonious organization might have arisen without recourse to the arbitrarily imposed, deterministic order of Newton's laws.

Immanuel Kant, who died more than 50 years before Darwin wrote *The Origin of Species*, heavily criticized the view that organisms can be understood as machine artifacts. His view is reminiscent of Aristotle, in that it affirms natural purposes without recourse to supernatural designers. Why the Anglo-American world paid so little attention to his critique of mechanistic biology is a historical curiosity worth exploring.

British colonialism (and later, American capitalism) has had no better apologist than Charles Darwin, whose theory of evolution by variation under natural selection can be read as the animistic projection[12] (through metaphorical transfer) of the socio-economic models of Adam Smith and Thomas Malthus[13] onto natural processes. England was at the height of its global empire while David Ricardo, Smith, and Malthus were writing their treatises on market economics. His own socioeconomic situation no doubt presented Darwin with a sense of moral obligation to explain natural history and biological evolution in such a way that they not contradict sanctioned norms of colonial and capitalist power relations.

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[11] "…a thoroughgoing evolutionary philosophy is inconsistent with materialism. The aboriginal stuff…from which a materialistic philosophy begins is incapable of evolution" (p. 107, Whitehead, 1925).

[12] "Descola (p. 88, 1996) defines animism as the use of 'the elementary categories structuring social life to organize, in conceptual terms, the relations between human beings and natural species" (p. 200, Hornborg, 2001).

[13] "In October 1838, that is fifteen months after I had begun my systematic enquiry, I happened to read for amusement Malthus' *Population*, and being well prepared to appreciate the struggle for existence [a phrase used by Malthus] which everywhere goes on from long-continued observation of animals and plants, it at once struck me that under these circumstances favorable variations would tend to be preserved and unfavorable ones to be destroyed. The result of this would be a new species. Here then I had at last got hold of a theory by which to work." –Charles Darwin (*The Zoology of the Beagle*, 1840).

Biologist Ernst Mayr has suggested that "Kant's acceptance of teleology…greatly affected German evolutionists in the nineteenth century"[14] (p. 82, 2001). Nonetheless, Mayr felt that any use of final causation in biology was doomed to failure (ibid.). We turn now to explore Kant's account of life, one that would almost two centuries later resurface in the scientific guise of Varela's theory of autopoiesis (p.136, Thompson, 2007).

IV. Teleology as a Regulative Principle of Living Organization

"An organized being is then not a mere machine, for that has merely moving power, but it possesses in itself formative power of a self-propagating kind which it communicates to its materials though they have it not of themselves; it organizes them, in fact, and this cannot be explained by the mere mechanical faculty of motion." – Immanuel Kant, *Critique of Judgment*

In *The Critique of Judgment*, Kant ridicules the very idea of a purely mechanical account of life:

> "…it is quite certain that in terms of merely mechanical principles of nature we cannot even adequately become familiar with, much less explain, organized beings and how they are internally possible. So certain is this that we may boldly state that it is absurd for human beings even to attempt it, or to hope that perhaps some day another Newton might arise who would explain to us, in terms of natural laws unordered by any intention, how even a mere blade of grass is produced" (p. 282-283).

Many materialists have argued that Darwin was precisely the "Newton of the grass blade" that Kant thought would never come. But this confuses an important distinction between ontogeny and phylogeny. Darwin's theory was concerned exclusively with the phylogenic diversification of species, not with the ontogeny of life itself.

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[14] Karl Marx, through Hegel, was certainly influenced, even if he rejected Kant's critical system.

As Evan Thompson makes clear,

> "Kant's concern was the definite organization of living beings, but the Darwinian theory of evolution by natural selection does not provide any account of organization at the level of biological individuals. On the contrary, the theory must presuppose biologically organized individuals that reproduce" (p. 131).

To suppose Darwin's theory banished the immanent purposes of particular beings, one must commit Whitehead's fallacy of misplaced concreteness by mistaking a general law about the abstraction "species" for an account of the nature and origin of concrete individuals. Further, because Darwin had to presuppose reproducing organisms for his theory of speciation to work, modern biology cannot look to his work for anything approaching a complete account of life.

Kant recognized that "some products of material nature cannot be judged to be possible in terms of merely mechanical laws" (p. 267, *CoJ*). To understand life, according to Kant, final causality must be employed. Like Paley, Kant also thought artifacts were impossible to explain without the application of some teleological principle. Material and efficient causes were not enough to account for the design of a bicycle, for instance. But unlike Paley, Kant understood organisms as "natural products," not artifacts of divine design (p. 133, Thompson). A natural product is generated immanently by a natural purpose, in contrast to an artifact, which is given its purpose by an external, intelligent agent.[15] A natural purpose is found in "a thing [that is] both cause and effect of itself" (p. 249, *CoJ*).

It will be helpful to explore the relationship between artifacts and organisms a bit further. Both are organized in a purposeful manner, which means they are incomprehensible without an idea

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[15] Kant's Aristotelianism is evidenced here. Darwin and Paley were more influenced by Plato's dualism between form and matter than Kant, who was able to conceive of the purposes of an organism as immanent, thereby avoiding the machine/organism analogy. However, Kant imposed a dualism of a different sort, explored below.

motivating their production. Further, the structure of any organized thing, machine or organism, is such that each of the parts composing it exists for the sake of the whole (i.e., each of the components conforms to an overall idea).

But this is not enough to understand the natural purposes of organisms, as Kant explains:

> "…we must think of each part as an organ that *produces* the other parts (so that each reciprocally produces the other)… Only if a product meets that condition…will it be both an *organized* and a *self-organizing* being, which therefore can be called a natural purpose" (p. 253, *CoJ*).

Again, an artifact is purposeful because it is caused by an idea, but it is an idea that "resides outside the entity in the mind of an intelligent designer" (p. 134, Thompson). The idea informing an organism, in contrast, is "both cause and effect of itself." Kant's coining and elucidation of the term "self-organization" is strikingly similar to Varela's theory of autopoiesis, but an important complication remains for us to discuss before I can move on to this more recent formulation. Kant restricted the natural purposes of organisms to a *regulative* principle of our judgement: organic purposes are an artifact, as it were, of the way the human mind is structured, rather than an intrinsic feature of nature. A regulative principle, in contrast to a *constitutive* principle, does not tell us what a thing is, but only what we can know about that thing (p. 137, ibid.). Kant held that we needed both mechanical and teleological modes of thought to investigate nature, but was agnostic as to these concepts' ultimate relation to things. This is a necessary result of the Kantian dualism between the phenomenal realm of experience and the transcendent realm of noumena.

Even so, Kant comes very close to admitting that self-organization is constitutive of living organisms (and not just a regulative principle), but backs away from this position for reasons that are extremely significant considering the overarching aim of our current exploration (to reverse

the disenchantment of nature that sustains the instrumentalist attitude so characteristic of techno-industrial capitalism).

It is worth quoting him at length:

> "In considering nature and the ability it displays in organized products, we say far too little if we call this an *analogue of art*, for in that case we think of an artist (a rational being) apart from nature. Rather, nature organizes itself… We might be closer if we call this inscrutable property of nature an *analogue of life*. But in that case we must either endow matter, as mere matter, with a property (hylozoism) that conflicts with its nature… Or else we must supplement matter with an alien principle (a soul) *conjoined* to it. But if an organized product is to be a natural product, then we cannot make this soul the artificer that constructed it, since that would remove the product from (corporeal) nature. And yet the only alternative would be to say that this soul uses as its instrument organized matter; but if we presuppose organized matter, we do not make it a whit more intelligible. Strictly speaking, therefore, the organization of nature has nothing analogous to any causality known to us" (p. 254, *CoJ*).

Kant here attempts to reconcile the possibility that organisms are intrinsically self-organizing (and therefore purposeful) with his philosophical commitment to Newtonian science.[16] He finds that he must either endow matter with life-like properties (hylozoism), or admit a dualism whereby an intelligent soul either constructs or inhabits organized matter (vitalism). He rejects both on the grounds that they conflict with Newton's view of nature as composed of inert and unfeeling atoms shuffled around by transcendentally imposed laws. Self-organization, therefore, is seen as an entirely irrational principle that is nonetheless indispensable for any human understanding of living creatures.

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[16] Kant's reluctance to imbue nature with life or soul (as constitutive) may be a symptom of capitalist ideology, which depends upon a fetishized productionist account of value where nature is worth only what human labor and inventiveness can add to it. An ensouled Earth could not be as guiltlessly exploited.

Kant's understanding of the nature and scope of science was lacking due to no fault of his own. In the time since his death, both the study of physics and the study of self-organization in biology have advanced beyond the wildest dreams of the 18th century imagination. Kant, like most of his generation, was mesmerized by the mathematical magic displayed in Newton's *Principia*.

But as Gebser points out,

> "This form of mathematics permits calculation with infinitely small variable quantities. These quantities…are merely mathematical quantities…[and]…render causal processes measureable by mathematically fragmenting intensities. These spatialized 'quantities' of intensity…will continue to exert a negative effect until we clearly recognize this rational falsification" (p. 311).

Gebser is here attempting to explain that calculative systems like Newton's are abstractions that base their measurements of space and time on "so-called 'ideal quantities'" (p. 310) that are actually falsely spatialized intensities. The significance of this will not become clear until Whitehead's process metaphysics are unpacked, but for now I will allude once more to the tendency of the deficient mental structure of consciousness to spatialize and quantify everything, leading to

> "an extreme dualistic form of thinking which recognized only two antithetical and irreconcilable constituents of the world: measurable, demonstrable things, the rational components of science which were valid; and the non-measureable phenomena, the irrational non-components, which were invalid" (p. 285, ibid.).

Kant falls victim to this extreme form of dualism, and so is forced to understand self-organization as merely an appearance necessitated by the structures of our understanding. Life,

for Kant, was self-organizing and purposeful, but only because the human mind is unable to experience and describe it any other way.[17]

This deficient mental dualism between what is rational/measurable and what is irrational/non-measurable will be explored later in connection with capitalism's tendency to wedge general-purpose money between all human-human and human-earth relations (see Chapters VIII, IX, X). Such decontextualization erases the qualitative diversity of cultural meanings and natural purposes, replacing them with abstract and homogenous quantities assigned arbitrary value by the short-term whims of the market.

