PHYSICS OF THE WORLD-SOUL: THE RELEVANCE OF ALFRED NORTH WHITEHEAD'S PHILOSOPHY OF ORGANISM TO CONTEMPORARY SCIENTIFIC COSMOLOGY

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Alfred North Whitehead
(1861-1947)

Editor's Note: Alfred North Whitehead was a British mathematician, logician and philosopher. His early work, as a student and professor at Cambridge University, was on mathematics and logic. The second period, 1910-24, when he had appointments at University College London and Imperial College of Science and Technology in London, he concentrated on the philosophy of science. The last period, beginning in 1924 and during which he taught philosophy at Harvard, he concentrated on metaphysics. His philosophy is known as both philosophy of organism and process philosophy.

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INTRODUCTION: FROM PHYSICS TO PHILOSOPHY

> *How shallow, puny, and imperfect are efforts to sound the depths in the nature of things. In philosophical discussion, the merest hint of dogmatic certainty as to finality of statement is an exhibition of folly.*
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> —Whitehead[1]

> *Philosophy begins in wonder. And, at the end, when philosophic thought has done its best, the wonder remains.*
>
> —Whitehead[2]

This essay is written in preparation for my dissertation, tentatively titled *Imagination between Science and Religion: Towards a Cosmotheandric Process Philosophy.* In this forthcoming dissertation, Alfred North Whitehead's and Friedrich Joseph Schelling's voices will play starring roles in my own attempt to re-construct the philosophical basis for a viable planetary civilization. Special attention will be paid to the methodological role of imagination in both scientific theorization and religious mythopoeia. Raimon Panikkar's "cosmotheandric experience," wherein Universe, God, and Human are the triune ultimates in terms of which experiential reality is to be interpreted, will provide the imaginative background guiding my philosophical speculations.[3]

In this essay, I will focus on Whitehead's organic cosmology, but Schelling's and Panikkar's conceptions of reality will never be far from my mind. The title of this essay is itself a nod toward Schelling's *Naturphilosophie,* which seeks to integrate humanity's ancient spiritual longing for wisdom and compassionate consciousness with its modern scientific knowledge of an evolutionary cosmos.

The important place of philosophy, from Whitehead's similarly anthropocosmic perspective, is that of the critic of the abstractions of the specialized sciences. It follows that:

> Philosophy is not one among the sciences with its own little scheme of abstractions which it works away at perfecting and improving.[4]

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[1]Alfred North Whitehead, *Process and Reality*, corrected ed., David Ray Griffin and Donald W. Sherburne, eds. (New York: The Free Press, 1979), xiv (originally published in 1929).

[2]Alfred North Whitehead, *Modes of Thought* (New York: The Free Press, 1968), 168 (originally published in 1938).

[3]Raimon Panikkar, *The Rhythm of Being* (New York: Orbis Books, 2010), 34.

[4]Whitehead, *Science and the Modern World* (Cambridge: Cambridge University Press, 1960), 83 (originally published in 1925).

Rather, the philosopher is always at work attempting to harmonize the abstract sciences (e.g., physics, chemistry, biology, psychology, sociology), both internally among themselves, and more generally with our deep moral intuitions and aesthetic feelings regarding the archetypal values inherent to the universe. In this sense, Whitehead sees philosophy's principle import to be "the fusion of religion and science into one rational scheme of thought."[5]

One of the major premises of this essay is that contemporary scientific cosmology has passed into an epicyclic phase of theoretical development.[6] The present disorganized assemblage of scientific hypotheses regarding the fundamental laws and material components of the universe has left contemporary cosmology on the verge of a paradigmatic shift whose existential significance may surpass even that of heliocentrism or evolutionism (though it will need to include rather than contradict these paradigms). Whitehead was among the first initiates into this new cosmological story, but grasping the novelty of his vision also requires remembering the insights of the ancients, even if in a modern context. This essay therefore situates Whitehead's animate cosmology in the context of the larger historical arc of Western natural philosophy dating back to Plato. It also brings Whitehead's philosophy of organism into conversation with several components of contemporary scientific cosmology–including relativistic, quantum, evolutionary, and complexity theories–in order to both exemplify the inadequacy of traditional materialistic-mechanistic metaphysics, and to display the relevance of Whitehead's cosmological scheme to the transdisciplinary project of integrating these theories and their data with the presuppositions of civilized society. This data is nearly crying aloud for a cosmologically ensouled interpretation, one in which, for example, physics and chemistry are no longer considered to be descriptions of the meaningless motion of molecules to which biology is ultimately reducible, but rather themselves become studies of living organization at ecological scales other than the biological.[7]

Almost a century ago, Whitehead warned that if physicists did not begin to reassess the outdated imaginative background of mechanistic materialism in light of their own most recent cosmological discoveries, the scientific enterprise would as a result "degenerate into a medley of *ad hoc* hypotheses."[8] Despite the conceptual revolutions of the 19th and 20th century (e.g.,

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[5]*Process and Reality, 15.*

[6]*Science and the Modern World*, 124.

[7]Ibid, 97.

[8]Ibid., 23.

evolutionary, relativity, quantum, and complexity theories), scientific materialism remains the *de facto* natural philosophy of Western civilization. It imagines the universe as

> irreducible brute matter . . . spread throughout space in a flux of configurations . . . in itself . . . senseless, valueless, purposeless . . . following a fixed routine imposed by external relations.[9]

Such a picture of ultimate reality leaves no room for life or consciousness. It seems likely that this metaphysical oversight is among the reasons for (post)modern civilization's ecological and socioeconomic crises. A coherent philosophy of nature has yet to take root among civilization's intelligentsia. Several centuries from now, if historians still exist, and if a new image of reality and with it a new civilization are in the process of flowering, the 20th century will stand out not only for its world wars and widespread environmental devastation, but for its disorienting scientific discoveries (like relativity and quantum theories) and the earthshaking technological inventions which resulted (like the atom bomb and the microchip). For a century, the greater part of the thinking heads of our civilization have been distracted by the electronic gadgetry and wartime glory afforded by technoscience.[10] This distraction has allowed them to overlook the philosophical incoherence of mechanistic materialism. Whitehead, one of the handful of historically sensitive scientists to grasp what was happening, wrote in 1925 that "The progress of science has now reached a turning point":

> The stable foundations of physics have broken up. . . . The old foundations of scientific thought are becoming unintelligible. Time, space, matter, material, ether, electricity, mechanism, organism, configuration, structure, pattern, function, all require reinterpretation. What is the sense of talking about a mechanical explanation when you do not know what you mean by mechanics? *[Science] must become philosophical.*[11]

The incoherence of mechanistic materialism stems from its neglect of the importance of harmonizing our theoretical knowledge of nature with the presuppositions of our ethical values, artistic projects, and spiritual aspirations. Unlike any of humanity's premodern cosmologies, modern scientific materialism has been predicated upon a metaphysical bifurcation separating human consciousness from the surrounding cosmos. This dualism between consciousness and cosmos is the fatal flaw at the core of modern scientific cosmology. Whitehead's philosophy of science is characterized by the attempt to correct for the widespread deployment of the fundamental fallacy of *bifurcation,* along with its daughter

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[9] Ibid.

[10] Unlike traditional science, still the cousin of philosophy, which sought to "confer an intelligible order on what confronts us," for technoscience "to understand is to be able to transform." Isabelle Stengers, *Thinking With Whitehead: A Free and Wild Creation of Concepts* (Cambridge, MA: Harvard University Press, 2011), 11.

[11] *Science and the Modern World, 23* (italics added). By way of comparison, Schelling's *Naturphilosophie* was similarly an attempt "to allow natural science itself to *arise* philosophically." F. W. F. von Schelling, *Ideas for a Philosophy of Nature,* trans. Errol Harris and Peter Heath (Cambridge, UK: Cambridge University Press, 1988), 5 (originally published 1787).

fallacy, that of *misplaced concreteness.* In effect, modern science has sacrificed intuitive understanding of the concrete passage and organic unity of the actual universe for the abstract knowledge of its mathematical formulae and mechanical models. No other fallacy occupied Whitehead's critical attention more than the bifurcation of nature: as we will see, he initially wandered out of mathematical physics and into the arena of full-fledged metaphysical cosmology precisely in order to integrate what had become dissociated. "Coherence," writes Whitehead, "is the great preservative of rationalistic sanity"[12]; without it, neither cosmology nor civilization would be possible.

Despite the need for greater philosophical coherence in contemporary scientific cosmology, many leading physicists are growing increasingly impatient with philosophers. Freeman Dyson writes

> For most of the twenty-five centuries since written history began philosophers were important. . . . They had a deep influence in the practical worlds of politics and morality as well as in the intellectual worlds of science and scholarship. . . . Compared with the giants of the past, [twentieth and twenty-first century philosophers] are a sorry bunch of dwarfs. . . . So far as the general public [is] concerned, philosophers [have become] invisible.[13]

Dyson at least has hope for the future importance of philosophy, if only it becomes willing to ask the big questions once again. Other physicists have become outright dismissive of the entire enterprise of philosophy. "Philosophy is dead," writes Stephen Hawking, because it "has not kept up with modern developments in science, particularly physics."[14] Lawrence Krauss similarly argues that much of contemporary philosophy suffers from "intellectual bankruptcy"[15]:

> When it comes to the real operational issues that govern our understanding of physical reality, ontological definitions of classical philosophers are, in my opinion, sterile.[16]

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[12]*Process and Reality*, 6.

[13]Freeman Dyson, "What Can You Really Know, *The New York Review of Books*, November 8, 2012, 20.

[14]Stephen Hawking, *The Grand Design* (New York: Random House, 2010), 5.

[15]Lawrence Krauss, *A Universe from Nothing: Why There Is Something Rather Than Nothing* (New York: The Free Press, 2012), xiv. Krauss claims to bring "nothing"–traditionally a topic for metaphysical speculation–into the purview of natural science such that it can be used to explain the creation of the universe materialistically (i.e., as the result of blind chance and causal necessity without meaning or purpose). I return to his ideas in a later section in connection with Terrence Deacon's less reductionistic scientific characterization of "nothing" in Terrence Deacon, *Incomplete Nature: How Mind Emerged from Matter* (New York: W.W. Norton & Company, 2013).

[16]Lawrence Krauss, "The Consolation of Philosophy," in Scientific American, April 27, 2012, http://www.scientificamerican.com/article.cfm?id=the-consolation-of-philos&page=2 (accessed 11/15/2012).

Like Hawking and Krauss, Stephen Weinberg is also of the opinion that scientists need not take the complaints of philosophers seriously:

> To tell a physicist that the laws of nature are not explanations of natural phenomena is to tell a tiger in search of its prey that all flesh is grass . . . with or without [philosophers], we will continue to [search for scientific explanations of natural phenomena].[17]

In response to such criticisms, it must first be said that Whitehead was well aware of the danger of supposing that our present definitions, whether they be in the language of mathematical physics or of metaphysical ontology, somehow already contain all the words, phrases, or formulae applicable to the analysis of experiential reality: he called this supposition "The Fallacy of the Perfect Dictionary."[18]

> We experience more than we can analyze. For we experience the universe, and we analyze in our consciousness a minute selection of its details.[19]

For Whitehead, the role of philosophy is akin to that of poetry: to introduce novel fundamental ideas and verbal expressions as an aid to the ongoing adventure of civilization.[20] This obviously makes philosophy's goals a great deal broader than those of physics; but as I hope to spell out in the course of this essay, it is essential to the health of civilization that lines of communication between philosophy and science remain open and mutually informative. Whitehead, a mathematical physicist by training, had just as much criticism for the habits of his own discipline as for philosophy. He placed the blame for the sorry state of both disciplines primarily on the process of professionalization, which pushes society's brightest minds to become narrow-minded specialists and technicians with little interest or respect for anything but the operational abstractions of their own field. The fragmentary proliferation of technoscientific disciplines during the 19th and 20th centuries mostly discouraged grand attempts at integration akin to those of philosophers past. "Sometimes it happens," writes Whitehead,

> that the service rendered by philosophy is entirely obscured by the astonishing success of a scheme of abstractions in expressing the dominant interests of an epoch."[21]

Whitehead's approaches to philosophy and to science are not typical of his age. A natural born integralist, he came to them from several angles at once: as a mathematician seeking truth in

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[17]Stephen Weinberg, *Dreams of a Final Theory* (London: Vintage Books, 1993), 21-22.

[18]*Modes of Thought,* 173.

[19]Ibid., 89.

[20]Ibid., 174

[21]*Science and the Modern World,* 58.

harmonious pattern, as a physicist attempting to describe the fundamental forces of nature, as a pragmatic educator searching for a viable pedagogy, and as an ally of the Romantic poets in their protest against abstraction on behalf of the concrete values inherent to the universe. According to contemporary interpreter Isabelle Stengers, Whitehead's central concern is precisely modern science's

> lack of resistance to the intolerant rule of abstractions that declare everything that escapes them frivolous, insignificant, or sentimental.[22]

Much of the hostility directed at philosophers by the physicists mentioned above would seem to be a result, not only of their lack of resistance, but of their outright celebration of the power of abstractions to explain away the depths of mystery inherent to lived experience. In contrast to the triumphant attitude fostered by scientific materialism, Whitehead does not look to natural science, or to philosophy, for reductive explanations. Rather, his philosophizing seeks "direct insight into depths as yet unspoken."[23] The purpose of philosophy is not to explain away mystery, but to add to it "some grasp of the immensity of things, some purification of emotion by understanding."[24]

As an aid to understanding the radical novelty of Whitehead's mature cosmological scheme, it is important to first grasp the essential features of his early reflections on the history and philosophy of science. It is to these reflections that the next section turns.

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[22]*Stengers, 136.*

[23]*Modes of Thought, 174.*

[24]Ibid., 168-69.

THE SUNSET OF MATERIALISM:
WHITEHEAD'S PHILOSOPHY OF SCIENCE

> *The sun rose on the flawless brimming sea into a sky all brazen–all one brightening for gods immortal and for mortal men on plow lands kind with grain.*
>
> —Homer[25]

> *God invented sight and gave it to us so that we might observe the orbits of intelligence in the universe and apply them to the revolutions of our own understanding.*
>
> —Plato[26]

> *When you understand all about the sun and all about the atmosphere and all about the rotation of the earth, you may still miss the radiance of the sunset.*
>
> —Whitehead[27]

For ancient poets like Homer, the sun was a being of tremendous spiritual significance. The immense beauty of its rising and setting brought forth a dramatic display of the abiding moral harmony underlying the cosmos. For ancient philosophers like Plato, the sun was similarly a sign of the highest Good, but its visible light was thought to be only partially responsible for the shower of colors drenching earth and sky. Participating in the sunlit phenomena of the outer world was an inner noumenal light emanating from the eyes. Plato suggested that this inner light flows gently outward through the eyes from a psychic fire kindred to that animating the sun. It meets and coalesces with the light of the sun (or at night, the moon and stars) to bring forth the beauty and splendor of the universe.[28] Plato's was a participatory account of our knowledge of nature, such that soul and world were understood to synergistically intermingle in each act of perception. He considered the eyes the noblest of the senses,

> source of supreme benefit to us, in that none of our present statements about the universe could ever have been made if we had never seen any stars, sun, or heaven. As it is, however, our ability to see the periods of [the heavens] has led to the invention of number, and has given us the idea of time and opened the path to inquiry into the nature of the universe.[29]

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[25]Homer, *The Odyssey,* trans. Robert Fitzgerald (Garden City, New York: Doubleday, 1961), bk. 3, lines 1-4.

[26]Plato, *Timaeus,* 47b-c.

[27]*Science and the Modern World*, 178.

[28]Plato, *Timaeus,* 45a-d.

Not only was Plato's cosmology inclusive of perceptual experiences in its definition of nature, it felt divine *eros* and saw eternal *eidos* at work throughout the cosmos. The circling stars, sun, and moon were considered to be living gods, humanity's wisest teachers. In his survey of European history, Whitehead places Plato at the center of the first great period of intellectual development, a period with deep influences on all subsequent thought.[30] In the main, Plato's cosmological scheme and account of visual perception, as articulated most profoundly in the dialogue *Timaeus*, reigned among Europe's intelligentsia for more than 1,500 years.[31] It was not until the height of the scientific revolution in the 17th century that his participatory premises were rejected by the next wave of great geniuses.

"In the year 1500," writes Whitehead, "Europe knew less than Archimedes who died in the year 212 BCE."[32] The commonsense assumption of a person living in 1500 was that Earth stood stationary at the center of a sacred series of eternally circling heavenly hosts. Below the moon, four elements composed everything; above it, something far subtler was thought to be at work. "Yet in the year 1700," continues Whitehead, "Newton's *Principia* had been written and the world was well started on the modern epoch."[33] The new analytic methods of Descartes, Galileo, and Newton succeeded in breaking the bond between the numinosity of the soul and the phenomenality of the world, bifurcating nature into two distinct substances, the material and the mental. Humanity's understanding of its relationship with the universe underwent a fundamental transformation.

Three hundred years later, despite the evidences of modern physical science, the average 21st century person still unhesitatingly refers to the setting of the sun, to the red hues of its surrounding sky, and to the waning of its warmth as it sinks beneath the horizon. From the perspective of the well-trained mathematical physicist, such a person's commonsense is mistaken: the sun does not set, nor is it warm, nor is its ambiance red. Its sinking, like its warmth and color, are only subjective appearances, artifacts of our perception and not facts of nature. "If the living creature were removed," argued Galileo, the first to formalize nature's bifurcation in terms of primary physical and secondary psychical characteristics, "all these qualities would be wiped away and annihilated."[34] The warmth and hue of a sunset, continues

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[29]Ibid., 47a

[30]*Science and the Modern World*, 38.

[31]Arthur Zajonc, *Catching the Light: The Entwined History of Light and Mind* (New York: Oxford University Press, *1993), 21.* Plato's cosmology's only serious challenger was Aristotle.

[32]*Science and the Modern World*, 13.

[33]Ibid.

[34]Galileo Galilei, "Excerpts from The Assayer," trans. Stillman Drake, in *Discoveries and Opinions of Galileo* (New York: Doubleday, 1623/1957), 274.

Galileo, "are no more than mere names so far as the object in which we locate them are concerned."[35] They reside not in the essential nature of the cosmos, but in the arbitrary names of consciousness. Plato's insight into the erotic coupling of inner/spiritual light with outer/physical light has been degraded into the dualistic modern theory of "two natures . . . one the conjecture and the other the dream."[36] Scientific materialism, in other words, has come to oppose our personal experience of nature (the dream) to an abstract model of nature theorized to be the impersonal cause of that experience (the conjecture).

Following upon Galileo's initial bifurcation of nature, Descartes brilliantly articulated the ontological and epistemological underpinnings of modern scientific materialism. The eclipse of the illusory geocentric cosmos by the mathematical elegance of Copernicus' heliocentric model (as improved upon by Kepler) made it clear to Descartes that sensory perception could not be trusted for scientific purposes. Science was to become the study of the mechanisms of the extended things (*res extensa)* of nature, a study guided by the exact mathematical measurement of primary qualities like length, width, height, mass, and motion. Religion, on the other hand, was to retain responsibility for shaping the unearthly substance of the soul, providing moral guidance for existentially troubled thinking things (*res cogitans)* like us. Secondary qualities like color, sound, and taste were left to the free play of artists to be combined and recombined for the purpose of heightening the pleasure of appearances, rather than penetrating deeper into the archetypal dimensions of reality.[37]

In the intervening years since the scientific revolution, a new civilization guided by the ideals of the Enlightenment has taken root on every continent. By 1850, the values of industrial capitalism, justified by the mechanistic cosmology of scientific materialism, had infected much of the Western world, forever altering traditional forms of agriculture, manufacturing, transportation, communication, and religious practice. "[All] thought concerned with social organization," writes Whitehead,

> expressed itself in terms of material things and of capital. Ultimate values were excluded. They were politely bowed to, and then handed over to the clergy to be kept for Sundays. A creed of competitive business morality was evolved . . . entirely devoid of consideration for the value of . . . life. The workmen were conceived as mere hands, drawn from the pool of labor. To God's question, men

[35]Ibid., 274.

[36]Alfred North Whitehead, *The Concept of Nature* (Cambridge: Cambridge University Press, 1964), 31 (originally published 1920).

[37]Prior to the differentiation of art, science and religion in the modern period, art served primarily a religious function as a sort of window from the earthly into the archetypal realm. See *Science and the Modern World,* 20. Art also served science by mastering perspective, allowing for realistic representations of nature. See Ibid., 45.

> gave the answer of Cain– "Am I my brother's keeper?"; and they incurred Cain's guilt.[38]

Today, at the peak (if not the beginning of the decline) of humanity's technoscientific mastery over nature, a coherent cosmology capable of guiding the adventure of civilization safely into the next millennium is just beginning to take root. Still, our knowledge remains fragmented, our society teetering on the brink of self- and world-destruction. What seemed like the cure for all ignorance in the 17th century has since become a curse. Our technoscientific way of knowing– constructed on the metaphysical assumption of the bifurcation of subject and object, fact and value, meaning and matter–threatens the continued existence of the community of life on Earth.

Beginning in the early 1920s, Whitehead interrogated modern science and industrialism, not to dismiss them,[39] but to remind them of what *they* had dismissed. He asks: "What has happened to us?" According to Stengers, this question is not an attempt to condemn scientific materialism for the wayward course of civilization, but is rather

> a resource for telling our stories in another way, in a way that situates us otherwise–not as defined by the past, but as able, perhaps, to inherit from it another way.[40]

Whitehead's creative retrieval of the history of natural philosophy is organized around a new concept of nature and a novel way of framing the activity of science. Instead of construing the task of science to be that of overcoming subjective illusion in order to reach objective reality, as many modern thinkers have done, Whitehead takes the speculative risk of defining nature otherwise: nature becomes, quite simply, "what we are aware of in perception."[41] "Everything perceived is in nature," says Whitehead, "We may not pick and choose."[42] This reframing of science's understanding of nature cannot be judged as "true" or "false" *a priori*; to judge it fairly, we must first trust it enough to take the "leap of the imagination"[43] it implies, waiting eagerly to see in what way it transforms experience. Passing judgment on the veracity of Whitehead's new concept of nature requires first deploying it, experimenting with its effects in the world, establishing its relevance to the values of actual life. Materialist enemies of his

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[38]Ibid., 181.

[39]"I assume as an axiom that science is not a fairy tale." *Concept of Nature*, 40.

[40]*Stengers,* 14.

[41]*Concept of Nature,* 28.

[42]Ibid., 29.

[43]*Process and Reality, 4.*

philosophy tend to lack the negative capability[44] required to pursue the consequences of Whitehead's unbifurcated image of the universe; they refuse to pay attention to what Whitehead's concepts make important. Instead, they remain bound within the limits of the same old poorly composed problems (e.g., "how does the brain secrete consciousness?", or "what sort of thing is curved space-time?"). Whitehead's cosmology and philosophy of science require the invention and deployment of novel concepts of space, time, causality, and consciousness. These concepts pose new problems for science, allowing it to become attentive to the relevance of both quantitative patterns *and* qualitative perceptions in the passage of nature, releasing it from the irrational and polemical desire to replace concrete experience with abstract explanation. In this sense, Whitehead's scientific method can be compared with Goethe's "gentle empiricism," which similarly rejected mechanical explanations, instead pursuing nature's reasons by learning to participate more fully in the archetypal patterns interwoven with experience itself.[45] "The divergence of [scientific] formulae about nature from the appearance of nature," argues Whitehead, "has robbed the formulae of any explanatory character."[46]

Equipped with a new kind of science, we can ask again, "What has happened to us?" We must be sensitive to both what Whitehead's concept of nature discloses and what it makes recede into shadow. In what way does it transform the adventures of science and civilization? What becomes important when the task of natural philosophy is not to explain away value, meaning, and subjectivity at all costs, but rather to avoid the bifurcation of nature at all costs? Whitehead's new concept of nature, should we commit ourselves to it, implies that

> the red glow of the sunset should be as much part of nature as are the molecules and electric waves by which men of science would explain the phenomenon.[47]

Whitehead's reframing of the task of science together with his redefinition of nature should not be construed as the imposition of limitations upon scientific knowledge. His aim is not to restrict what science can know, but to remind science what it already knows, and what its knowledge presupposes. By defining nature as "what we are aware of in perception," Whitehead explicitly brackets "mind" (i.e., "that which perceives") from nature. This bracketing is done in order to avoid struggling to answer badly formulated problems, such as the so-called "hard problem" of how the brain produces the mind. Posing such a problem immediately drags

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[44]"Negative Capability, that is, when a man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason." John Keats' letter to his brothers, December 22, 1817; available at http://www.poetryfoundation.org/learning/essay/237836?page=2 (accessed December 20, 2014).