"Like all structures," says Hornborg,

> "the biosphere is composed of differences. If it is humankind's mission to devise a coded system of signals to integrate this most inclusive of living systems, our monetary system must recognize those differences or continue to annihilate them" (p. 174, 2001).

Mechanistic biology quantifies living organization by reducing its essential nature to the replication of genetic algorithms. A living organism, from the perspective of such a paradigm, is defined as "anything that can use the resources of the world to get copies of itself made" (p. 15, Ridley, 1999). It is a small step to the *de facto* attribution of vital existence to money itself, which feeds off the energy of the planet to turn a profit (i.e., make copies of itself).

V. Autopoiesis: Teleology as Constitutive of Living Organization

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[17] In his last philosophical text (*Opus Posthumum*), Kant realized that his thinking on this matter was incomplete. Varela (after Jonas, 1973) argues that "without invalidating the a priori categories that had been the possibility of all knowledge, Kant finds an entirely new foundation for them: the lived body. The moving forces of matter—prime subject of natural science—are not deduced from or 'dictated' by the a priori categories of reason but themselves are a basic experience underlying all a priori categories" (p. 109, 2002). Thus we know an organism is intrinsically purposeful and self-organizing because we extrapolate as much from our own experience as organisms.

"…autopoiesis proposes an understanding of the radical transition to the existence of an individual, a relation of an organism with it-self, and the origin of 'concern' based on its ongoing self-produced identity." –p. 116, Francisco J. Varela, et al., 2002

The resurrection of Aristotelian teleology in modern biology is a matter of great controversy (p. 1, Colin et al., 1998). Some biologists, such as Richard Dawkins, deride any mention of it, as natural selection is deemed to have explained away any requirement of purpose or aim behind the purely mechanical process of reproduction.[18] This view was addressed earlier: Darwin's theory concerned phylogenic change, having nothing to say whatsoever about the self-organization and goal-directed behavior of individual organisms. Indeed, Darwin's mechanism of natural selection is applicable only given an already self-organizing creature.

Other biologists have adopted a new term, "teleonomy," to describe the "as if" property of purposes evident in the behavior and organizational dynamics of life. Biologist Jacques Monod goes so far as to say that "it is indispensible to recognize that [teleonomy] is essential to the very definition of living beings" (p. 9, 1972). Here, he echoes Kant by pointing out that life cannot be understood without purposes, though also like Kant, he understands these purposes to be a projection of the human observer. This is as far as most biologists are willing to go, as they feel obliged to respect the epistemological dualism of the mechanistic paradigm. Hornborg points to the cognitive science of Varela and Humberto Maturana in an attempt to deconstruct this dualism, suggesting that their approach "…[downplays] the distinction between human intention and other forms of systemic directionality in living systems" (p. 179).

Whitehead similarly notes that "no biological science has been able to express itself apart from phraseology [that] refers to ideals proper to the organism in question" (p. 84, 1978). Whitehead goes on to credit Aristotle with having impressed this fact on the science of biology, and relates

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[18] See *The Blind Watchmaker*, 1986

how the over-stressing of final causation during the Christian medieval period probably provoked the equally overstressed reliance on efficient causation in modern science.

When Varela and Maturana originally developed the theory of autopoiesis, they were undoubtedly influenced by this scientific tendency to over-stress efficient causes: "Living systems, as physical autopoietic machines, are purposeless systems" (p. 86, 1980). By machine, they did not intend to confuse organisms with artifacts, but meant that the system was determined by its structure and organization (p. 141, Thompson). Any purposes attributed to it were considered projections: regulative, as opposed to constitutive features.

In one of the last essays he authored before his death, however, Varela proposed a revision of the understanding of purposes present in his earlier work with Maturana. He recognized that an autopoietic organization of the living implies the emergence of "an autonomous center of concern capable of providing an interior perspective" (p. 97, 2002). To understand why, it is necessary to explore in more detail the theory of autopoiesis:

> "…an autopoietic system—the minimal living organization—is one that continuously produces the components that specify it, while at the same time realizing it (the system) as a concrete unity in space and time, which makes the network of production of components possible" (p. 115, ibid.).

To understand this rather abstract definition, let us ground it in the paradigm case from which it is drawn: the cell. A living cell is engaged in a continual process of self-production and repair, wherein each of its organelles participate in the production of one another, as well as in the production of the membrane defining them as a unity. Though an autopoietic system is also a

self-organizing, dissipative structure,[19] it should not be reduced to these more general categories. What distinguishes an autopoietic system is its "self-produced identity," or "instauration of a point of view" (p. 116, ibid.). An autopoietic entity is one that can be studied empirically (from the outside), but that also requires one to appreciate the horizon of experience brought forth by its continual self-production (from the inside). It is here that an immanent teleology finds its way back into biology, not as a regulative principle of our study of organisms (teleonomy), but as constitutive of life itself.

> "…self-production is already and inevitably a self-affirmation that shows the organism as involved in the fundamental purpose of maintaining its identity" (ibid.).

Varela's analysis of the experiential component of autopoiesis involves more than just recognizing the identity arising due to an organism's internal circular dynamics, but also the surrounding *Umwelt*[20] emerging from its "sense-making" abilities, allowing it to "change the physiochemical world into an environment of significance and valance" (p. 147, Thompson). In this way, intentional movements directed toward ends become the very basis of life. Both formal (the identity, or idea, actualized in the movement of the organism and its organs) and final (end-directed behavior) causality are here implicated in the organization of the living.

But can the Kantian dilemma be so easily resolved? Kant, as was discussed earlier (p. 19), did not understand how self-organization of the autopoietic variety could be possible naturalistically. In the last century, however, our understanding of the physiochemical make-up of organisms has

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[19] A dissipative structure is an energetically open system that emerges in non-equilibrium conditions (ex: tornado, whirlpool, etc). The key difference between a dissipative structure and an autopoietic system is that the former usually does not produce a boundary that establishes it as a unity, nor does it produce the components on which it depends. Instead, it is more structurally dependent on its local environment and so lacks a degree of autonomy present in organisms.

[20] This concept was first developed by Jakob von Uexküll (1940). Hornborg writes that "Each organism lives in its own subjective world (Umwelt) largely defined by its species-specific mode of perceiving its environment…The implication is that ecological interaction presupposes a plurality of subjective worlds…ecological relations are based on meaning; they are semiotic" (p. 183).

increased significantly. We are far better equipped than Kant to cope with organic form (p. 140, Thompson; p. 101, Varela, 2002). But how, exactly, does an autopoietic account of life establish that the activity of an organism is intrinsically purposeful? How do we know that a teleological element is behind life when it could just as well be a projection of our own "…perspective on an otherwise completely neutral behavior" (p. 108, Varela, 2002)?

> "It is actually by experience of our teleology—our wish to exist further on as a subject, not our imputation of purposes on objects—that teleology becomes a real rather than an intellectual principle. Thus causality, as it is perceived by us as sentient beings, may be subsumed under the more general principle of life" (p. 110, ibid.).

Varela here inverts the whole tradition of natural philosophy since at least Descartes by reminding us that, "before being scientists we are first living beings, and as such we have the evidence of our intrinsic teleology in us" (ibid.). The mechanistic paradigm could begin only after Descartes had firmly established a metaphysical rift between thinking and extended substances. The Kantian difficulty over whether to embed teleology in organisms themselves, or to recognize it as a heuristic principle of human judgment, can be traced back to this division between mind and matter.[21] Descartes decreed that the extended substance was purely mechanical, ruled by efficient causes alone. This included our own living bodies.

Once it is understood that experience is rooted in bodily processes, and not in some invisible mental substance existing beyond it, attributing genuine interiority and teleology to other living bodies is simply a matter of generalizing our own embodiment. We need not, as Whitehead warns, "relapse into the tacit presupposition of the mind with its private ideas which are in fact qualities without intelligible connection with the entities represented" (p. 76, 1978).

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[21] Descartes needn't take all the blame: We could also point to Plato's dualism of form and substance, to Aristotle's subject-predicate logic, to Parmenides' separation between being and non-being, or indeed to more the modern separation between culture and nature.

But how far can this generalization of our own experience be taken? Varela, while he grants that teleology is more than an artifact of the human mind, only re-establishes it as a necessary phenomenological fact about our own embodied experience. To firmly root teleology, and therefore formal and final causes, in organisms generally, Varela must establish an ontological principle, not merely a phenomenological description. It appears he is willing to do just that:

> "To speak of [autopoiesis] thus directly links the biological sphere with a teleological account of ontology. On a material, concrete level we can observe in the organism the flip side of mechanical causality, a final causality as the basic process of life itself—the establishment of an identity. But this happens not by revising physical laws for particle-interactions in special application to organisms, nor by imposing an extra-mechanical entelechy. It is rather the 'subject-pole' that is the organism in its autonomy, which changes linear causality by structuring matter in the process of self-realization to maintain itself as this very process" (p. 119, 2002).

Exploring this process of the formation of a "subject-pole" (or mental-pole) requires connecting Varela's biology to Whitehead's metaphysics, where an analysis of the general character of experience in terms of concrescence provides us with the conceptual platform necessary to understand how organisms don't need to "transcend the neutrality of pure physics" (p. 118, Varela, 2002) because there never was a purely neutral physics to begin with. In the broader context of this book, it is clear that conceptually correcting the metaphysical rift between mind and matter is not unrelated to collectively healing the metabolic rift between the human economy and the Earth community.

VI. Concresence and Bodily Perception

"The philosophy of organism aspires to construct a critique of pure feeling, in the philosophical position in which Kant put his *Critique of Pure Reason*. This should also supersede the remaining Critiques required in the Kantian philosophy." – p. 113, Whitehead, 1978

The mechanistic mode of thought thus far critiqued habitually commits the fallacy of misplaced concreteness due in large part to conceptual patterns inherited from the ancient Greeks. Aristotle can be praised for ushering in the mental mutation of consciousness by recognizing the immanence of nature's purposes and articulating a form of logic that would clarify the thinking of scholastic theologians for more than a thousand years. But this same substance-quality logic became deficient with the rise of modern science and what Whitehead refers to as the sensationalist doctrine. This doctrine mistakes a high abstraction—universals derived from bare perception of sensory data (Whitehead's perception in the mode of "presentational immediacy") —for the most primitive, concrete element of experience: "sense-reception" (perception in the mode of "causal efficacy"). This confusion of the concrete with the abstract allowed for the unchecked spatialization of time, with all its rigidifying and alienating effects. Whitehead adopts Bergson's "admirable phraseology" to explain why: "Sense-reception is 'unspatialized,' and sense-perception is 'spatialized'" (p. 114, 1978). The sensationalist doctrine of modern science collapses the unspatialized creative flow of experiential intensity connecting actual occasions, and so entirely ignores the immanent teleology found therein.