[45] Arthur Zajonc, *Catching the Light: The Entwined History of Light and Mind* (New York: Oxford University Press, 1995)*, 203.*

[46]*Modes of Thought, 154.*

[47]Ibid.

science into metaphysics, into reflection upon "both what is perceived and what perceives."[48] Metaphysics seeks after the nature of nature beyond what we are aware of in perception, and so pursuing such questions would negate the speculative wager whose consequences for experience Whitehead's philosophy of science is trying to spell out. For now, says Whitehead, "we leave to metaphysics the synthesis of the knower and the known."[49] Later in his philosophical career, when he turns to full blown cosmological speculation, Whitehead will be forced to tackle such metaphysical issues; but in his early philosophy of science, he keeps his eye on the prize: a coherent foundation for our scientific knowledge of nature. From Whitehead's re-imagined point of view, the questions of science "do not enable [it] to formulate the problem of the 'mind' because these questions and their answers presuppose it."[50] Science is a way of knowing nature; therefore, the pursuit of knowledge of nature presupposes that there is a knower, i.e., a mind.

> Knowledge is ultimate. There can be no explanation of the "why" of knowledge; we can only describe the "what" of knowledge.[51]

If science is going to commit itself to the pursuit of knowledge of nature, there can be no going behind knowledge to explain it by some more fundamental activity (e.g., neurochemistry). The possibility of scientific explanation cannot itself be scientifically explained. Whitehead's decision to bracket mind from what we are aware of in perception is not the same as the materialist's decision to bifurcate nature into primary (physical-scientific) and secondary (psychological-aesthetic) qualities. Instead of turning science against commonsense experience through "heroic feats of explaining away,"[52] Whitehead defines the truth of science in terms of its experimental achievements and experiential disclosures.[53] The numinous glow of the sunset as experienced by the poet comes again to be rooted in nature, no less an aspect of what we come to be aware of in perception than the wavelengths of the photons detected by the sophisticated instrumentation of the physicist. The data of science, no matter how abstract and seemingly removed from everyday experience, must ultimately be translatable back into

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[48]*Stengers*, 34-36.

[49]Ibid., 49; *Concept of Nature* 28.

[50]*Stengers*, 35

[51]*Concept of Nature*, 32.

[52]*Process and Reality, 23.*

[53]Or in William James' terms (a major influence on Whitehead), scientific truth becomes subject to the tests of pragmatism and radical empiricism, respectively.

some operational technique or direct observation. "If the abstractions [of science] are well-founded," says Whitehead,

> that is to say, if they do not abstract from everything that is important in experience, the scientific thought which confines itself to these abstractions will arrive at a variety of important truths relating to our experience of nature.[54]

The "photon," for example, is not just an invention of the physicist, nor is it simply a fact of nature. The photon is what the physicist has come to be aware of in his or her perception of light as a result of certain replicable experiments, laboratory technologies, theoretical images, and mathematical equations. The photon, as a scientific-object, is said to be abstract only in that it cannot be grasped in isolation from the "whole structure of events" or "field of activity" (i.e., the creative advance of nature) to which it belongs and through which it endures.[55] From the perspective of Whitehead's philosophy of science, the abstract will never be able to offer a satisfactory explanation for the concrete.[56] The wavelength of a photon does not explain the perception of redness, nor does even a connectionist model of neurochemistry explain the artist's aesthetic encounter with a beautiful sunset. Whenever scientific materialists try to provide such heroic explanations, they succeed only in offering descriptive commentaries in terms of the scientific objects most fashionable in their time–commentaries that presuppose the very thing they pretend to have explained away: consciousness. The only valid method of explanation from Whitehead's point of view is the reverse of the materialist's, an explanation which traces the genesis of abstractions back to the concrete consciousness and perceptual presences from which they emerged.[57] A science that seeks to explain the concrete by way of the abstract all too easily falls prey to a form of knowledge production whose adequacy is judged instrumentally, i.e., in terms of its capacity to *transform* and *control* nature, rather than ecologically, i.e., in terms of its capacity to *understand* and *relate* to nature.

Whitehead's aim in pursuing the philosophy of science was largely in service of pragmatic experience and commonsense: he sought to leap across and straddle the fissure bifurcating nature into the facts of physical reality on the one side and the values of psychical appearance on the other.[58] In order to achieve this end, he struggled to imagine a participatory mode of attending to nature–a nature no longer objectified into the inert stuff instrumentally manipulated by an alienated technoscientific mode of knowing. Instead, Whitehead sought to disclose nature to awareness as a community of relationships shaped by the social desires and individual decisions of living organisms. Organisms cannot be characterized merely by mass, extension, and velocity; they are creatures enjoying the value of their own experience, which

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[54] *Science and the Modern World*, 58.

[55] *Concept of Nature,* 170-171.

[56] *Stengers*, 99.

[57] Ibid., 110.

[58] Ibid., 38.

itself is initially inherited from the feelings of others. Contrary to Galileo, Descartes, and Newton, Whitehead's vision of the cosmos is ecological: the final real things are individual living organisms, each dependent on their relationships to others for their continued existence as themselves.

By the late 1920s, Whitehead had given up on the problems that framed his earlier inquiry into the philosophy of science in order to pursue the riskier adventure of metaphysics. "Riskier" because "the recourse to metaphysics is like throwing a match into the powder magazine. It blows up the whole arena."[59] For the later, more explicitly metaphysical Whitehead, "mind" can no longer be bracketed from a neatly delimited "nature." The imaginative enjoyment of the poet and the intellectual reflection of the theoretician resulting from the beauty of the setting sun must themselves be understood as ingredient in the creative advance of the universe. Mind must find its foothold in the midst of things themselves, an inhabitant of nature and not its transcendental knower. In the next section, I further unpack Whitehead's venture beyond the philosophy of science into the formidable project of constructing a coherent cosmology justifying the civilized phases of human society.

[59]*Concept of Nature*, 29.

WHITEHEAD'S ONTOLOGY OF ORGANISM

Lo! keen-eyed, towering Science!
As from tall peaks the Modern overlooking,
Successive, absolute fiats issuing.

Yet again, lo! the Soul -- above all science;
For it, has History gather'd like a husk around the globe;
For it, the entire star-myriads roll through the sky.

In spiral roads, by long detours,
(As a much-tacking ship upon the sea,)
For it, the partial to the permanent flowing,
For it, the Real to the Ideal tends.

For it, the mystic evolution . . . .

—Walt Whitman[60]

Everything happens for the first time, but in a way that is eternal.

—Jorge Luis Borges[61]

From Whitehead's perspective, a successful cosmological scheme should aim to exhibit itself "as adequate for the interpretation of . . . the complex texture of civilized thought."[62] To this end, the cosmologist's central motivation must be

> to construct a system of ideas which brings the aesthetic, moral, and religious interests into relation with those concepts of the world which have their origin in natural science.[63]

Already an important difference can be marked between contemporary scientific cosmology and Whitehead's more philosophical (and cosmotheandric) approach to cosmologizing. Following his metaphysical turn in the late 1920s, Whitehead sought nothing less than the integration of our artistic, religious, and scientific intuitions into one general scheme of thought. The typical aim of the modern scientific cosmologist, even when they claim to be pursuing a "grand unifying theory," or "theory of everything," is obviously far less integral in

[60]Whitman, "Song of the Universal," in *Leaves of Grass* (New York: Barnes and Noble Classics, 1892/2004), 380.

[61]Jorge Luis Borges, "Happiness," trans. Stephen Kessler, in *Selected Poems*, ed. Alexander Coleman (New York: Penguin, 1999), 441-42.

[62]*Process and Reality*, xi.

[63]Ibid., xii.

scope: only the empirico-mathematical features of the physical world are given systematic treatment, while everything else, no matter its importance to civilized human life, is, at best, bracketed as irrelevant, and at worst, explained away as illusory. The specialized operational/instrumental methods of contemporary scientific cosmology have allowed it to precisely measure and carefully dissect much of the known world, but the materialistic ontology providing its imaginative background has lead it to "exclude itself from relevance to the ordinary stubborn facts of daily life."[64] For example, average law-abiding citizens must go about their day under the assumption that they bear some responsibility for their actions, despite the fact that materialistic interpretations of neuroscience leave no room in the brain for anything remotely resembling consciousness, much less free will. Scientific materialism leaves us in the impossible position of having to affirm in theory what we are unable to deny in practice.

Whitehead had little doubt that the technological applications of modern science would continue to transform civilization. Technologically speaking, science is only becoming more intensely relevant to daily life. Indeed, the technological applications of science have come to dominate not only human life, but the entire Earth community. It cannot be denied that the increase in physical power which has resulted from rapid technoscientific advance has afforded civilization the opportunity for social betterment; but it has also brought us perilously close to destroying ourselves.[65]

"It may be," says Whitehead,

> that civilization will never recover from the bad climate which enveloped the introduction of machinery . . . . The world is now faced with a self-evolving system, which it cannot stop.[66]

As was discussed earlier, modern technoscience has excelled at transforming and controlling what it has not adequately understood and cannot morally or aesthetically appreciate. The scientistic presupposition that "matter in motion is the one concrete reality in nature," such that "aesthetic values form an . . . irrelevant addition," has proven itself to be an error of disastrous proportions.[67] It is precisely this materialistic ontology and its accompanying instrumentalist epistemology that Whitehead's cosmological scheme endeavors to re-imagine. Instead of pursuing science in abstraction from the values of earthly life, Whitehead's cosmology seeks to replace the traditional scientific conception of *mechanism,* along with the traditional religious conception of *deism,* with a novel conception of *organism.* With mechanistic substance as its foundational concept, modern science's bifurcation of nature into

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[64]*Process and Reality*, xiii.

[65]*Science and the Modern World*, 182-183.

[66]Ibid., 181,183.

[67]Ibid., 182.

objective natural facts and subjective human values is inevitable. With a conception of organic process as his starting point, Whitehead is able to articulate a cosmology whose details elucidate, rather than eliminate, the common sense values of civilized life, such as moral responsibility, aesthetic appetition, and veritable knowledge (or goodness, beauty, and truth, respectively).

"If nature really is bifurcated," argues another of Whitehead's contemporary interpreters, Bruno Latour,

> no living organism would be possible, since being an organism means being the sort of thing whose primary [physical] and secondary [psychical] qualities–if they exist–are endlessly blurred.[68]

Whitehead's philosophy of organism rejects the bifurcation of such qualities, as well as any type of arbitrary ontological dualism. Nonetheless, it must be admitted that the widespread acceptance of dualism during the modern period implies that, as an abstract scheme, it can prove elucidatory of the texture of experience in some instances. Whitehead criticizes Descartes' mind/ matter dualism for its incoherence due to excessive abstraction, but adds that "[his] system obviously says something that is true."[69] Whitehead appropriates much from the modern natural philosophical tradition, all the while keeping in mind that "the chief error in philosophy is overstatement."[70] By way of his method of imaginative generalization, Whitehead is lead to experimentally construct[71] an alternative cosmological scheme that is ultimately rooted in *creative process,* rather than *static substance,* and whose fundamental categories are *actual occasions, prehensions,* and *eternal objects,* rather than *minds, representations,* and *matter.* The dualistic Cartesian problematic is not thereby eliminated or explained away; rather, it is transformed.[72] The relationship between actual occasions and eternal objects is no longer one of *duality,* where neither kind of entity requires the other in order to exist, but of *polarity,* such that the being of eternal objects cannot be grasped in abstraction from the becoming of actual occasions, or vice versa. Whitehead avoids the modern bifurcation of nature (which restricts experiential value only to the human sphere and relegates everything non-human to the status of "vacuous actuality"[73]) by recognizing that every organic occasion or ecosystem of occasions–whether it be an electron, a bacterial

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[68]Bruno Latour, foreword to *Stengers*, xiii.

[69]*Process and Reality, 6.*

[70]Ibid., 7.

[71]His method is experimental in that it redesigns the philosophical instrument of language "in the same way that, in physical science, pre-existing appliances are redesigned." Ibid., 11.

[72]Ibid., 108.

[73]The bifurcation may be thus *anthropocentric,* or it may, when pressed, become *biocentric,* such that it restricts value to the biological sphere, thereby denying it to the physical or cosmic as such.

colony, a sequoia, a bottle-nosed dolphin, a human civilization, a star, or stellar society (a galaxy)–is constituted by both a physical pole inheriting the feelings of realized actual facts and a mental pole anticipatory of realizable eternal possibilities.

As for the special significance of the human sphere, the *conscious* mental pole of "high grade" organisms like Homo sapiens is said to be so advanced in *degree* that it appears also to become different in *kind.* Whitehead is able to preserve what is elucidatory in the binary theocosmic or cosmoanthropic formulations of reality while at the same time jettisoning the substantialist ontology that would draw them back into the modern bifurcation dissecting the living body of the cosmos straight down the middle.[74] The philosophy of organism avoids having to invoke incoherent accounts of the emergence of mind from matter, or value from vacuity, by recognizing that conscious human experience is only a special case of a more general, or cosmic, mode of experience. For Whitehead, to exist at all is already to experience, and to experience is to value:

> Realization is . . . in itself the attainment of value. . . . Aesthetic attainment is interwoven [with] the texture of realization.[75]

While the orthodox materialistic natural philosophy begins by assuming the two independently existing substances, mind and matter–where material objects are modified by external relations of locomotion, and mental subjects are modified by internal (or private) cogitations representative of external (or public) objects–Whitehead's philosophy of organism begins with "the analysis of process as the realization of events disposed in an interlocked community."[76] Actual occasions, as the final realities of which the universe is composed, are self-creating buds of experience, each one uniquely itself even while it remains internally related to every other occasion in the creative community of the universe. Occasions are interrelated by way of the pattern of eternal objects characterizing for each of them the qualitative aspects of the other occasions in their community. Eternal objects "interpret [occasions], each to the other,"[77] such that they come to find themselves related to one another in an extended space-time continuum according to certain invariant geometric principles,[78] principles which are explored in a subsequent section in the context of a discussion of Whitehead's philosophical critique of Einstein's relativity theory.

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[74]*Science and the Modern World*, 132.

[75]Ibid., 89-90.

[76]Ibid., 138.

[77]Ibid., 137.

[78]Ibid., 145.

"The solidarity of the universe," writes Whitehead, "is based on the relational functioning of eternal objects."[79] As relational entities, eternal objects cannot themselves *cause* actual occasions, they can only characterize the *how* of prehension. "[Eternal objects] are adverbial, rather than substantive," according to Whiteheadian interpreter Steven Shaviro, in that "they determine and express *how* actual [occasions] relate to one another, take one another up, and 'enter into each other's constitutions.'"[80] Each actual occasion is, in this sense, nothing but the multiplicity of prehensions of other occasions (as characterized adverbially by eternal objects) which it unifies. But in another sense, as a self-unifying creature, an occasion not only prehends and reiterates the realized spatiotemporal pattern of the settled past, it adds a new value (itself) to the ongoing evolution of the universe. Whitehead coined the term *concrescence* to refer to the "production of novel togetherness" resulting from the completed satisfaction of each occasion of experience.[81] By way of concrescence, a particular actual occasion's many prehensions of other occasions becomes one, thereby adding one more realized unity of experience to the ongoing creative advance of the cosmic community: "The many become one, and are increased by one."[82]

It is important not to think of prehension resulting in an actual occasion "having" experience of other occasions, as though an occasion were "the unchanging subject of change."[83] This would inevitably lead back to the classical, bifurcated conception of mental subjects qualified by their private representations of supposedly public material objects. "If this be granted," argues Whitehead, "there is no escape from solipsism."[84] It was only by arbitrary recourse to the goodness of an omnipotent God that Descartes was able to re-establish any meaningful epistemic connection between ideas in the soul and matters of fact in nature. For the philosophy of organism, an actual occasion is not a pre-existent subject qualified by its representations of ready-made objects; rather, an occasion is better characterized as a dipolar "subject-superject."[85] The "subject" phase of a concrescing occasion emerges from the prehensions of antecedent occasions which it unifies, while in the "superject" phase the occasion, having attained satisfaction as a unified drop of distinctly patterned experience, immediately perishes into "objective immortality," such that it can be prehended by subsequently concrescing actual occasions. Whitehead expresses the perpetual perishing of

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[79]Ibid., 137.

[80]Steven Shaviro, *Without Criteria: Kant, Whitehead, Deleuze, and Aesthetics* (Cambridge: The MIT Press, *2009), 37;* quoting *Process and Reality, 148-149.*

[81]*Process and Reality*, 21.

[82]Ibid.

[83]Ibid., 29.

[84]*Science and the Modern World*, 137.

[85]*Process and Reality, 29.*

subjectivity into objective immortality in terms of his "principle of relativity," such that "it belongs to the nature of a 'being' that it is a potential for every 'becoming.'"[86]

Actual occasions, then, are describable in two ways, as "being" and as "becoming." These ontological designations are not independent, since, according to Whitehead's correlative "principle of process," an occasion's "being" arises from its "becoming": *"how* an actual [occasion] *becomes* constitutes *what* that actual [occasion] *is*."[87] The description of an occasion according to its genetic "becoming" provides an account of the occasion's own subjective aim (its final cause), while the description according to its extensive "being" provides an account of its superjective effect as prehended by other occasions beyond itself (its efficient cause).

By conceiving of the basic constituents of the world as unified prehensive processes of causal inheritance and conceptual anticipation, rather than static, isolated substances qualified by accidental predicates, Whitehead is able to preserve the unique identity of each individual organism without at the same time so exaggerating their separateness that continuity with the larger ecosystem of other organisms is broken.

Thus far, my account of the fundamentals of Whitehead's philosophy of organism has been rather abstract, which is to say purely *metaphysical;* but before moving on to further explicate its implications in the context of contemporary *physical* theory, it may be helpful to examine exactly what role *abstraction* itself plays in Whitehead's cosmological scheme.

"In any occasion of cognition," says Whitehead,

> that which is known is an actual occasion of experience, as diversified by reference to a realm of entities which transcend that immediate occasion in that they have analogous or different connections with other occasions of experience.[88]

Whitehead here makes reference to the realm of "eternal objects," or "pure potentials," which "connote a kind of cosmic geometrical/genetic code."[89] The eternal objects contribute to the definiteness of actual occasions without themselves being reducible to the experience of any particular occasion, since "eternal objects are the same for all actual [occasions]."[90] Many contemporary thinkers, laden with the nominalistic presuppositions of the modern age, come to Whitehead's metaphysics expecting everything to be explained according to immanent

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[86]Ibid., 22.

[87]Ibid., 23.

[88]*Science and the Modern World, 142-143.*

[89]Catherine Keller, *Face of the Deep: A Theology of Becoming* (London: Routledge, 2003), 198.

[90]*Process and Reality*, 23.

process alone. They are surprised by his introduction of the hierarchy of eternal objects, not to mention the divinity envisaging it, both of which can at first seem to be rather *ad hoc* additions to his cosmology. Whitehead introduces them, however, with the aim of maintaining the overall coherence of his scheme. He writes:

> It is the foundation of the metaphysical position which I am maintaining that the understanding of actuality requires a reference to ideality. The two realms are intrinsically inherent in the total metaphysical situation.[91]

Once again displaying his allegiances both to mathematical physics and to poetry, Whitehead recognizes that "the interfusion of events" constituting cosmogenesis participates in eternity as much as time, being infected as much by the values of actual nature as by the ghostly traces of "colors, sounds, scents, [and] geometrical characters . . . required for nature and . . . not emergent from it."[92] Only actuality has value, but in order for "actual value" to find its metaphysical definition, some reference to the adjacent possibilities provided by ideality is necessary. Each actual occasion of experience realizes itself as a complex unity of valued patterning; this patterning displays itself as a subjective harmonization of the prehended superjective values achieved in the occasion in question's causal past. The experiential achievement of some more or less complex unity of patterning is only felt as valuable to the occasion which realizes it because this occasion simultaneously feels, via the divinely envisaged gradation of the infinite set of eternal objects as they are relevant to its unique situation, those definite possibilities which remain abstract because unrealized in its concrescence. In other words, a drop of experience

> is decisive in proportion to the importance (for it) of its untrue propositions: their relevance to the [occasion] cannot be dissociated from what the [occasion] is in itself by way of achievement.[93]

Each occasion becomes what it is by not being what it isn't. Whitehead is able to avoid a dualism between actuality and ideality by showing how the realization of definite concrete values requires the ingression of what "is not" alongside the prehension of "what is." In this sense, the prehension of actuality and the ingression of possibility cannot be defined in isolation.[94] Each must require the other if a coherent account of both the solidarity and the separability of the universe is to be articulated. Eternal objects have a "twofold role," in that they both relate occasions to each other (allowing the creative many to become the one created universe) and unify occasions for themselves (allowing the one universe to become

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[91] *Science and the Modern World*, 143.

[92] Ibid., 97.

[93] Ibid., 143.

[94] *Stengers*, 189.

many again). The open-ended creative advance of the actual universe in this way depends on both conjunction and disjunction, both unification and differentiation.[95]

Having crowned creativity "the universal of universals characterizing ultimate matter of fact," Whitehead needed to account for the unique character of more mundane matters of fact (i.e., finite actual occasions). How is the infinite creativity conditioning the universe to be canalized into the decisive prehensions and relevant evaluations characterizing the concrescence of each of its unique, finite creatures? To answer this question, Whitehead was lead to bring forth a novel concept of divinity. The only difference between God and every other actual occasion is that divine experience appears to occur in the reverse direction to that of finite experiences, such that God's mental pole is primary while God's physical pole is consequent.[96] God's mental pole is described as the primordial creature of creativity, the first act of unfettered conceptual valuation responsible for ordering the realm of eternal objects. God is thus simultaneously a creature of Creativity and, by its persuasive influence on the decisions of finite actual occasions, a condition limiting the otherwise chaotic potency of Creativity.

> By reason of this complete valuation, the objectification of God in each derivate actual [occasion] results in a graduation of the relevance of eternal objects to the concrescent occasion in question. . . . Apart from God, eternal objects unrealized in the actual world would be relatively non-existent for the concrescence in question.[97]

God, as the "primordial superject of creativity," is the first fact giving any definite face to the otherwise impersonal creative advance. God's primordial nature assures that every finite occasion of experience subsequent to God's initial act of envisagement includes in its physical prehension of the actual world a conceptual prehension of the realm of possibilities *as relevant to it*. In this way, those abstract potentials remaining as yet unrealized in a particular occasion's actual world nonetheless find their definite relation to that occasion and its world without having to float into their situation from nowhere.[98] According to Whitehead's "ontological principle," "the general potentiality of the universe must be somewhere . . . this 'somewhere' is the non-temporal actual entity": God.[99]

As was already mentioned, God is a dipolar actual occasion like every other, "finding [itself] in the double role of [agent] and [patient] in a common world."[100] God's primordial envisagement

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[95]*Process and Reality*, 21.

[96]Or perhaps it is finite experience that appears backwards?

[97]*Process and Reality*, 31.

[98]Ibid., 32.

[99]Ibid., 46.