This ignorance of what Whitehead calls sense-reception, or causal efficacy, prevents mechanistic paradigm from accounting for sentience of any grade, whether the motile sensitivity of flagellating bacteria or the discursive consciousness of human beings. The sensationalist doctrine lead Hume to deny causality and the soundness of induction, for with only sense-perception of the surfaces of external objects to go on, the best the reflective mind can do is bundle sequential observations with the tendency to arise together into generalizations about an apparent nature. Because the mind only has access to bare sensory impressions (of color and shape, for example), we can say nothing about what nature is in itself. Causation, as Kant would later declare based on Hume's empiricist premises, becomes merely a regulative principle projected onto nature by the structure of the mind. Whitehead blames this misplaced

concreteness on the Greek over-reliance on visual perception (p. 117, p. 121, ibid.),[22] which Gebser also points to as the dominant mode of sensory experience in the mental structure. Visual perception of extended objects, when considered in abstraction from any reference to our concrete embodiment, supports the materialist mode of thought which views nature as a series of instantaneous configurations of inert particles, where each "point-instant" has no essential connection to its past or future. Sense-reception, in contrast, provides a temporally-ordered experience of one's own bodily existence, whereby feelings of the past and the future contribute uniquely to the concrescence of each passing moment, thus granting us an experience of the present moment that is transparent to the whole of time. The immanence of past and future in the present provides us with a direct link, Whitehead argues, to the creative becoming of the universe:

> "It is the accepted doctrine in physical science that a living body is to be interpreted according to what is known of other sections of the physical universe. This is a sound axiom; but it is doubled-edged. For it carries with it the converse deduction that other sections of the universe are to be interpreted in accordance with what we know of the human body" (p. 119, ibid.).

Here, Whitehead is attempting to generalize the texture of human experience, especially our bodily perception of time, to all other actual occasions in the universe. Concrescence is best understood as the most general analysis of the phases of becoming of every actual occasion in the universe, though it should be remembered that these phases are not temporal but logical, i.e., they are distinguished and ordered only for the purposes of intellectual apprehension. In reality, each phase is an inseparable ingredient in the concrete constitution of each actual occasion of experience.

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[22] "Philosophers have disdained the information about the universe obtained through their visceral feelings, and have concentrated on visual feelings" (p. 121, 1978).

The easiest way to explain the phases of concrescence is to analogize them to Aristotle's four causes. So long as we remember "the passage from phase to phase is not in physical time," we will avoid oversimplification due to a false spatialization of the process (p. 283, ibid.). Aristotle uses the example of a house to elucidate the meaning of the causes, which was fitting for the mental structure's preference for static categories. It is important to emphasize *organic process* in an integral account of experience; but for simplicity's sake, I introduce the phases of concrescence by analogy to another artifact: a sailboat at sea.

The material cause, for Whitehead, is the creative potential underlying all actuality: "It is that ultimate notion of the highest generality at the base of actuality" (p. 31, ibid.). In my sailboat analogy, this cause is the wind and the water, as well as the wood and fiberglass composing the boat. This entire nexus of occasions emerges each moment out of the satisfactions of the actual occasions that have perished before it. The efficient cause is "the transition from attained actuality (satisfaction) to actuality in attainment," such that the prehensive acquisition of the satisfied occasions becomes the datum for the next phase (p. 214, ibid.). This prehensive phase is represented by the sails of the boat catching the winds of prior creative expressions, feeling their actualized potential, and endeavoring, in the next phase, to make something of its own with them. This next phase is associated with the formal cause, wherein the valuation of future possibilities informs the reshaping of past actualities. The winds of inherited expression caught by the sails form a contrast between what is already given and what might yet become. As the saying goes, "You cannot change the wind, but you can adjust your sails." The final cause is the ideal of satisfaction luring the sailboat in the direction formed by the adjustment of its sails. It is here that the analogy begins to break down, as the sailboat, like Aristotle's house, is an artifact. Its purposes are imposed on it from without, and so it attains no satisfaction of itself in the final phase of concrescence. This extremely simplified analysis of concrescence must be extended to the more complex occasion of the living human body.

The first thing to remember is that the emergence of each occasion of experience is partially conditioned by the entire past unfolding of the cosmos. The material cause, as described above, contains within it the subjective aims of countless actual entities that have come into being and perished. They gain objective immortality as they "[pass] over into the 'given' primary phase for the concrescence of other actual entities," (p. 85, ibid.). This givenness is the efficient cause as experienced directly through the body's non-sensuous perception (or causal efficacy) of the immediate past. Rather than understanding efficient causes as mere mechanical effects lacking emotive agency, Whitehead reconnects mind and matter by interpreting them as *affects*, or feelings directly prehended through bodily experience. As Whitehead puts it, "…sympathy…is the primary ground for the continuity of nature" (p. 183, 1967). The emotive forces of the past, aptly referred to as the physical-pole of concrescence, situate our immediate experience "…as a fact in history, derivative, actual, and effective" (p. 72, 1938).

Whitehead describes the transition to the mental-pole:

> "In the formation of each occasion…the swing over from re-enaction to anticipation is due to the intervening touch of mentality…the occasion arises as an effect facing its past and ends as a cause facing its future. In between there lies the teleology of the Universe" (p. 194, 1967).

This swing from re-enaction to anticipation is the subjective form of concrescence, which, after integrating physical feelings related to actuality, opens to the ingression of eternity into time as the possibilities of definiteness available for shaping the future. Without this "intervening touch of mentality," every actual occasion would be entirely determined, destined to passively repeat the past without any hope for novel expression or valuation of the future.

As was mentioned earlier in relation to Kant (see sec. IV), the defining characteristic of living organisms is that they are cause and effect of themselves. The importance of such reciprocal

causality becomes evident when considering the role played by the mental-pole of concrescence. The initial phase of the mental-pole is the self-formation of the organism, wherein the determined effects of its past are evaluated in light of future ideals. This contrast between feelings of givenness (physical prehensions) and feelings of potential (conceptual prehensions) constitute the autonomous subjective form of each occasion of experience. The completion of each occasion is reached when the subjective comparison of affects reaches satisfaction, perishing into objective immortality by becoming the efficient cause of subsequent occasions. This continual process of death-life-rebirth, of "derivation from without [physical prehension],… immediate enjoyment within [conceptual prehension],…and transmission beyond [final satisfaction]," is continually taking place within what would be recognized empirically as a single living organism. The phases of concrescence should shed light on what it means for organisms to be their own cause and their own effect. If Kant was able to analyze the organization of the living without having mistakenly assumed his sensuous perception (presentational immediacy) was most primitive, he might have recognized in himself, as an instance of living matter, an analogue of the teleological process of organic formation in nature.[23]

Varela realizes just this when he writes that "causality, as it is perceived by us as sentient beings, may be subsumed under the more general principle of life," which for Varela and Whitehead is intrinsically teleological. I will now explore the close ties between Varela's biological account of autopoiesis and Whitehead's metaphysical account of concrescence.

VII. Concrescence and Autopoiesis

"[The] wholeness [of an organism] is self-integrating in active realization, [its] form is not the result but the cause of the dynamic arrangements of matter, and hence the process at the same time is the form." – p. 21, Hans Jonas, 1992

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[23] Indeed, as we already mentioned (see footnote, p. 21), Kant recognized this possibility late in his life, but was unable to rework his entire philosophical system to reflect it prior to his death.

"It belongs to the essence of all occasions of experience," contends Whitehead, "that they are concerned with an otherness transcending themselves" (p. 180, 1967). As Hosinski says of this contention, it implies that "subjectivity is derivative from objectivity" (p. 56). In other words, each occasion receives from the objective world the ground of its [the occasion's] subjective enjoyment and the motive for its own subsequent (logically, not temporally) individual expression.

Similarly, Varela says of organisms that

> "…because there is an individuality that finds itself produced by itself it is ipso facto a locus of sensation and agency, a living impulse always already in relation with its world" (p. 117, 2002).

The relation of an organism to its Umwelt is one of care and concern, as Whitehead says:

> "The occasion as subject has concern for the object. And the 'concern' at once places the object as a component in the experience of the subject, with an affective tone drawn from this object and directed towards it," (p. 176, 1967).

Varela is in agreement, in that "there cannot be an individuality which is isolated and folded into itself," (p. 117, 2002). Instead, organisms have

> "…[a] precarious existence…always menaced by concern, the need to avoid perishing, and to do this, [they are] again dependent on matter whose characteristics are the reason for [their] concern" (p. 113, ibid.).

The constant threat of perishing referred to by Varela is a result of every organism's dependence upon flows of matter and energy, which mechanistic science tells us inevitably tend towards entropy. But as Whitehead's metaphysical scheme allows us to grasp, the notion of "dead

matter…is an abstraction from the full complexity of concrete actuality" (p. 62, Hosinski, 1993). Life is defined by its continual self-production, maintaining its form by remaining far from thermodynamic equilibrium riding atop a wave of negentropy (or extropy). As Varela says, "this entails that teleology is a primordial tendency of matter manifest in the form of organisms," (p. 114, 2002). An organism's material struggle to avoid death will not ultimately succeed, but in temporarily achieving its ongoing life via autopoiesis, it brings forth a subjective form, "[enjoying] its decisive moment of absolute self-attainment as emotional unity" (p. 177, 1967) before perishing, becoming an immortal object to be prehended by subsequent occasions of experience.

To account for the natural purposes inherent in living forms, both Varela and Whitehead are forced to reject the materialist doctrine that defines matter as inert and passive.

As Varela puts it:

> "The emergent causality of the reciprocal passages between the local elements [physical-pole] and the global emergent identity [mental-pole] are not a caprice, but inscribed and endogenous to nature itself, a tendency rather than an irregularity" (p. 114, 2002).

And Whitehead:

> "…what has vanished from the field of ultimate scientific conceptions is the notion of vacuous material existence with passive endurance, with primary individual attributes, and with accidental adventures…the concept is useless as an ultimate notion in science and in cosmology" (p. 309, 1978).

A materialist may here protest that I have run roughshod over the established empirical facts concerning objective nature. But from Whitehead's perspective, the dualism between subject and object established by Descartes is in conflict with the "organic realism" he sought to establish.

Descartes dualism lead to the uneasy doctrine of primary and secondary qualities, a dualism Whitehead rejects, pointing out that "what [Descartes] described as primary *attributes* of physical bodies are really the forms of internal relationships *between* actual occasions, and *within* actual occasions" (p. 309, ibid.).

For Whitehead, primary qualities, which are supposed by the materialist doctrine to be the final real things existing independently of subjective experience, are but abstractions, for

> "…we can never survey the actual world except from the standpoint of an immediate concrescence…actuality means nothing else than this ultimate entry into the concrete, in abstraction from which there is a mere non-entity," (p. 211, ibid.).

Both the primary and secondary qualities of the experienced world must be understood in a relational, ecological way, rather than in a Cartesian, representational way. The mind does not make an internal picture of the world based on subjective ideas and perceptions corresponding to its objective, pre-existing features, but participates through the process of concrescence in the bringing forth of intersubjective worlds.

This return to the evidence of concrete experience leads to a further parallel between Varela's theory of autopoiesis and Whitehead's process of concrescence. Concrescence can be defined as "the real internal constitution of a particular existent" (p. 210, ibid.).

More technically, concrescence is

> "the name for the process in which the universe of many things acquires an individual unity in a determinate relegation of each item of the 'many' to its subordination in the constitution of the novel 'one,'" (p. 211, ibid.).

Though it is true that "every entity in the actual world of a concresent actuality has some gradation of real relevance to that concrescence" (p. 41, 1978), in order to attain its unity of subjective satisfaction, the concrescence must simplify the multiplicity of its feelings with negative prehensions. A negative prehension is "the definite exclusion of that item from positive contribution to the subject's own real internal constitution" (ibid.).

Varela account of the autopoietic process of self-realization is similar: "stimuli from outside enter the sphere of relevance…only by their existential meaning for…the process of self-establishment," (p. 117, 2002). Any element of the actual world incompatible with the subjective aim of an organism is negatively prehended, such that its role becomes negligible, though still actual enough to affect the emotional complex involved in the final satisfaction of the concrescence (p. 41, 1978). In Varela's terminology, organisms bring forth their own domain of cognitive significance; or, in Whitehead's: "Each actual occasion defines its own actual world from which it originates" (p. 210, ibid.).

Before exploring the cosmological significance of this metaphysical account, it is necessary to elucidate the relation between form and matter that has been tacitly assumed so far. The classical materialist account is that matter has a fixed essence, cannot evolve, and has no intrinsic potential; it is determined entirely by exterior forces. The emergence of life out of such material would therefore require a miracle, as there is no way to account for individual self-formation without a yearning for organization and enjoyment present in matter from the beginning. Accounting for the ontological status of biological identity—for the "ever existing gap between the realization of the living and its underlying matter" (p. 119, 2002)—requires moving beyond the mechanistic understanding of organisms as substances informed with genetic qualities (traits) through passive selection by a pre-given environment. Not only does this ignore the reciprocal role played by organisms in the selection of their environment, it fails to fully consider an organism's moment-to-moment task of having to produce its identity out of a continual flow of

matter and energy. The neo-Darwinist claim is that genetic algorithms are responsible for the formation of the organism, but as has been pointed out numerous times already, one cannot account for the teleological organization and meaningful experience of individual living organisms (ontogeny) by reduction to a mechanical process operating at the level of whole species (phylogeny). To do so is to commit the fallacy of misplaced concreteness.

Accounting for the natural purposes of individual organisms does not require that we reject the reality of physiochemical constraints. On the contrary,

> "the organism has to remain in the field of physiochemical laws to maintain a 'coupling' with the underlying energetical structures [i.e., entropy, autocatalyzing reactions, etc.] whose regularities assure that it can maintain coupling through the course of its life" (p. 118, 2002).

In other words, "the environment gives the basis for the organism's behavior precisely by establishing a continuous challenge to it" (ibid.). This point is similar to the one made earlier about the object-subject structure of experience (see sec. VI). The basis of subjectivity is a concern for that which transcends it. This subjectively immanent concern for objective transcendence is equivalent to the desire to exist for one's own sake, or as Varela puts it, "Subjectivity is the absolute interest the organism takes in its continued existence" (p. 119, ibid.).

Varela continues:

> "Necessary…are the material compounds of an organism, their incessant input and their unhindered supply. But this necessity…is governed by a principle of autonomy: the fact that a living system is able to become an ontological center, that it is able to organize itself into a form that is not explainable by the features of the underlying matter (the pure necessity) alone. This autonomy then is nothing other than true teleological behavior" (p. 119, ibid.).

To understand how purposeful living forms could arise from matter, an evolutionary tendency toward increased intensity of autonomous experience and planetary interconnectivity must be attributed to it.

"The doctrine [of evolution]," says Whitehead,

> "cries aloud for a conception of organism as fundamental to nature. It also requires an underlying activity—a substantial activity—expressing itself in individual embodiments, and evolving in achievements of organism. The organism is a unit of emergent value, a real fusion of the characters of eternal objects, emerging for its own sake," (p. 107, 1925).

The "substantial activity" Whitehead refers to could be called Eros. Eros is the "the soul stirring itself to life and motion" (p. 66, 1967) to "endow with agency all ideal possibilities" (p. 210, ibid.). If matter/energy is imbued with self-enjoyment and the desire to evolve (as in a Whiteheadian cosmology), it should be possible to give a thermodynamic account of the work of Eros in the universe, on earth, and in human society. The next section will unpack the implications of thermodynamics for both the biosphere and the noosphere, looking at how Gaia and the global techno-industrial economy relate materially and semiotically.

VIII. Mechanized Life and Spatialized Time

"Blessed be you, mighty matter, irresistible march of evolution, reality ever newborn; you who, by constantly shattering our mental categories, force us to go ever further and further in our pursuit of truth." –Teilhard de Chardin's *Hymn to Matter*

The tremendous temperature gradient between space, the surface of the earth, and solar radiation generates the far from equilibrium conditions necessary for biological life to emerge.[24]

[24] Incoming solar radiation is approximately 5800 Kelvin and outer space approximately 2.7 Kelvin (p. 46, Margulis, 2003).

The gradient produces a tremendous amount of free energy, allowing autopoietic beings "to spontaneously create new patterns of order and organization by dissipating entropy" (p. 32, de Quincey, 2002). A thermodynamic account of living organization demonstrates the planetary basis of life. It is the material earth who is in the first pregnant with the energetic possibility of life, which quickly spreads around the planet to become a biospheric phenomenon. Lovelock hypothesizes that life, should it exist on Mars today, will not exist much longer; without pervading the entire planet with their metabolic presence, isolated organisms remain unable to activate the self-regulatory effects displayed by Gaia and so quickly perish.[25]

"Life," says biologist Lynn Margulis, "is a gradient-reducing system" (p. 46). Living organization does not contradict the 2nd law of thermodynamics, as was once thought.[26] Instead, it feeds on extropy produced by the generous sun and receptive earth in much the same way as the industrial organism.[27] Though in the case of industrialism, the rate of gradient reduction via exergy extraction has become so accelerated that it threatens to upset Gaia's ability to self-regulate its climate and sustain its biodiversity.

Hornborg distinguishes between "biomass" and "technomass" to make transparent the difference between Gaia's growth/maintenance strategies and the industrial machine's:

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[25] While Lovelock was working with NASA to detect life on Mars, he had "a gentle discussion with Carl Sagan, who thought it might be possible that life existed in oases where local conditions would be more favorable. Long before Viking set course from Earth I felt intuitively that life could not exist on a planet sparsely; it could not hang on in a few oases, except at the beginning or at the end of its tenure. As Gaia theory developed, this intuition grew; now I view it as a fact" (p. 6).

[26] Margulis points to the "geometry of the universe's expansion" to account for its ever increasing creative possibilities for gradient reduction (p. 48), while Whitehead suggests "…the expansion of the universe in respect to actual things is the first meaning of 'process'; and the universe in any stage of its expansion is the first meaning of 'organism'" (p. 214-15, 1978).

[27] "…both biomass and 'technomass' represent positive feedback processes of self-organization, where the system's use of harvested resources is 'rewarded' with new resources in a continuing cycle. Both are dissipative structures, requiring inputs higher than outputs and subsisting on the difference. A crucial difference is that biomass is a sustainable process whereas technomass is not. For biomass, energy resources are virtually unlimited, and entropy—in the form of heat—is sent out into space. For technomass, resources are ultimately limited, and we are left with much of the entropy in the form of pollution" (p. 17, Hornborg).

> "For biomass, growth is a morally neutral reward granted by nature itself, whereas for technomass it is a reward resulting from human ideologies and generating unequal global relations of exchange" (p. 17).

He goes on to remind us that technomass and biomass are currently competing for energy with one another on a planet with finite resources. Technology and economics, according to Hornborg, are not unrelated, independent levels of reality; machines do not magically create "growth," "progress," and "development" at the industrial centers out of nothing, but are animated by land and labor that has been exploited in the periphery (p. 147). Economics, like ecology, is a zero-sum game. Hornborg urges us to adopt wiser cultural concepts through which to engage with the rest of the community of life on earth. Mechanistic biology functions politically as a pseudo-scientific apology for contemporary industrial capitalist human-human and human-earth relations, and so my critique of its metaphysical foundations and reconstruction of biology in light of Varela and Whitehead is not merely academic, but rather constitutes a political and eco-spiritual revolt. A mutually enhancing relationship between human beings and the rest of the Earth community will require more philosophically nuanced and spiritually mature discourses about the complexities of life and living.