[100]Ibid., 315.

of eternal objects occurs in abstraction from finite actual occasions; it is accomplished by God alone. As such, the primordial aspect of God's nature remains deficient in actuality. While the abstract order of creation depends upon God's agential "adjustment of the togetherness of eternal objects," the concrete values of creation depend upon the "infinite patience" of God's consequent pole, God's "tender care that nothing be lost."[101] God experienced in full concreteness (i.e., as a living, cosmic personality) is not the distant unmoved mover or all-powerful creator of traditional religious metaphysics, but the poet and lover of the world, "the fellow-sufferer who understands."[102] Whitehead's imaginative description of God has more in common with the intermediary World-Soul of Plato's *Timaeus* than it does with the "wholly transcendent" Jehovah of Newton's *Scholium*, "creating out of nothing [by fiat] an accidental universe."[103] I continue the comparison between Whitehead's God and Plato's World-Soul in the final section of this essay. The next section concerns the relevance of Whitehead's philosophy of organism to evolution, relativity, quantum, and complexity theories, each in turn.

[101]Ibid., 346.

[102]*Process and Reality*, 346, 351.

[103] Ibid., 95.

WHITEHEAD AND CONTEMPORARY SCIENTIFIC THEORY

> *The general principles of physics are exactly what we should expect as a specific exemplification of the metaphysics required by the philosophy of organism.*
>
> —Whitehead[104]

Since its eruption in the 17th century, modern science has instigated profound re-orientations in the outlook and self-conception of European civilization. More recently, in the last century and a half, various discoveries have forced upon science the need for no less fundamental a transformation of its own presupposed materialistic-mechanistic ontology. This transformation, understood in the light of Whitehead's organic ontology, is the focus of this section. To begin, let us take stock of what has happened: In 1859, Darwin published *On the Origin of Species*, wherein he described, according to the special abstractions proper to biology, a process which would later come to be known more generally as the theory of evolution:

> 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.[105]

In the early 1880s, while Whitehead was still a student of mathematics at Cambridge, "physics was supposed to be nearly a closed subject," with just a few minor details left to be explained in terms of Newton's fundamental principles. "No one sensed what was coming," according to Whitehead: "By 1900, the Newtonian physics were demolished, done for!"[106] The whole notion of fixed laws of nature imposed upon the behavior of ready-made material particles in absolute time and space, which Darwin's mechanistic biology took for granted as its foundation, had been called into question by relativity and quantum theories. "The appeal to mechanism on behalf of biology," wrote Whitehead in 1925,

> was in its origin an appeal to the well-attested self-consistent physical concepts as expressing the basis of all natural phenomena. But at present there is no such system of concepts.[107]

Arguably, almost a century after Whitehead's remark, physical science still lacks anything approaching such a systematic account of nature. While several candidate theories uniting relativistic and quantum effects have been proposed, due to lack of empirical confirmation or mathematical coherence, none of them has succeeded in garnering the widespread support of

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[104] Ibid., 116.

[105] Charles Darwin, *The Origin of Species* (New York: Barnes and Noble Classics, 1859/2004), 384. Darwin added the words "by the Creator" in the second edition.

[106] Lucien Price, *The Dialogues of Alfred North Whitehead* (New York: Mentor, 1954), 277.

[107] *Science and the Modern World*, 97.

the physics community. Quantum electrodynamics (QED) is generally understood to have successfully unified quantum mechanics with at least special relativity, but because it leaves out gravitational effects, and because its approach remains largely *instrumental*, it does little in the way of providing a truly unifying theory of nature.[108] According to physicist Leon Lederman,

> Gravity is our number one problem as we attempt to combine particle physics with cosmology. . . . Here we are like the ancient Greeks, waiting and watching for something to happen, not able to experiment. . . . Without bringing the gravitational force into the family of quantum forces, we'll never understand the details of the Big Bang or, in fact, the deep, deep structure of elementary particles.[109]

Though it remains mechanistic in orientation, QED, unlike 19th century physics, can longer claim that its mechanical accounts reflect a reality independent of its experimental instruments. What was originally a mechanistic *ontology* meant to explain nature has become a mechanistic *epistemology* meant to operationally describe it; as a result, metaphysical realism in science has devolved into nominalism. This allows instrumentalist approaches to quantum mechanics to avoid the philosophical challenge of having to integrate the spooky paradoxes of wave/particle duality and non-locality into their hypothesized materialist ontology. Instead, as Whiteheadian physicist Michael Epperson suggests, instrumentalists can defer their philosophical failings by invoking the fact that "quantum mechanics is simply a tool used to predict the outcomes of measurements under specific conditions."[110] Even if its mechanistic models cannot be unambiguously proven to reflect the reality of nature in itself, "nature" (whatever it is) can be made, at least under laboratory conditions, to agree with QED's operational predictions to an extremely high degree of statistical accuracy. According to philosopher of science Karl Popper, this instrumentalist mindset among physicists is a result of a lack of respect for the importance of philosophy in framing the way problems are posed in physics: "It is a tradition which may easily lead to the end of science and its replacement by technology."[111]

Supposing a properly physical (if not fully metaphysical) "grand unifying theory" is eventually discovered, there still remains the philosophical problem of unifying physics with biology, psychology, and spirituality. During the latter half of the 20th century, a number of explanatory and descriptive strategies began to be developed in an attempt to tackle aspects of this problem, all of which could be said to fall under the general umbrella of complex systems theory. Many of these scientific approaches to theretofore intractable philosophical problems

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[108]Lederman, *The God Particle: If the Universe is the Answer, What is the Question?* (New York: Mariner Books, 2006), 277.

[109]Ibid., 99.

[110]Epperson, *Quantum Mechanics and the Philosophy of Alfred North Whitehead* (New York: Fordham, 2004), 33.

[111]Karl Popper, *Quantum Theory and the Schism in Physics* (New Jersey: Rowman and Littlefield, 1956), 100.

became possible, not because humanity suddenly developed a finer imagination, but rather because we developed finer technological instruments.[112] Computer modeling now provides scientists with God-like powers of simulation; however, deep philosophical issues remain regarding how such simulations can be said to relate to reality.

Keeping the limits of modeling in mind, the key concept that has arisen out of work on complexity theory is undoubtedly that of *emergence*. Simply defined, emergence is that process by which the components of a system begin to interact in such a way that the behavior of the system *as a system* can no longer be understood by reduction to the sum of its components. Even more succinctly put, emergence is said to have occurred whenever a whole exhibits properties which are greater than the sum of its parts. The most recent attempt to unify the emergent stages of nature by applying the principles of complexity is that of biological anthropologist Terrence Deacon in his book *Incomplete Nature: How Mind Emerged from Matter* (2012). Regarding the history of the concept of emergence, Deacon writes that

> it has been used to describe the way that living and mental processes depend upon chemical and physical processes, yet exhibit collective properties not exhibited by non-living and non-mental processes, and in many cases appear to violate the ubiquitous tendencies exhibited by these component interactions.[113]

Deacon's path-breaking scientific work in this area provides an ideal comparison with Whitehead's philosophy of organism, in that both seek to articulate a processual account of the universe no longer restricted to the efficient causes of strict mechanism, or to the nominalist epistemology of instrumentalism, but open to the creative organic influence of formal and final causality. The two also provide an ideal contrast, in that they each set out to think nature on somewhat different metaphysical footing. Whitehead begins his path by balancing his thinking upon the speculative stance that *experience* pervades the natural world, which is to say that a universally communicated texture of experience links everything in the cosmos.[114] Deacon begins his climb toward knowledge of nature from a somewhat off-kilter panmaterialist posture that assumes experience and value (in his terms, "ententionality") emerge atop a basically purposeless material flux. Despite their differing philosophical presuppositions, it is nevertheless possible to re-interpret Deacon's scientific contribution as a specific application of Whitehead's more general cosmological scheme. In other words, despite Deacon's dissatisfaction with panexperientialism, without something like Whitehead's radical reconstruction of the metaphysical foundations of scientific materialism, Deacon's account of the emergence of biotic and psychic phenomena from physics and chemistry remains literally *incomplete*. Deacon's and Whitehead's approaches are compared and contrasted in more detail in a later subsection. The philosophical commitments differentiating their approaches to the

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[112]*Science and the Modern World*, 107.

[113]Terrence Deacon, *Incomplete Nature: How Mind Emerged from Matte*r (New York: W. W. Norton, 2012), 549.

[114]*Process and Reality*, 4.

emergence of complexity should become clearer if I first unpack Whitehead's startlingly novel interpretations of 20th century physics and his cosmological generalization of evolutionary theory.

The Imaginative Generalization of Evolutionary Theory

> *In the most literal . . . sense the lapse of time is the renovation of the world with ideas. [The universe is] passing with a slowness, inconceivable in our measures of time, to new creative conditions, amid which the physical world, as we at present know it, will be represented by a ripple barely to be distinguished from non-entity.*
>
> —Whitehead[115]

The main outlines of the doctrine of evolution, on Whitehead's reading, must be "[absorbed] as the guiding methodology of all branches of science."[116] Grasping the transdisciplinary significance of evolution requires the "negative capability" mentioned earlier, a willingness to consign oneself to the speculative risks Whitehead's philosophy of organism has proposed for thinking. Because all our knowledge depends upon abstraction, the point is not to avoid it but to do it gently, such that our knowing leaves the concrete life of the world unharmed and intact. Whitehead's contribution to the philosophical integration of the special sciences and their abstract domains of relevance is derived from what he calls his method of "imaginative generalization." Metaphysics is the imaginative attempt to express in language the most general features of experience, and therefore, of nature. Every special science devises its own instruments: the instrument of metaphysics, the science of sciences, is language.[117] Like physics, metaphysics should be undertaken as an experimental practice, only the experiments are to be performed on language itself. "The success of the imaginative experiment," according to Whitehead, "is always to be tested by the applicability of its results beyond the restricted locus from which it originated."[118]

In the case of the connection between evolutionary theory and the new physics, Whitehead's experiment is to imaginatively generalize Darwin's specialized concepts of variability, reproduction, and inheritance, such that evolution comes to describe the activity of self-organizing entities at every scale of nature, no longer just the biological. In this sense, as was mentioned earlier, biology becomes the study of the evolution of the larger organisms, while

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[115]Whitehead, *Religion in the Making* (Edinburg: Cambridge University Press, 2011), 100, 144 (originally published 1926).

[116]*Science and the Modern World*, 101.

[117]*Process and Reality*, 11.

[118]Ibid., 5.

physics becomes the study of the evolution of the smaller organisms.[119] "I am . . . a thoroughgoing evolutionist," says Whitehead,

> Millions of years ago our earth began to cool off and forms of life began in their simplest aspects. *Where did they come from?* They must have existed in potentiality in the most minute particles, first of this fiery, and later of this watery and earthy planet.[120]

Einstein's famous equation $E=MC^2$ demonstrates that "mass [is] the name for a quantity of energy considered in relation to some of its dynamic effects"; this leads, according to Whitehead, to the displacement of matter by energy as the most fundamental concept in physics. But what is energy other than

> the name for the quantitative aspect of a structure of happenings [a structure] that depends on the notion of the functioning of an organism?[121]

That is, if energetic activity is to be understood in its full concreteness, and not just as mathematical functions in an abstract equation, then some reference must also be made to the mental functions of the self-realizing but prehensively interrelated creatures of the actual world (i.e., to purposeful organisms in an ecology). Whitehead explains:

> Evolution, on the materialistic theory, 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. . . . There can merely be change, purposeless and unprogressive [and] there is material [or energy] which endures. On the organic theory, the only endurances are structures of activity, and the structures are evolved [units of emergent value].[122]

After Whitehead's imaginative generalization, evolution by the reproductive inheritance of variations under selective pressure becomes evolution by the rhythmic propagation, or vibratory reiteration, of actual occasions along historically organized routes, whereby a specific occasion's conformal physical prehensions of past actualities (the cause of structural inheritance) become synthesized with its novel conceptual prehensions of future possibilities (the source of structural variation) into some enduring pattern of experiential value. In other words,

> There is a rhythm of process whereby creation produces natural pulsation, each pulsation forming a natural unit of historic fact.[123]

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[119] *Science and the Modern World*, 97.

[120] Price, 277.

[121] *Science and the Modern World*, 96.

[122] Ibid., 101.

[123] *Modes of Thought*, 88.