As was suggested in the preface, the tremendous (and perhaps cancerous) growth of technomass can be understood as an extension of thermodynamic law to human economic activity. But this does not imply that the total dissipation of the planet's energy via industrial extraction is inevitable. Consciousness can and must awaken to its integral, planetary role by overcoming the deficient mechanistic thinking currently polluting the noosphere. It might be helpful here to unpack, with Gebser, the process of mutation in the evolution of consciousness.

Gebser describes the mutation from the mythic to the mental structure as an "earth-shaking" event: it pierces the womb of the psyche—where all was pregnant with imaginal meaning and

polar congruence—birthing the directed, dualistic, and discursive thought of the mind (p. 75). "The ring [of his protective psychic circle] is broken, and man steps out of the two-dimensional surface into space, which he will attempt to master by his thinking" (ibid.). Gebser describes this process as "a fall from time into space," as the sheltering cyclical temporality of the mythic structure gives way to the three-dimensional, alienating vacuum of space (p. 77). Efficient mentality, first exemplified by the thought of Aristotle (as well as Socrates and Plato before him), was a momentous achievement of the human spirit. It broke the mythic circle of temporality and aligned humanity with a purposeful, historical evolution. But after more than two millennia of increasing conceptual and colonial conquest of space, a growing sense of anxiety is alerting the mind to its deficiencies. Despite all our conceptual systematization and technoscientific mastery, it seems the health of the Earth hasn't been in so precarious a state for at least 65 million years.

"The environmental crisis," says Hornborg,

> "forces upon us the insight that Descartes expelled from view, that the human subject, with its bundle of concepts, anxieties, and aspirations, is recursively interfused with the planetary landscape" (p. 160).

The mutational task of integral consciousness is to free time from the spatial containers the mind has attempted to trap it in. The alienating struggle to spatialize time so characteristic of a deficient mentality turns creative and purposeful life into static and inert material. This disembodied perspective on a disenchanted cosmos empowered the psycho-spiritual attitude that allowed the towering empirco-mathematical system of Newton—not to mention the global techno-industrial system first gaining ideological steam in 18th century England[28]—to stand for

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[28] "The neoclassical concept of growth was borrowed from…Newton, to whom it would simply have meant a process of aggregation. Whereas natural science has moved on to a more organic or systematic perception of growth, that is, as *appropriation* of order (Schrodinger, 1944), mainstream economists remain confined within the old, mechanical version" (p. 94, Hornborg); "Nineteenth-century scientists materially constituted the organism as a laboring system, structured by a hierarchical division of labor, and an energetic system fueled by sugars and obeying the laws of thermodynamics" (p. 97, Haraway, 1997).

several centuries, "but at last the Newtonian cosmology has broken down" (p. 156, Whitehead, 1967). Erecting such systems was possible only after Descartes had "decisively [separated] 'mind' from 'nature' (p. 210, bid.). This separation allowed Newton to conceive of atoms as "devoid of self-enjoyment." Mind was deemed present only in the human, who through its unique access to conscious deliberation imposed upon a dead material cosmos the clarity and distinctness of its innate ideas (p. 212, ibid.).

As Gebser puts it,

> "In the process of consolidating space-consciousness man has precariously placed himself at the outermost reaches of all manifestations. He brought about the isolation of the human, leaving it with only matter as its valid support…." (p. 310).

Whitehead recognizes that "human mentality is an extreme instance…of those happenings which constitute nature," but refuses to exempt humanity from the course of natural events by imposing an artificial dualism. He argues that humanity must generalize its own conscious experience so that the phases of concrescence discovered therein become applicable to the descriptions of all other species of occasion in the cosmos, including God (p. 184-5, 1967; p. 110, 1978).

Failing to overcome the human-nature duality leads to a rigidification of culture wherein, as Gebser says,

> "…consciousness increasingly empties itself of the 'time' it has negated, which, as a result of this attitude, itself becomes a lifeless spatial component. And *the quantified motoricity of the machine and its lifelessness are in turn merely another expression of the spatialized concept of time* [emphasis added]" (p. 310).

The danger in falsely spatializing time, of which we have given so much attention, is not only that it replaces the transparency of our experience with a confused dualism, but that this dualism results in the attempt to make measurable and predictable every phenomenon the mind is faced with, even when such measurement, as in the case of a living organism, fractures its qualitative intensities of feeling, meaning, and purpose into abstract, homogenous quantities of matter and energy[29] (p. 311, 383, ibid.).

"If technology is the verification of modern scientific thought," says Hornborg, "its social and ecological failures pose a challenge to that mode of thought" (p. 130). The global techno-industrial machine will continue to hollow out the heart of the earth until the human organism regains its own alienated labor.[30] Land (earth), too, must come to be experienced as more than a mere spatial extension of property or standing reserve of raw materials awaiting manufacture. The living earth is the primordial producer of life whose generativity is overshadowed only by the radiant generosity of the sun (p. 123, Hornborg). The humanist productionism discussed earlier is a gross distortion of our species' actual energetic relation to the biosphere.

Hornborg goes on to suggest that "…a more profound understanding of the machine must rest on the recognition that 'technology,' 'society,' and 'cosmology' are inseparable: as a socio-technical artifact, the machine simultaneously embodies and reproduces a specific configuration of cultural categories" (p. 127).

These deficient cultural categories are dominated by the notion of materiality. Hornborg argues that the word "material" is used prescriptively in modern Western discourse to refer to those

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[29] And money. The whole world is supposed in the capitalist scheme to be encompassable, at least in promise, by a sufficient quantity of general-purpose money.

[30] "The relationship between human labor and technology is clearly ambiguous in terms of which serves which" (p. 103, Hornborg).

aspects of life that are unquestionable (p. 130).[31] The result of this materialistic obsession is that thought begins to obediently kneel before the power of the machine (p. 116, ibid.), helpless to avert its thermodynamic trajectory toward ever more efficient conversion of exergy into entropy for the sake of disproportionate monetary accumulation.[32] The machine is "a material object of our own making which we seem to have lost control" (p. 147).

Nonetheless, "intensities, unless we mistake them for pressure or tension, are not measureable" (p. 310, Gebser), and so cannot be successfully mechanized/monetized. The materialism and mechanization still in vogue in contemporary economics and biology are, in part, a result of a failure to assimilate the transformation occurring in physics over the past century.

As was discussed earlier, Darwin's reduction of the apparent design of species to the mechanism of random variation under natural selection was based on the fundamental assumption that space, time, and matter were Newtonian in nature. While his theory was undoubtedly empirically sound, it is often the case that "we have to rescue the facts as they are from the facts as they appear" (p. 155, Whitehead, 1967) by metaphysically reorienting the mind in its relation to things. Darwin selected from among the facts appearing to him only those most salient to his Newtonian mind. As a result, the animate presence of the creatures he sought to understand was ignored, overlaid by the abstract rationalizations favored by the deficient mental structure of consciousness (p. 387, Gebser).

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[31] Rudolf Steiner had a similar understanding of the psycho-spiritual causes of materialism: "The concept of *matter* arose only because of a very misguided concept of time. The general belief is that the world would evaporate into a mere apparition without being if we did not anchor the totality of fleeting events in a permanent, immutable reality that endures in time while its various individual configurations change" (p. 174, 2000).

[32] Hornborg suggests that "general-purpose money was the universal solvent that gave Western industry access to the resources of its global periphery" (p. 105).

Time, for Newton as for Darwin, played merely a quantitative role: it was the *space*, conceived as a fourth dimension of extension, that allowed one moment, a fixed instant, to pass into the next, equally as instantaneous and having no intrinsic relation to the one prior to or following it but for the exchange of forces by way of efficient causation.[33] This collapse of time into a spatial sequence, each snap shot externally and accidentally related to the next, vanquished the concrete temporal intensity required to understand how formal and final causes participate in living organization.

As Whitehead puts it:

> "…the old conception [of time] allows us to make an abstraction of change and to conceive the full reality of nature at a given moment…an abstraction is made of all temporal duration" (p. 195, 1934).

From Darwin's point of view, the admission of teleology in evolution was absurd because it implied that the future had causal influence on the past. Time, conceived as purposeless and entirely accidental renders the future a mere result of forces determining it from the past—an aggregate of instants piled one on top of the other, species gaining their form along the way from the accumulation of chance mutations surviving the differential selection of a pre-given environment. This may be a partial explanation for the diversity of species[34], but not for the origin of life itself: the process presupposes self-organizing creatures that reproduce. This inadequate explanation retards a full account of life by neglecting the formal and final causes of autopoiesis, which become occluded when the "opposed doctrine of internal relation [is] distorted by reason of its description in terms of language adapted to the presupposition of

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[33] Henri Bergson refers to this way of understanding time as the "cinematographical method." "Instead of attaching ourselves to the inner becoming of things, we place ourselves outside them in order to recompose their becoming artificially" (p. 204).

[34] Though Margulis' theory of the origin of species via symbiogenesis may provide more robust an account, as the mere accumulation of chance mutations, even given billions of years, does not provide a means of phylogenic change quick and resilient enough to have done the necessary organizational work (see *Acquiring Genomes*, 2003).

external [i.e., spatial] relations of the Newtonian type" (p. 157, Whitehead, 1967). It should be noted in Darwin's defense that his theory of variation under natural selection wasn't designed to explain anything but the origin of *species*. The neo-Darwinism of Dennett, Dawkins, Ridley, and others is the source of the epistemic over-extension of Darwin's more modest proposal.

Darwin imagined that all relations between occasions were external, but concrete/integral time is not decomposable into the static and exclusionary categories of past, present, and future—nor space into "here" and "there": every point is the center.[35] Teleology is not a matter of the future causing the past, but of the future and the past being immanent in the concrescence of every occasion. Formal and final causation are relevant only for the internal relations within and between organisms and their environments, which Darwin assumed could only be related externally because of his commitment to mechanistic materialism.

"Evolution for the materialistic theory," says Whitehead,

> "…is reduced to the role of being another word for the description of the changes of the external relations between portions of matter. There is nothing to evolve, because one set of external relations is as good as any other set of external relations. There can merely be change, purposeless and unprogressive. But the whole point of the modem doctrine is the evolution of the complex organisms from antecedent states of less complex organisms" (p. 107, 1925).