These processes of evolutive concrescence "repeat themselves to the crack of doom in the creative advance from creature to creature."[124] Whereas in the Darwinian version of the theory, a pre-existent environment of inert material in empty space is considered to be the sole source of selective pressure, in the Whiteheadian version, organisms are understood to be co-creators of their own environments.[125] Also, whereas in the Darwinian theory the competitive struggle for existence is considered the primary engine of evolution, in the Whiteheadian version, cooperative interaction becomes the essential factor for long-term survival. Wherever resilient ecosystems are found, whether at the atomic, biotic, or anthropic level, it is evident that their success is a result of an association of organisms "providing for each other a favorable environment."[126] Whitehead offers a descriptive example of the evolution of atomic ecologies:

> Thus just as the members of the same species mutually favor each other, so do members of associated species. We find the rudimentary fact of association in the existence of the two species, electrons and hydrogen nuclei. The simplicity of the dual association, and the apparent absence of competition from other antagonistic species accounts for the massive endurance which we find among them.[127]

In the image of the cosmos constructed by the philosophy of organism, evolution comes to refer not only to the process of biological speciation in the earthly mesocosm, but also to wider micro- and macrocosmic ecologies of individualizing energetic activity. Evolution, in its most general outlines, is a theory relevant to the entire scope of cosmic history. Just as Copernicus' heliocentric theory threw Earth into motion, thereby turning the medieval world upside-down, under the new requirements of the evolutionary theory, the sturdy mechanistic cosmos of modernity has been turned inside-out, revealing an organic cosmogenesis creatively advancing through emergent stages of organization. Cosmogenesis, resting on the infinite potential of literally *nothing* (i.e., the quantum vacuum), has since its eruption been rushing toward more and more complex forms of realization over the course of billions of years.

Cosmic evolution began with the "primordial Flaring Forth," after which the earliest generation of primate organisms emerged out of the "cosmic fecundity" of the quantum vacuum.[128] In Whitehead's philosophy of organism, this fecundity finds its place as the ultimate principle of his metaphysical scheme: Creativity. Creativity is "universal throughout actuality," such that it eternally pervades creation to infect each and every one of its creatures with sparks of

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[124] *Process and Reality*, 228.

[125] *Science and the Modern World*, 105.

[126] Ibid., 104.

[127] Ibid., 104-105.

[128] Brian Swimme and Thomas Berry, *The Universe Story: From the Primordial Flaring Forth to the Ecozoic Era, A Celebration of the Unfolding of the Cosmo*s (San Francisco: Harper, 1992/1994), 21.

potentiality.[129] As the geologian Thomas Berry and the evolutionary cosmologist Brian Swimme suggest,

> Though the originating power gave birth to the universe fifteen billion years ago, this realm of power is not simply located there at that point in time, but is rather a condition of every moment of the universe, past, present, and future.[130]

In Whitehead's scheme, even God is creaturely, and therefore conditioned by the power Creativity. As discussed in the last section, Creativity is also conditioned or concretized in turn by God's all-embracing valuation of the multiplicity of potentialities, thereby providing each finite organism with erotic lures encouraging the sort of harmonious functioning that has led to the stages of enduring societal organization characteristic of the universe.[131]

Whitehead's organic primates–or, speaking metaphysically, actual occasions–cannot be understood in isolation; like all biological creatures on Earth, with both their ecological relations in the present and their evolutionary relations in the past, primate organisms are bound together as co-creators in a multiform cosmogenetic community, all of which emerged from one original unfathomably powerful energy-event. "At the base of the serene tropical rainforest," write Berry and Swimme,

> sits this cosmic hurricane. At the base of the seaweed's column of time is the trillion-degree blast that begins everything. All that exists in the universe traces back to this exotic, ungraspable seed event, a microcosmic grain, a reality layered with the power to fling a hundred billion galaxies through vast chasms in a flight that has lasted fifteen billion years. The nature of the universe today and of every being in existence is integrally related to the nature of this primordial Flaring Forth.[132]

The primitive beings which first emerged from the Flaring Forth have come since Whitehead's day to be known by the standard model of particle physics as the muon and tau leptons, along with the charm, strange, top, and bottom quarks, collectively called the fermions.[133] These fundamental organisms have mostly evolved, or decayed, since the Big Bang into the more familiar electrons, protons, and neutrons which make up (as organelles, so to speak) the larger atomic organisms of the periodic table of elements. Left out of this picture are the bosons, or force carriers, like gluons, photons, and the as yet undetected graviton. In Whitehead's organic terms, bosons and fermions can be described according to the two types of vibration,

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[129]*Process and Reality*, 164.

[130]Swimme and Berry, 17.

[131]*Process and Reality*, 244.

[132]*Swimme and Berry,* 21.

[133]Lederman, 62.

"vibratory locomotion" and "vibratory organic deformation."[134] Organic deformation describes the wave-like aspect of primate organisms (i.e., their continuous transition, or duration, of realized pattern, as felt from within), while locomotion describes the particle-like aspect (i.e., their discontinuous epochal realizations, as felt from without).

The entire genus of atoms did not appear all at once. Prior to the assistance of the higher-level activity of stars (i.e., the process of stellar nucleosynthesis), no elemental organisms heavier than hydrogen and helium were able to stabilize out of lower-level energetic activities. But before most stars could emerge, hydrogen and helium had to collect into huge swirling clouds, which became galaxies.[135] At the center of these early galaxies there emerged black holes (whose gravity was so intense not even light could escape), further securing the next stage of evolutionary complexity. According to astrophysicist Caleb Scharf, the influence of "energy feedback" from these early black holes played a crucial role in forming the stars and planets making up the universe we know today.[136] Star formation was first catalyzed as a result of the rapid revolution of the black holes at the center of galaxies, which generated gravitational density waves that "shocked clouds of hydrogen and helium to condense rapidly into thousands of stars at a time."[137] Had this rapid process of star formation continued unabated, the raw hydrogen and helium gas of most of the galaxies in the universe would long ago have become far too hot to form any new stars.[138] Fortunately, the energy feedback effects of supermassive black holes has kept star formation in check. In effect, the eating habits of black holes allow them to act as cosmic thermostats, "making sure the porridge of intergalactic matter is not to hot and not too cold."[139] Black holes have played a fundamental role in the evolutionary adventure that gave rise to our present cosmic ecology.[140] According to Scharf,

> The fact that there are *any* galaxies like the Milky Way in the universe *at this cosmic time* is intimately linked with the opposing processes of gravitational agglomeration of matter and the disruptive energy blasting from matter-swallowing black holes. Too much black hole activity and there would be little new star formation, and the production of heavy elements would cease. Too little black hole activity, and

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[134]*Science and the Modern World*, 121-125.

[135]Current evidence suggests a few very large but short-lived stars may have formed before the galaxies. *Universe Story*, 34.

[136]Caleb Scharf, *Gravity's Engines: How Bubble Blowing Black Holes Rule Galaxies, Stars, and Life in the Cosmos* (New York: Scientific American, 2012), 210.

[137]*Swimme and Berry*, 34.

[138]Scharf, 202.

[139]Ibid., 143.

[140]Ibid., 164.

environments might be overly full of young and exploding stars–or too little stirred up to produce anything.[141]

Galaxies and black holes can be understood as analogous to massive cellular systems, where the regulative role of the black hole is akin to that of the central nucleus of a cell. Like all other organisms, galaxies appear to have a finite life-span, beyond which they can no longer produce new stars. The nested feedback loops at work to secure the self-organizing dynamics of a biological cell are obviously far more complex and adaptive than the simpler feedback exhibited by black holes; but nonetheless, the general analogy seems to hold.

Space-Time in an Ontology of Organism

The metrical properties associated with space-time should not be defined a priori, but should characterize the pattern of the environment that is inseparable from [the endurance of organisms].

—Stengers[142]

Whitehead's amendments to the general theory of evolution follow from his desire to re-construct the theory on the basis of the demands of post-Newtonian physics, as he understands them. As a result of relativity theory, the pre-existent geometrical structure of the spatio-temporal environment can no longer be taken for granted; a further result of relativity is the displacement of static material substances by dynamic energetic processes as fundamental to nature. As a result of quantum theory, the activity of this energy must be understood in terms of the definite values achieved by the momentary synergy of rhythmic vibrations, where the emergence of a complete pulse of energy, or organic bud of experience, requires a stretch of time for its unfolding.[143] The abstract point-instants of mechanistic materialism, be they Newtonian or Einsteinian, become concrete actual occasions in Whitehead's reading of the new physics. The discoveries of the 20th century regarding the nature of space, time, and energy are a warning against the misplaced concreteness that would "abstract from change [in an attempt] to conceive the full reality of nature *at an instant*."[144]

By 1920, Whitehead had already published two books exploring the implications of relativity theory for the philosophy of science.[145] In June 1921, Whitehead met and had several in depth

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[141]Scharf, 204.

[142]*Stengers*, 168-169.

[143]*Science and the Modern World*, 122.

[144]*Modes of Thought*, 145.

[145]Alfred North Whitehead, *An Enquiry Concerning the Principles of Natural Knowledge* (New York: Dover Publications, 1982) (0riginally published 1919), and Alfred North Whitehead, *The Concept of Nature* (Cambridge: Cambridge University Press, 1964) (originally published 1920).

conversations with Einstein during the latter's stay with the philosopher and statesman Richard Haldane in London. Accounts offered by those present suggest that Whitehead made several gentle attempts over the course of two days to convince Einstein "to give up his identification of the [curved] geometry of space-time and the physics of gravitation."[146] Einstein admitted he had difficulty grasping Whitehead's radically novel metaphysical scheme. It was a little more than a year later, in September of 1922, that Whitehead published *The Principle of Relativity* in an attempt not only to more fully work out the proper philosophical rendering of Einstein's scientific discovery, but to provide an alternative set of gravitational field equations no longer based on the notion of curved space-time. The book follows on the heels of the famous debate between Einstein and Henri Bergson, which took place in April of 1922 at the Société Française de Philosophie in Paris. At stake in this debate was not only "the status of philosophy *vis à vis* physics"–that is, it was not only "a controversy about who could speak for nature and about which of these two disciplines would have the last word."[147] It was also a *political* debate about the proper roles of science and philosophy in society, especially in regard to international relations. Bergson had recently been appointed president of the International Commission for Intellectual Cooperation, a precursor to UNESCO. Einstein, originally a member of the Commission and a vocal supporter of its internationalist mission, would eventually resign, largely as a result of his disagreement with Bergson concerning relativity.[148]

Bergson's tremendous popularity prior to confronting Einstein began to wane, probably due to the perception that he was willing to ignore scientific facts if they contradicted his irrational intuitions. This orthodox narrative, retold most recently by the anti-philosophical physicist Alan Sokal,[149] has it that Bergson lost the debate because he did not understand the mathematical physics behind relativity. Following the recent revival of interest in Bergsonism,[150] the orthodox narrative is increasingly being called into question.[151] The specifics of Bergson's alleged "mistake" regarding the details of Einstein's twin paradox are beyond the scope of this

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[146]Ronny Desmet, "Did Whitehead and Einstein Actually Meet?" in *Researching With Whitehead: System and Adventure*, eds. Franz Riffert and Hans-Joachim Sander (Freiburg: Verlag Karl Alber, 2008), 154.

[147]Canales, Jimena. "Einstein, Bergson, and the Experiment that Failed: Intellectual Cooperation at the League of Nations." in *Modern Language Notes* 120, no. 5 (December 2005): 1169; available at http://www.fas.harvard.edu/~hsdept/bios/docs/canales-Einstein,%20Bergson%20and%20the%20Experiment%20that%20Failed.pdf (accessed 11/18/2012).

[148]Ibid., 1175.

[149]See Alan Sokal and Jean Bricmont, *Intellectual Impostures: Postmodern Philosophers' Abuse of Science* (London: Profile Books, 1998).

[150]Largely a result of the influence of Gilles Deleuze (see http://plato.stanford.edu/entries/bergson/#7 [accessed 11/18/2012]).