The doctrine of matter as merely externally related "stuff" in a continual process of purposeless re-arrangement according to arbitrarily imposed preconditions is no longer tenable, for reasons discovered in both the biological, as well as the physical sciences. Darwin's theory of evolution

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35 "God is an intelligible sphere whose center is everywhere and whose circumference is nowhere" –Corpus Hermeticum, 3rd century; "Nature is an infinite sphere whose center is everywhere, whose circumference is nowhere" Blaise Pascal, 1670. In a Whiteheadian metaphysics, both God and nature participate in the integral becoming of every actual occasion.

by natural selection, though its discoverer does not take it this far, was the first crack in the foundation of Newton's cosmological edifice.

The final sentence of Darwin's *Origin* reads:

> "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved" (p. 384).

Darwin's mistake was to assume that the law of gravity is fixed. He fails to extend the formative influence of evolution far enough. But worse for the implications of his theory within his own field of biology, he assumes that living organization is just an anomaly in nature[36], having been imposed upon matter from without by a capricious God, "breathed…into a few forms or into one" at the dawn of life. Darwin's book, "*The Origin of Species*" tells us nothing of scientific value about the origin of life. For natural selection to be of any use as a theory of biological form, we must presuppose the self-creation and natural purpose of individual organisms. Only given self-organizaion and Eros does Darwin's theory shed any light on the subsequent development and diversification of the biosphere. Mechanistic attempts to account for the organization of the living fail because they employ too abstract and disembodied a conception of space, time, and matter, mistaking the quantities of Newtonian equations for the durations of lived experience, where each actual occasion, though continuous with the past, can anticipate novel futures. Newton's conception of space and time was that each was a vast container indifferent as to what filled it, and even indifferent one to the other. Matter shuffled through, blindly obeying arbitrarily imposed laws.

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[36] i.e., accidental, rather than essential.

But contemporary physics no longer understands time and space, nor matter and energy, as separate or absolute. Each shares a common history, having co-emerged and reciprocally conditioned the other throughout the process of cosmogenesis. Matter, similarly, is intimately related to the development of space and time—not *in* space-time as a kind of inert "stuff," but integrally woven with it into a physio-psycho-spiritual process of inconscient yearning gradually flowering into luminous awareness, compassion, and bliss.

Emerson suggests there is "a necessity in spirit to manifest itself in material forms" and that "The visible creation is the terminus or the circumference of the invisible world" (p. 25). Matter is not lifeless, but intrinsically animated by an enfolded spiritual destiny always and everywhere calling it toward higher forms and ideals. Its motion is not accidental or imposed upon it from without, but manifest by an indwelling spiritual longing for wholeness.[37]

Most contemporary physicists are still unwilling to grant that spirit pervades matter because the deficient mental structure of consciousness prevents its presence from being transparently apprehended. Having gained a better handle on the potential for the emergence of thermodynamic order found throughout nature, however, physics is now in a position to supplement the "aimless, aloof, and external power of natural selection" with the "willful, self-sufficient, and internal power of self-organization" (p. 128, Barlow). Evolution really is what arch-mechanist Daniel Dennett calls a "universal acid" (p. 63). It leaks out of biology and dissolves traditional ways of thinking in every field it comes in contact with. But it cannot be understood as a "mindless, purposeless, algorithmic process" unless we somehow exempt the Cartesian/Newtonian paradigm (Gebser's deficient mental structure of consciousness) from evolution's transformative reach. Evolution is a theory that points to the common origin of the

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[37] "…when, following the invisible steps of thought, we come to inquire, Whence is matter? and Whereto? many truths arise to us out of the recesses of consciousness. We learn…that spirit creates; that behind nature, throughout nature, spirit is present; one and not compound, it does not act upon us from without, that is, in space and time, but spiritually, or through ourselves: therefore, that spirit, that is, the Supreme Being, does not build up nature around us, but puts it forth through us, as the life of the tree puts forth new branches and leaves through the pores of the old" (p. 41, Emerson).

many forms of matter, life, and mind—not just at some distant moment in the past, but as a present reality, as every living creature owes its continued existence to its ecological (material-semiotic) relationship with others. Evolution (in a more cosmological sense than Darwin intended) is incompatible with the doctrine of external relation, which is the foundation of materialism.

The progress in the field of thermodynamics over recent decades, specifically the work of Ilya Prigogine, has established that the irreversibility of time is essential to the emergence of order in nature. This is a direct break with all of the mechanistic attempts to account for time, which did not recognize anything essential whatsoever about its direction. Newton's equations give the same results no matter which direction time flows. This is also true for all equations expressing relativistic or quantum mechanics. Einstein himself once remarked that "time [as irreversible] is an illusion." For Prigogine, however, the directionality of time is essential for any account of non-equilibrium systems and the creative advance into novelty that they make possible.

Whitehead's notion of concrescence, derived from the Latin verb meaning "growing together," is, according to Prigogine, an attempt to "reconcile permanence and change" (p. 59). Whitehead recognizes the essential role played by time in the creative unfolding of the universe, and his analysis of concrescence allows us to understand what was said at the outset (p. 6), that life is a moving image of eternity. Living organization cannot be accounted for in terms of the stuff of which it is made because its processual and experiential essence always transcends the mind's attempt to decompose it into a spatially rationalized mechanism or totalized system.

Life perpetually recedes from the mind's attempts to conceive of it materially because the mind's materiality (i.e., its *life*) is the very source of its limiting spatialized modes of conceptuality. Life sustains the dynamic and evolving interplay of mind in matter, liberating mentality from its material slumber by increasing the sensitivity and reactivity of its

concrescence. Only integral consciousness becomes aware of life as a transparent and purposeful whole, whose autonomous individual parts naturally tend toward symbiotic mutuality. Deficient mental consciousness, disillusioned by the disembedding forces of the techno-industrial market, is forced to explain life away as the naturally selected product of accumulated genetic algorithms. This supposedly scientific story about the reduction of life to DNA only carries metaphorical weight when imbued with mythological significance in the biological guise of Dawkins' capitalistic "selfish genes."

Logically, the neo-Darwinian mechanism is tautological: it says only that genotypes continue to survive today because they survived in the past. The only way to turn this from a meaningless non-statement into the founding principle of deficient mental biology is to mythologize it by metaphorically transferring English socio-economic ideology onto natural processes. Self-interested genes compete for resources in order to reproduce themselves indefinitely, much like middle-class industrial consumers and corporations compete for money (via sale of labor, land, products, and ideas) in order to generate the highest possible profit. Each instance ignores the concrete reality of its situation: the notion of selfish genes is a fetishized reduction of the teleology of whole organisms, just as the notion of general-purpose money and profit are fetishized reductions of the purposes of interpersonal relationship.[38]

Transparently apprehending the spiritual meaning underlying nature's evolutionary unfolding requires new modes understanding and perception. Only an integral way of seeing and being can break the ideological spell techno-industrial capitalism has cast upon the human imagination. In the next section, I will recount Gebser's attempt to bring forth understanding as systasis and perception as synairesis, comparing these to the deficient modes caused by what Heidegger has called the "enframing" of nature.

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[38] "Fetishism is about interesting "mistakes"—really denials—where a fixed thing substitutes for the doings of power-differentiated lively beings on which and on whom, in my view, everything actually depends…Without question, contemporary genetic technology is imbricated with the classical commodity fetishism endemic to capitalist market relations" (p. 135, Haraway, 1997).

IX. Integral Thought-Perception and Market Cosmology

"Integral reality is the world's transparency, a perceiving of the world as truth: a mutual perceiving and imparting of the truth of the world and of man and of all that transluces both." –Jean Gebser, *The Ever-Present Origin*

In the *Ever-Present Origin*, Gebser introduces two terms he feels exemplify the transparency and wholeness typifying the integral structure of consciousness. The first is systasis, "the conjoining or fitting together of parts into integrality" (p. 310). Gebser contrasts systasis with system, not to imply that they are opposites (as a thesis to its antithesis), but rather to make explicit the fact that systematization is still the method of a consciousness stuck in the three-dimensional, predominantly spatial world of parts. When one refers to a system, he describes the effect of some quantitative process of addition, thereby draining that process of any intrinsic life. Viewing an organism as a system converts it into a lifeless collection of objects, whereas systasis grants the parts a transparency allowing the organism to be understood as a subject perpetually becoming whole.

The second term, synairesis, refers to the mode of perception adequate to the integrality of reality. Gebser says that synairesis

> "fulfills the aperspectival, integrative perception of systasis and system…[and is] a precondition for diaphany, which is able to be realized when, in addition to systasis and system, the symbol—with its mythical effectivity—and magic symbiosis are included, that is to say, present" (ibid.).

Varela and Whitehead display a clear understanding of the need for a synairetic mode of perception that breaks free of the spatial categories and systematization endemic to the mental structure. Whitehead's analysis of concrescence is precisely an attempt to come to terms with

living organization systatically. Systasis is Greek for "put together," with the connotation of "forming" (Gebser, p. 292), linking it closely with the meaning of concrescence.

As Whitehead says,

> "We have to discover a doctrine of nature which expresses the concrete relatedness of physical functionings and mental functionings, of the past with the present, and also expresses the concrete composition of physical realities which are individually diverse" (p. 157, 1967).

The related processes of concrescence and autopoiesis bring together each of the structures of consciousness in their attempt to make clear the organization of the living, uniting the systematic categorization and empirical attention to detail of the mental (through an appreciation of the dynamics of genetic inheritance), the circular polarity of the mythic (through an appreciation of cellular autopoiesis), and the vital synchronicity of the magic (through an appreciation of the concresent interpenetration of subject and object) without becoming fixated upon any in particular. The transparency of the whole is thus made evident.

It was not until the 20th century that time became fully apparent to human consciousness. Whitehead, a mathematician and a physicist, participated directly in the scientific revelation that our sensory experience of the heavenly bodies is delusory until we have an appreciation of eternity. That is, because light takes time to travel from distant stars and galaxies to our eyes, we can only appreciate them as actual occasions if time has become transparent to us. Then we *presentiate* them without having to see them, bringing forth a "[reality] in which the present is all-encompassing and entire" (Gebser, p. 7).

Gebser continues:

> "The synairesis which systasis makes possible integrates phenomena, freeing us in the diaphany of 'a-waring' or perceiving truth from space and time. Space and time are, after all, merely conditional realities and as such realities with a double relation. They are in the first place 'objective' as the transitory structure of our universe, and in the second, 'subjective' as the transitory structure and mirroring of our consciousness. This transitory character refers us to origin, which, with respect to consciousness, becomes space-and-time-free when we fulfill and complete synairesis, the aperspectival imparting-of-truth. In this are consolidated the clarity and transparency of man and universe in which origin becomes present, inasmuch as origin, which 'lies' before spacelessness and timelessness, manifests itself in consciousness as space-time-free present" (p. 311-12).

Absent such integration, those fixated within the mental structure will continue to reduce all factors of living organization to spatial-material components, thereby negating not only the natural purposes of the organisms around them, but "denying [their] own status as sentient beings who have a right to the pursuit of an undisturbed life" (p. 111, Varela, 2002). We cannot afford to ignore what Whitehead, after Shelley and Wordsworth, refers to as the "values [arising] from the accumulation of the brooding presence of the whole on to its various parts" (p. 88, 1925).

Thinking nature as concrescence and bios as autopoiesis prepares the conceptual alembic necessary for an integral cosmology that not only re-ensouls the world, but makes the ideas at work in the heart of the universe transparent to the human spirit. Human and universe are an anthropo-cosmogenesis, a whole in the process of intelligently forming itself; in its human mode, the universe not only forms, but performs the story of its evolution through cultural expression and civillizational ideals.

"Our image-building," says Hornborg, "actively participates in the constitution of the world… Our perception of our physical environment is inseparable from our involvement in it" (p. 10). Market cosmology conceives of the world as a fragmentary heap of raw materials awaiting technological production, a standing reserve of objects devoid of intrinsic worth or self-

enjoyment. This leads to the mistaken idea that industry produces real value, when in thermodynamic fact, it operates deceptively by generating symbolic value (money) with no intrinsic relation to the actual earth processes it is degrading at evermore efficient rates (p. 32, ibid.). An integral perception and understanding of human-earth-cosmos relations grasps the inseparability of mind and nature, as "the whole of nature is a metaphor of the human mind" (p. 24, Emerson). Space-time is not an objective container to which the rational human mind is subject, but the outermost reaches of the living tissue of an evolving consciousness.

The systematicity so characteristic of techno-industrial capitalism drains the earth of its vitality by fragmenting its symbiotic diversity of eco-semiotic valuations into a uniform, general-use currency such that "resource nations are economically forced to trash their ecologies to promote foreign exchange" (p. 174, W. I. Thompson). "Money in itself," says Hornborg, "is merely an idea about the interchangeability of things and about the mutability of the rates at which things are exchanged" (p. 10). Hornborg understands general-purpose money (especially fiat currency) to be an "algorithm of destruction" because it is symbolically accumulated at the industrial centers even while the actual means of production underlying its profits on the periphery systematically render useless the truly generative potential of the planet.[39] "Industrial sectors of world society," says Hornborg, "subsist precisely on that discrepancy between the material and the symbolic" (p. 47). This exploitative techno-socio-economic situation has resulted from a dissociation of human symbolic valuation from earthly productivity, and is principally responsible for the ecological crisis. Deficient mental attempts to commodify the ecopoietic processes[40] of nature (biosphere) and culture (noosphere) are given traction by abstract,

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[39] "An item produced from oil and metal ores must be priced as if it were more valuable than the oil and the ores that were destroyed in making it, or the process could not go on. This in turn amounts to a constant *rewarding* of the continued destruction of oil and ores by giving industry access to increasing amounts of oil and ores to destroy" (p. 14-15, Hornborg).

[40] "In one of his articles Lovelock uses the term *ecopoiesis* to describe Gaia (Lovelock, 1987). This term seems just right for conveying both the resemblance and difference between Gaia and the autopoietic cell. The resemblance is due to the ecosphere and the cell being autonomous systems, the difference to the scale and manner in which their autonomy takes form" (p. 122, E. Thompson).

quantitative measures of energy. Such hyper-perspectivalism severs all lines of possible contact between the raw state of natural energy and the qualitative and purposive temporality of human life.[41] In the next section (X), Lockean notions of labor, property, and the common state of nature will be re-imagined in an attempt to enact an integral "Gaian politique" (p. 174, W. I. Thompson, 1985).

A systatic understanding of earth as a whole awakens the knower to his or her participation in a complex physio-bio-noospheric concrescence that is intrinsically purposeful and generative. Integral consciousness perceives synairetically the co-emergence of ideas and images in a living cosmos that always already involves the human being in processes beyond his or her ability to rationally dissect and control (though spending great amounts of energy "tying nature to the rack"[42] may temporarily make the mechanization of life seem possible –witness the so-called Petroleum Interval[43]).

Energy has become a concept of central importance for the current ecological crisis. Cries abound for sustainable sources of energy, for technologies that extract energy for human consumption without destroying nature. But technology can never extract energy from the earth in a sustainable way, because the mechanistic conception of energy already systematically

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[41] The implications of the mathematical formalisms of quantum mechanics were so contrary to mechanistic expectations, that Niels Bohr once remarked, "It is wrong to think the task of physics is to find out how nature is. Physics concerns what we *say* about nature" (p. 291, McEvoy, 2001).

[42] "My only earthly wish is... to stretch the deplorably narrow limits of man's dominion over the universe to their promised bounds... [Nature will be] bound into service, hounded in her wanderings and put on the rack and tortured for her secrets"(p.viii); "I am come in very truth leading you to Nature with all her children to bind her to your service and make her your slave... the mechanical inventions of recent years do not merely exert a gentle guidance over Nature's courses, they have the power to conquer and subdue her, to shake her to her foundations" (p. 21, Francis Bacon, 1980).

[43] "'The Petroleum Interval' [is] the brief interlude of 200 years where we extracted all of this amazing material from the ground and burnt it" (p. 20, Hopkins, 2008).

enframes nature, such that it becomes a mere standing-reserve awaiting human use, a means to our monetary ends.

Nature conceived of as a source of energy enframes nature in that it "puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such" (p. 320, Heidegger, 1977). Technology seems to be the means to this end. However, Heidegger argues that the essence of technology is not its instrumentality, but its mode of revealing by enframing. To reveal by enframing is to challenge-forth "energy" in the abstract, as something separable from the life of the earth. Heidegger contrasts this mode of revealing with that of *poïesis*, which brings-forth of itself. The best example of such bringing-forth is *physis*, "the irruption belonging to bringing-forth, e.g., the bursting of a blossom into bloom, in itself," (p. 317, ibid.). *Physis* reveals the way in which energy and nature are originally united as the self-generating capacity of the living earth. A conception of "energy" independent of earth, extractable from earth, is the result of an enframed way of thinking only interested in quantifying what can be challenged-forth from nature. The danger in relating to earth in such a way—as a "calculable coherence of forces" (p. 326, ibid.)—is that, eventually (if not already), even the human being becomes the standing-reserve of industry[44], which "[drives] on to the maximum yield at the minimum expense (p. 321. Ibid.).

Energy becomes, for the mechanistic attitude, the most neutral of names for the essence of nature. Nothing could be further from the truth. The earth does not originally show itself as a resource, as a standing-reserve, but becomes so only because of the technological way of being that forcibly reveals it as such. That technology nonetheless *reveals* is what makes it so dangerous, as all revealing (*aletheia*) is truthful. Energy does show itself as a quantifiable substance, but only after the earth's *poïesis* has been falsely monetized and thermodynamically

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[44] Hornborg makes similar aspects of technology transparent: "Industrial technology does not simply represent the application of inventive genius to nature but is equally dependent on a continuous and accelerating social transfer of energy organized by the logic of market exchange" (p. 45).

exploited. Both the revealing that is *poïesis* (or *physis*) and the revealing that is enframing provide a kind of truth; but enframing goes on for the most part unconsciously, because everyone assumes that the essence of technology is merely instrumental, that it is neutral but for how the human being puts it to use.

Humanity seems afraid to recognize that its technological presence on the earth has the potential, not only to forever forestall self-generating capacity of nature, but to forever alter human nature, as well. Ours is a crisis not only of the environment, but of the human souls dwelling within it. If the essence of technology remains hidden, and nature continues to be used up as mere energy, human beings will become batteries bio-powering the machines that have enslaved us, homeless upon a dying earth.

Heidegger warns not only of the dangers of technology, but after Hölderlin ("…where danger is, grows/the saving power also…" -p. 340, ibid.), heralds also its potential to re-establish our being-on-the-earth, though in sublated form. This saving power is realized only if the essence of technology is understood. For Heidegger, scientific materialism owes its existence to the technological method of enframing. This reverses the commonsense idea that science brought forth technology. The great success of the empirico-rational disciplines is not the result of their metaphysical truth or correspondence to reality, but rather of the practical, economic value of their methods. These methods, made possible by the enframing of the earth as mere energy for instrumental use, have depleted its body of the life-giving qualities that created and provide for humanity's, and all life's, continued existence. It is the shock of this near suicide, however, that has given our species the opportunity to truly stand watch over the earth as the only home we'll ever have.

The mythical fall from grace and eviction from the Garden of Eden can only be overcome by taking to an extreme the alienating way of inhabiting the earth that caused the fall to begin with.

Humanity cannot turn back—we cannot put humpty dumpty back together again. Our destiny has had to be lived out—our process of maturation cannot be reversed. In a typical enantiodromic reversal, our rush to remake the planet technologically has lead to an opening that, if seen synairetically, will allow us to remember our original identity as earthlings, now capable of saving the earth from the techno-industrial monster that has been strangling it. For the first time, the noosphere can truly become aware of and responsible for the ground beneath its feet.

As Heidegger says, being-on-the-earth already means being beneath the sky (p. 351, ibid.). And to be beneath the sky means to behold the stars and the sun, whose diviner energies grant life to we mere earthly mortals. But instead of energy, we may find "something waiting inside [the things themselves], like an unplayed melody in a flute" (p. 167, Rilke). Only a way of thinking/dwelling upon the earth that grants such melodies their say (i.e., systasis and synairesis), and that safeguards their becoming, can save us from the total annihilation of ourselves and the rest of the community of life upon this planet.