[151]See Canales generally; Val Dusek, "Clarity, Charity and Criticism, Wit, Wisdom and Worldliness: Avoiding Intellectual Impositions," Metascience 9, no. 3 (2000), 358-366; pre-publication manuscript available at http://www.physics.nyu.edu/sokal/dusek.html (accessed 11/18/2012).

discussion, but suffice it to say that, contra Sokal and other scientific critics, Bergson was well aware of the observational facts concerning the comparison of different time-systems.[152] His critical approach to relativity theory was based on *metaphysical*, not *physical* grounds. Like Whitehead, Bergson was not contesting the general physical validity of Einstein's theory. Rather, Bergson simply wanted to establish, despite Einstein's protests, that the scientific confirmation of relativity theory was not the end of the matter regarding the philosophical understanding of time.[153]

Regardless of whether or not Sokal's criticisms of Bergson's alleged misunderstandings are justified, he would have a far more difficult case trying to dismiss Whitehead, whose grasp of the mathematical and physical principles at stake arguably surpassed even Einstein's.[154] "The essence of [the structure formed by space-time]," wrote Whitehead in 1922,

> is that it is stratified in many different ways by different time-systems. This is a very peculiar idea which is the product of the speculations of the last 15 years or so. We owe the whole conception notably to Einstein . . . no one can study the evidence in its detail without becoming convinced that we are in the presence of one of the most profound reorganizations of scientific and philosophic thought. But so many considerations are raised, so diverse in character, that we are not justified in accepting blindfolded the formulation of principles which guided Einstein to his forumlae.[155]

Whitehead set out in his book on relativity to "[carefully scrutinize] the fundamental ideas of physical science in general and of mathematical physics in particular."[156] As discussed earlier, his reaction to the disorienting discoveries of the new physics led him to re-assess the philosophical foundations of scientific materialism, which had been assumed with great (instrumental) success since the time of Newton. Though Einstein was initially suspicious of philosophy's role in physics, as is evidenced both by his debate with Bergson and by his signature of a 1913 anti-metaphysical positivist manifesto,[157] he came late in life to respect the

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[152]See Canales, 1170-1171.

[153]Bergson, "Discussion avec Einstein," in *Mélanges* (Paris: Presses Universitaires de France, 1972), 1345.

[154]"Professor Whitehead seems to me to have brought out the character of space and time in his treatment of relativity more thoroughly than Einstein or even Minkowski himself has done." Richard Haldane, *The Reign of Relativity* (New Haven: Yale University Press, 1921), 110. See also letters exchanged between Einstein and his first wife, Mileva Einstein-Maric, herself an accomplished mathematician, which suggest that Einstein required her help with some of the more difficult aspects of his equations. "Did Einstein's Wife Contribute to His Theories?", *New York Times,* March 27, 1990, available at http://www.nytimes.com/1990/03/27/science/did-einstein-s-wife-contribute-to-his-theories.html (accessed 11/18/2012).

[155]Whitehead, *The Principle of Relativity* (New York: Cosimo, 2007), 59, 67 (originally published 1922).

[156]Ibid., 40.

[157]Stanley Jaki, *The Road of Science and the Ways to God* (Edinburgh: Scottish Academic Press, 1978), 182.

importance of philosophical reflection upon the conceptual background of science. In his foreword to physicist and philosopher Max Jammer's historical study of the concept of space, written in 1953, Einstein admits that

> the scientist makes use of a whole arsenal of concepts which he imbibed practically with his mother's milk; and seldom is he ever aware of the eternally problematic character of his concepts. . . . He uses these conceptual tools of thought as something . . . immutably given . . . which is hardly ever . . . to be doubted. How could he do otherwise? How would the ascent of a mountain be possible, if the use of hands, legs, and tools had to be sanctioned step by step on the basis of the science of mechanics?[158]

Here, even though Einstein affirms science's practical need to take its conceptual tools for granted, he also seems to approach Whitehead's characterization of philosophy as "the criticism of abstractions which govern special modes of thought."[159] Further, in 1950, Einstein remarked that every genuine physicist "is a kind of tamed metaphysician," no matter how much lip service he or she may pay to positivism.[160] This taming is achieved, according to Whitehead, by holdings one's "flight in the thin air of imaginative generalization" accountable, upon landing, to "renewed observation rendered acute by rational interpretation."[161] Unfortunately, Einstein's more mature views on the proper disciplinary relationship between philosophy and physics have still not been fully digested by contemporary materialistic scientists.

In his debate with Bergson, Einstein insisted that no such thing as "philosophical time," or what Bergson called "duration," existed; rather, there was the real "physical time" revealed by natural science, and the illusory "psychological time" experienced by human consciousness.[162]

Whitehead's unflinching commitment to an organic philosophy of nature prevented him from accepting Einstein's blatant bifurcation:

> It follows from my refusal to bifurcate nature into individual experience and external cause that we must reject the distinction between psychological time which is personal and impersonal time as it is in nature.[163]

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[158]Albert Einstein, Foreword to Max Jammer, *Concepts of Space: The History of Theories of Space in Physics* (Mineola: Dover, 1993), xiii-xiv.

[159]*Modes of Thought*, 49.

[160]Einstein, "On the Generalized Theory of Gravitation," in *Scientific American*, Vol. 182, Issue 4, April 1950.

[161]*Process and Reality*, 5.

[162]Bergson, "Discussion avec Einstein," 1346

[163]*Principle of Relativity*, 66.

Whitehead differs from Bergson in that he sought to re-construct science itself on an organic basis, whereas Bergson was content to leave science to its mechanical models and instrumental methods. He conceived of science as the result of "intelligence," rather than "intuition," meaning that its approach to nature is necessarily mediated by artificial instruments and laboratory techniques; therefore, science can offer no insight into the immediate life of things.[164] "For [natural science's] object," writes Bergson, "is not to show us the essence of things, but to furnish us with the best means of acting on them."[165] Though Whitehead does not share Bergson's dualism between the activity of living organisms and the passivity of material mechanisms (since for Whitehead, all sciences are the study of dipolar organismic occasions), he does share his sense that Einstein's abstract account of relativity in terms of mechanical clock-time obscures the true import of the theory as regards our experience of concrete temporality (i.e., *duration*). The time of the physicist, as measured by a clock, "merely exhibits some aspects of the more fundamental fact of the passage of nature," according to Whitehead. "In this doctrine," he continues, "I am in full accord with Bergson."[166]

The agreement between Whitehead and Bergson concerns the way in which concrete temporality is inevitably *spatialized* in the process of being translated into the abstractions of physics. Mechanical clocks quite literally flatten the passage of time into discrete units of distance meant to represent seconds, minutes, and hours. So far as it goes, such spatialization is necessary for the coordination of civilized life. But it is important not to forget what this translation obscures when we endeavor to understand the creative advance of the actual universe: the clock itself–like everything else in the universe, from carbon atoms to stars to the person who consults it–*is aging*. To be *aging* is to be always in irreversible organic *process*. In a process ontology like Whitehead's, an actual entity doesn't "have" an age, as though it were an accidental property of an underlying substance; rather, the very essence of an entity is to age, to emerge out of a definite past and pass into an indefinite future. In Whitehead's words:

> [To discuss] present fact apart from reference to past, to concurrent present, and to future, and from reference to the preservation or destruction of forms of creation is to rob the universe of essential importance.[167]

Even a physicist who has mastered all the mathematical formulas and techniques of measurement cannot avoid the philosophical quandaries which arise from a moment's reflection upon the fact that his or her conscious presence is necessary in order for the clock, or

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[164]C. F. Delaney, "Bergson on Science and Philosophy, in *Process Studies* 2, no. 1 (1972): 29-43.

[165]Henri Bergson, *Creative Evolution* (New York: Henry Holt and Company, 1911), 93.

[166] *Concept of Nature*, 54.

[167]*Modes of Thought*, 84.

any measuring instrument, to get itself read.[168] Our direct experience of concrete existence–whether we are artists, clergymen, homemakers, or astrophysicists–reveals nature to be an irreversible process of becoming, a creative advance. This fact stands in sharp contrast to Einstein's incredible remark:

> For us believing physicists, the distinction between past, present, and future is only an illusion, even if a stubborn one.[169]

The philosopher Niels Viggo Hansen boils down what is at stake in the debate between Einstein, Bergson, and Whitehead by asking about the meaning of "fact," both as it is assumed in our concrete (temporal) experience of a specious present, and as it is assumed in the abstract (spatialized) notations of physics:

> If there is any such thing as a fact . . . then either there are temporal facts (e.g., that you have *already* read the previous sentence) or there are atemporal facts (e.g., that your reading of it is *later than* my writing of it). . . . Bergson was right that . . . we cannot seriously hold at the same time both that there are concrete facts involving distant simultaneity, and also that such facts cannot exist in the physical universe. Surely one could claim that such immediate facts are eliminated in the production of physical descriptions . . . but if concrete facts of co-presence are there before clocks . . . are used, they will still be there in the background when [clocks] are employed.[170]

Where Bergson goes wrong, according to Hansen, is in claiming that our concrete experience of co-presence, or durational simultaneity, is somehow universal. It is as if he claims to have some special intuitive access to what is happening right now on the surface of Mars, even though all the theoretical and experimental evidence of relativistic physics suggests that distant happenings are not instantaneously communicated to our concrete experience.[171] Whitehead's novel solution to this paradox regarding the irreconcilable notions of "fact" is to construe the concrete simultaneity of an actual occasion's specious present as a *local*, rather than a *global*, fact. Such a construal entails rejecting the often implicit ontologization of the Einsteinian notion of a ready-made 4-dimensional fabric of space-time "out there" within which actual occasions

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[168]See Canales, 1176-1177.

[169]Einstein to Vero and Mrs. Bice, March 21, 1955. Einstein Archive, reel 7-245; reprinted in *Albert Einstein-Michele Besso Correspondence 1903-1955* (Paris: Harmann, 1972), 537-538.

[170]N. V. Hansen, "Spacetime and Becoming: Overcoming the Contradiction between Special Relativity and the Passage of Time," in *Physics and Whitehead: Quantum, Process, and Experience*, ed. Timothy Eastman and Hank Keeton (New York: State University of New York, 2003), 150.

[171]It takes anywhere between four and 20 minutes for light to travel from Mars to Earth, depending on our relative orbital locations. It is important to note here that the non-local effects of quantum physics makes the issue of instantaneous communicability more complicated. I explore this issue below, but suffice it to say for now that Whitehead's account of the ingression of eternal objects into actual occasions allows for a coherent integration of the relativistic limits placed on *efficient* causality with the non-local *formal* causality of quantum physics.

would unfold, or through which the plane of the present would slide as an indication of global simultaneity (as Bergson seems to have believed[172]). Actual occasions are not to be pictured as if they were bits of matter located *in* a pre-given spatiotemporal "loaf"; rather, the abstract geometry of space-time described by the Lorentz transformations, or by Whitehead's alternative tensor equations,[173] is derivative from the most general pattern of experience realizable by the actual occasions constitutive of our cosmic epoch. In other words, the geometry of curved space-time itself emerges from the character, taken collectively, of individual drops of experience. These self-creating and other-prehending drops of experience are the final real things of which reality is composed. These processes are what is concrete, while space-time is an abstraction from the concrete. "Whitehead is explicit about the idea," writes Hansen,

> that the concrete dynamism of processes can be understood as the ground of extension rather than the reverse. This is the first element of the Whiteheadian solution to the tension between extension and becoming: the modalities are not really situated in space and time at all, but in the concrete processes whose web of relations gives rise to space and time.[174]

Metaphysically speaking, that space-time is *abstract* doesn't mean it isn't *real*, only that it isn't *actual*. Space-time is a system of modalities, a configuration of forms, or, in Whitehead's terms, a definite patterning of eternal objects that has ingressed into the prehensive unifications of actual occasions. Eternal objects, as discussed earlier, have a relational function: their ingression allows for the solidarity, or extensive continuity, of the universe by providing actual occasions with the definite adverbial "how?" characterizing their prehensions of other occasions. This "two-way function" shapes both the private experience, or "subjective form," of an occasion, and grants this form publicity, so as to offer it as an objective datum for the larger society of occasions within which the occasion becomes and perishes.[175] Among the most fundamental set of adverbs characterizing the "how?" of the mutual prehensions of our cosmic epoch is the system of geometrical modalities known to physics as space-time. Also among the

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[172]See Gilles Deleuze, *Bergsonism*, trans. Hugh Tomlinson and Barbara Habberjam (New York: Zone Books, 1991), 82.

[173]See *Principle of Relativity*, 139.

[174]Hansen, 154.