X. Integral Enaction of a Gaian Polity

"The revolution cannot come in time for us to quit out jobs or cancel our debts, and the end of the world cannot come in time to eliminate the mess we have made of history; nothing smaller than the earth is large enough to express the revelation, and nothing smaller than this instant is vast enough to contain all the future that we need" -p. 182, W. I. Thompson

John Locke articulated the social foundations of market cosmology by defining property as anything human labor has taken out of "the state nature leaves it in" (p. 330, 1965). Human labor is said to produce property and value, the first of its proclaimed properties being itself. Once I have monetized my own ability to do work, the reduction of nature to a standing reserve of raw materials to be exploited is an afterthought.

"In our informational society," says William Irwin Thompson, "property is no longer simply land; it is consciousness" (p. 177). Thompson suggests we think with Gregory Bateson by

understanding matter, not as a "state of nature" awaiting human production, but as "unconscious Mind, or Gaia" raised to consciousness by the labors of the soul (ibid.). Such a shift in economic ethos reverses the relationship between mind and matter currently informing industrialism: the former is epiphenomenal to the latter. In a Gaian polity, Mind is understood to be united with the living earth, whose value is determined by the intensity of consciousness associated with the particular product in question (179, ibid.).

Thompson continues:

> "If autonomy is the fundamental recognition of the distinction of life, and if autopoiesis is the fundamental narrative process of life, then the biological politics that derive from these descriptions are radically different from sociobiology or scientific socialism. This is what I see as the Gaia Politique, a politics that is radical in the sense that it is deeply rooted in the understanding of life [and] is truly…ecological and not simply the old industrial Marxist critique newly decorated with sun-flowers and green paint" (p. 180, ibid.).

Thompson goes on to suggest that, autonomy being essential to life and consciousness, the evil of market cosmology consists in its "failure to recognize the [distinct] living [performances] of autonomous unities" in their "narrative process of self-description" (p. 179). A Gaian polity would evoke the "counterdrive to total commoditization" that Hornborg identifies as culture (p. 172). Culture's main resistances to the homogenizing tendencies of market exchange are the processes of singularization and sacralization that reverse money's "tendency to render social [and human-earth] relations increasingly abstract" (p. 166, ibid.). Sacred or spiritual forms of culture are also abstract, but still rooted in narratives of "local resonance," unlike the disembedded abstractions of science and money (p. 171, ibid.).

"The ecological crisis of modern society," says Hornborg,

> "has two connected aspects: one objective and generated by the general-purpose market and its axiom of universal inter-changeability, the other subjective and founded in the alienation of the disembedded, modern individual" (p. 160).

The challenge of enacting an integral cosmology hinges upon a transformed sense of narrative and the construction of meaning, which, according to Hornborg (p. 120) and Thompson (p. 101), is motivated by a fear of chaos and the desire to establish order through the ritualized performance of myth. Even the culture-eating techno-industrial worldview is made to function ideologically by way of deficient mythic narratives depicting the march of progress toward total control and rationalization of life.

Thompson defines narrative as a uniquely human way of responding to time, "an attempt to escape the infinity of the present as duration by reifying time into a past" (p. 100). Our narratives bring forth the worlds we inhabit, and enacting worlds of ecological resilience and diverse cultural expression requires respecting the autonomy of both Gaia and her many children. While only humans seem capable of *knowing* they tell stories, all creatures unconsciously bring forth their own cognitive domains of significance. The reduction of human consciousness to wage labor (measured by falsely spatialized clock-time) is a symptom of modern technology's tendency to dissociate formerly integrated facets of reality, "namely tool/body, physical work/ mental work, means/ends, work/agency, use/meaning, production/art, and work/life" (p. 130, Hornborg). Techno-industrial life leads to meaninglessness and existential anxiety precisely because money (and the social relations it establishes) alienates consciousness from its own powers of creative response to the overflowing meaning of each and every moment. Money is understood by Hornborg to be a "communicative disorder"; empty signs of arbitrary value are shown to be the very heart of market cosmology (p. 170-171). While general-purpose money can reinforce power relations, it cannot itself convey meaning, which depends on difference (p. 167, ibid.).

Thompson sees "the recognition of differences as the consciousness of the unique that contributes to the understanding of the universal" (p. 163), which is to say that cultural diversity is paramount to the establishment of resilient forms of meaning capable of providing spiritual nourishment for the whole human family. "Regional devolution," says Thompson, "is part of planetary evolution; so it is the larger entity that nourishes the emergence of the smaller identity" (p. 166). Hornborg recognizes the need for a similar return to local valuation to "domesticate the market," calling for the creation of dual currencies "so as to render local subsistence and global communication two parallel but distinct and incommensurable domains" (p. 34).

The living earth is the new stage upon which all human interaction must take place, but not in the decontextualized fashion typical of global capitalism. The move to a Gaian Politique deconstructs the Western division between person and thing, human and nature (p. 195, Hornborg).[45] Hornborg points out that, the more tied up with global networks of exchange we become, the less "outreaching" we become as persons. A return to local material and cultural subsistence would involve taking up forms of reciprocity that have been increasingly marginalized by market forces. Marshall Sahlins (1972) has articulated three forms of reciprocity, including generalized reciprocity (a "pure gift" with no expectation of return), balanced reciprocity (a fair trade), and negative reciprocity (an impersonal exchange where each party seeks to get something for nothing via symbolic persuasion) (p. 201, Hornborg).

An integral cosmology functions on "the basic intuition [of a] shift from industrial work, abstraction, and materialism to play [and] sensual consciousness" (p. 161, Thompson). Enjoyment of subjective community becomes the primary value of life, replacing the market cosmology of atomistic competition of each against all to accumulate quantities of money whose value is appraised based upon how successfully it can disembed meaning and material from its

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45 "Such a distinction…is alien to hunter-gatherer groups like the Algonquian-speakers of northeastern North America, who tend to view *all* living beings as undivided centers of awareness, agency, and intentionality" (p. 195, Hornborg).

local, inter-personal and inter-bodily instantiation. A return to the experiential depth of the places where we live and the faces who we live with is the only way to reverse industry's destruction of earth and money's inversion of the Sacred (p. 171, Hornborg). The disenchantment and alienation resulting from the monetized mechanization of life are rectified only through a renewed authenticity capable of bringing forth the specificity and non-interchangeability of individual expression and inter-personal relation that resists being appropriated by the abstract and impersonal values of the market.

Conclusion: On the Soul and Spirit of Life

"The problem of restoring to the world original and eternal beauty, is solved by the redemption of the soul. The ruin or the blank, that we see when we look at nature, is in our own eye. The axis of vision is not coincident with the axis of things, and so they appear not transparent but opaque. The reason why the world lacks unity, and lies broken and in heaps, is, because man is disunited with himself [and with woman and humanity]. He cannot be a naturalist until he satisfies all the demands of the spirit." –p. 47, Ralph Waldo Emerson

Aurobindo lists death and mutual devouring, hunger and conscious desire, and the struggle to increase, expand, conquer, and possess as the basic truths of Darwin's theory of natural selection (p. 199). But this theory defines life only by its relation to the mechanisms of matter, forgetting the arc of evolution extends also toward mind and spirit. As mind emerges to overtake the vital striving of life, the "law of love" replaces that of death, and the fittest become those "who harmonize most successfully survival and mutual self-giving" (p. 203).

Mind, according to Aurobindo, "does not need to devour in order to…grow; rather, the more it gives, the more it receives and grows" (p. 204). The global economy has thus far been guided by Darwin's overemphasis on the aggressive principle of life, devouring the very vitality of the planet it depends upon for its continued existence. Humanity is struggling to give birth to the higher principle of mind, to the love of conscious joining and interchange that might forestall our entropic rush to convert the common earth into private property.

The biosphere is experiencing the pains of labor as it struggles to give birth to its enfolded destiny, the noosphere. "We can hope for no progress on earth," says Teilhard, "without the primacy and triumph of the *personal* at the summit of *mind*" (p. 297). Teilhard reminds us that even an interiorized and involuted universe labors, sins, and suffers (p. 313). Such are the demands of the spirit working through this anthropo-cosmogenesis, which, as Teilhard says, even from the perspective of a biologist, "resembles nothing so much as a way of the Cross" (ibid.).

"Eros (love) does not occur only in the human soul," says Eryximachus in Plato's *Symposium*,

> "It is a significantly broader phenomenon. It certainly occurs within the animal kingdom, and even in the world of plants. In fact, it occurs everywhere in the universe. Eros is a deity of the greatest importance: he directs everything that occurs, not only in the human domain, but also in that of the gods" (186b).

The personalization of earth and the cosmos is essential to any renewed engagement of humanity with its ecological context, as "persons and landscapes are mutually constitutive [and] co-evolve" (p. 3, Hornborg, 1998). The deficient mental separation of mind from nature has shattered the wholeness of the biosphere and of human society by translating the living intensity and particularity of the relationships holding each together into quantities of money and raw materials.

"Driven by the forces of love," says Teilhard, "the fragments of the world seek each other so that the world may come into being" (p. 264-265). Teilhard urges humanity to overcome the "anti-personalist" complex paralyzing our techno-industrial civilization, and to at least grant the possibility, under the heightened pressure of our infolding world, that the earth has a face and a heart (p. 267). Life is not a machine, nor the human being a consumer. A human being, like all creatures, is alive because a great cosmic creativity stirs its very atoms into autopoietic *e*-motion.

"Whatever happens on the earth," says Gebser,

> "man [who is the consciousness of earth] must share the responsibility…On its great journey across the millennia it hastens through the changing landscapes of 'heaven,' transforming its own countenance and man's" (p. 541).

An integral biology of economics brings to light the wholeness of life and makes transparent the law of love luring even the materiality of the earth toward its center. The mutation of consciousness into its integral mode requires enduring a violent birth, as the industrial process has made quite evident. But the end of consciousness' unfolding is not the annihilation of earth—rather, it is to participate with earth in the regeneration of Eden by learning to face the universe with an open heart and a mind transluced by the spirit of origin.

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