[175]*Process and Reality*, 164.

most fundamental set of adverbs are the mathematical fields of force known to physics as gravity and electromagnetism.[176]

> These mathematical relations belong to the systematic order of extensiveness which characterizes the cosmic epoch in which we live. The societies of [organisms]–electrons, protons, molecules, material bodies–at once sustain that order and arise out of it. The mathematical relations involved . . . thus belong equally to the world perceived and to the nature of the percipient. They are, at the same time, public fact and private experience.[177]

Whitehead's reference to our "cosmic epoch" is important, since it is a reminder that the 4-dimensional character of space-time as we experience and measure it today is contingent and could change as the creative advance of the universe continues to unfold. The "laws" of nature, and the structure of space-time, are not eternal, nor necessarily universal.[178] They are the result of widespread, habitual forms of organization achieved by the mutual prehensions of the most encompassing society of actual occasions which communicate with our experience.[179] "How do we know," asks Whitehead, "that only one geometry is relevant to the complex happenings of nature?" He continues:

> This planet, or this nebula in which our sun is placed, may be gradually advancing towards a change in the general character of its spatial relations. Perhaps in the dim future mankind, if it then exists, will look back to the queer, contracted three-dimensional universe from which the nobler, wider existence has emerged.[180]

The cosmic habits called "laws of nature" by contemporary physicists are extremely stable relative to the individual novelty achievable by high-grade, conscious occasions (like multicellular animals) because they are derived from the decisions of very simple, low-grade actual occasions (like electrons). The "mental pole" of these occasions is negligible: they are statistically dominated by the habitual "physical feelings" of their environment, and so almost always reproduce the systematic order of the eternal objects characterizing that environment with little in the way of autonomous flashes of creativity.[181]

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[176]Unlike Einstein, whose conception of a ready-made "fabric" of space-time allowed him to explain gravity as a pseudo-force which really results from the warping of the fabric due to presence of massive objects, Whitehead described gravity as a genuine physical force, like electromagnetism. *Principle of Relativity*, 91.

[177]*Process and Reality*, 326.

[178]*Stengers*, 168.

[179]*Process and Reality*, 98.

[180]*Modes of Thought*, 57.

[181]*Process and Reality*, 245.

To sum up, Whitehead's reformed principle of relativity is based on the metaphysical priority of actual facts, or occasions of experience, from which the geometrical order of spatiotemporal extension is derived.[182] Through an abstractive process of logical construction rooted in the coordination of the somewhat fragmentary nature of individual occasions of experience, the general character of space-time holding true for our cosmic epoch can be produced.[183] While Einstein's proposal of a universal and *a priori* space-time implies a taut, already fully woven fabric whose spatial curvature is modified by the material bodies situated within it, Whitehead's alternative theory of a coordinated plurality of space-times implies a fraying fabric always in the process of being repaired by the dipolar physical-mental concrescences of organismic occasions of experience. In this way, Whitehead translates many of the properties that Einstein's general relativity defines *a priori* into empirical, or *a posteriori* facts.[184] Instead of privileging the misplaced concreteness of an abstract space-time that would "[separate] an organism from its environment" such that "the endurance of the former and the patience of the latter [is defined] in terms of right [or "law"], not of fact," Whitehead emphasizes the contingency of the evolved habits currently holding sway over the ecology of organisms shaping our cosmic epoch, no matter how general or universal they may appear at this time.[185]

Whitehead terms the general character of space-time "the uniformity of the texture of experience."[186] "The physical world [i.e., the extensive continuum of space-time]," he goes on, is,

> in some general sense of the term, a deduced concept. Our problem is, in fact, to fit the world to our perceptions, and not our perceptions to the world.[187]

Here, Whitehead directly contradicts Einstein's famous statement that our immediate experience of temporality, while perhaps necessary for civilized life, is in reality nothing but a persistent illusion no longer to be believed in by professional physicists. Whitehead's reconstruction of relativity theory so as to avoid the social and ecological perils of the bifurcation of nature is not based on a denial of Einstein's *physical* formulations, but a denial of the unconscious imaginative background shaping Einstein's *metaphysical* interpretation of these formulations. Following Stengers, it can be said that Whitehead's philosophy of organism

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[182]*Epperson*, 5.

[183]Alfred North Whitehead, *The Aims of Education* (New York: The Free Press, 1957), 162-163 (originally published 1929).

[184]*Stengers*, 168.

[185]Ibid., 169.

[186]*Aims of Education*, 163.

[187]Ibid., 165.

aims not to belittle or deny the abstractions of the scientific intellect, as Bergson seems to, but rather to articulate an

> ecology of abstraction . . . that creates the possibility of a mutual aesthetic appreciation between specialists of precision and adventurers of generalization.[188]

Quantum Decoherence and the Incompleteness of Nature

> *[Creativity] prevents us from considering the temporal world as a definite actual creature. For the temporal world is an essential incompleteness*.
>
> —Whitehead[189]

Epperson argues that Whitehead's account of the process of concrescence, the centerpiece of his metaphysical scheme, provides "an extremely precise, phase-by-phase exemplification" of contemporary "decoherence-based interpretations" of quantum mechanics.[190] Unlike the instrumentalist interpretations that have spun off Niels Bohr's account of quantum effects in terms of *epistemological* "complementarity," quantum decoherence offers a full-fledged *ontological* description of quantum reality.[191] Further, unlike Hugh Everett's "many worlds" interpretation, the decoherence-based approach provides a more ontologically parsimonious, not to mention less empirically question begging, account of the unfolding of the physical universe. And finally, unlike the quantum cosmogonies offered by Hawking and Krauss, which purport to explain the random emergence of the actual universe *ex nihilo* from the sheer potentiality of the "quantum void," decoherence-based interpretations avoid the logical incoherence of having to posit a realm of pure potentiality utterly independent of, and somehow responsible for generating, concrete actuality.[192] Whitehead, as discussed earlier, also describes something akin to the "quantum void," or "vacuum," from which all potency is ceaselessly born: Creativity. But, in order to maintain the coherence of the fundamental categories of his metaphysical scheme (such that all ideas require one another for their meaning), the sheer potentiality of Creativity is said always to be conditioned by at least one actual creature.[193] The primordial creature of Creativity is God. Subsequently to God, Creativity also comes to be conditioned by the passage into objective immortality of finite actual occasions.[194] Potentiality, in other words, has never been untouched by actuality.

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[188]Stengers, 141.

[189]*Religion in the Making*, 80.

[190]Epperson, 129.

[191]Ibid., 33.

[192]Epperson, 18; Krauss, *Universe from Nothing*, xiv.

[193]*Process and Reality*, 3.

[194]Ibid., 31.

The decoherence interpretation of quantum mechanics, like Whitehead's philosophy of organism, presupposes the givenness of facts, rather than trying to offer some arbitrary *ex nihilo* explanation of their spontaneous appearance. According to Epperson,

> Actuality is necessarily presupposed by . . . potentiality, such that the latter cannot be abstracted from the former. This is both a logical requirement and a requirement of quantum mechanics, which describes the evolution of actual facts and their associated potentia–not the evolution of vacuous potentia into actuality.[195]

In other words, quantum mechanical descriptions *presuppose* actuality, and so cannot explain its emergence by reference only to potentiality. Nonetheless, potentiality does have a significant role to play in both decoherence-based and Whiteheadian accounts of the evolution of the universe. In 1958, probably independently of Whitehead's earlier re-incorporation, Werner Heisenberg argued that quantum effects demanded that something like Aristotle's concept of "potentia" be brought back into the philosophy of nature.[196] The decoherence interpretation describes the way a quantum event, or wave-function, first arises from the actualized facts of the past, evaluates the potentia relevant to its situation, and finally selects among those potentia to bring about the collapse of its wave-function, thereby realizing some novel actual fact.[197] It is a process of "evolutions from actuality to potentiality to actuality."[198] In Whitehead's terms, the concrescence of an actual occasion passes through several phases: 1) the occasion prehends the initial data provided to it by the multiplicity of objectively immortal occasions making up its past actual world, negatively prehending those elements which are irrelevant to its situation, 2) the occasion, through a process of integration of simpler feelings into more complex feelings, unifies its many prehensions of its actual world into one, objective datum, 3) the objective datum is felt by the subjective form of the occasion, which is the complex qualitative pattern of eternal objects characterizing how this occasion experiences its world, 4) the occasion, having satisfied its subjective form, perishes into objective immortality to become the data prehended by further occasions.[199] The end result of this process is the emergence of a novel actuality.

Earlier, in a discussion of the inherent limits to our experience of simultaneity based upon the finite (but invariant) speed of light, I mentioned a further complexity based upon quantum non-locality and the difference between efficient and formal causality. Efficient causes are those influences involving the direct transmission of feeling from one actual occasion or society of

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[195]*Epperson*, 7

[196]Heisenberg, *Physics and Philosophy* (New York: Harper and Row, 1958), 185.

[197]*Epperson*, 8-9.

[198]Ibid., xii.

[199]*Process and Reality*, 221.

occasions to another, as when a flashlight shines in my eyes or a baseball breaks through a window. They are *physical* causes. Formal causes, from both a Whiteheadian perspective on reality more generally and a decoherence-based perspective on quantum physics more specifically, can involve instantaneous, non-local affection of the potentia of distant actual occasions. These are *conceptual* causes. To illustrate the difference, Epperson uses the example of an asteroid that has just been knocked by a comet into a collision course with Earth.[200] Although in terms of physical influence, we will not be affected by the incoming asteroid until the photons reflecting off its surface reach Earth, in conceptual, or potential, terms, the asteroid's change of course has instantaneously affected the potentia describing Earth's ongoing evolution. Further clarifying the difference between efficient and formal causality, Epperson writes:

> "Causal influence," in the Whiteheadian scheme, is operative in the physical pole or primary stage (the conformal phase, or phase of causal efficacy), and is bound by the speed of light according to the theory of special relativity; "causal affection" is operative in the mental pole or supplementary stage, and is not limited by special relativity.[201]

If the local relativistic relationships of causal influence among actual occasions were not supplemented by the non-local quantum relationships of logically ordered potentia, the reality of an asymmetrical passage of time from closed past to open future would be impossible to account for. On the purely relativistic reading, time is symmetrical: causality works just the same whether you run it forward or backward. But from the perspectives of quantum decoherence, thermodynamics, Whitehead's process philosophy, and our own direct experience, time is intrinsically irreversible.[202]

The physical account of the decoherence of a wave-function and the metaphysical account of the concrescence of an actual occasion both imply a panexperientialist ontology of constructive becomings, rather than a materialist ontology of ready-made beings. In a materialist ontology, reality is identified with actuality.[203] This implies that nothing new ever really emerges, since all that can be has already been actualized. Change is merely apparent, the re-shuffling of static parts that are externally related. In an ensouled process ontology like Whitehead's, actuality and potentiality are organically integrated so as to allow for a genuinely creative cosmos where, though the past is settled, the future remains wildly open. New forms of fact are always

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[200]Epperson, xii-xiii.

[201]Ibid., 228.

[202]Ibid., 234.

[203]Ibid., xii.

emerging, though none ever exists in isolation from its environment. “In sharp contrast [to mechanistic materialism,],” writes Epperson,

> [in] Whitehead’s cosmology as exemplified by the decoherence interpretations of quantum mechanics, the universe is. . .characterized as a fundamentally complex domain with an inherent aim toward an ideal balance of reproduction and reversion–a balance formative of a nurturing home for a seemingly infinitely large family of complex adaptive systems such as ourselves.[204]

Epperson explicitly connects Whitehead’s metaphysical scheme, along with the decoherence-based account of quantum mechanics, to efforts in the complexity sciences to account for the regularity and diversity achieved by the various examples of emergent order at all scales in nature.[205] In Whitehead’s terms, emergence concerns the achievement by actual occasions of novel forms of “structured society,” be they physical (atoms, stars), biological (cells, plants), or psychological (animals, humans).[206]

For contemporary complexity scientist Terrence Deacon, mentioned earlier, coherent accounts of emergence also depend upon the ontologization of potentiality alongside actuality. Deacon coins the term “absential” to refer to those features of nature that, while not physically present, nonetheless have an important role to play in the emergence of the higher order organizational levels of biology and psychology.[207] The role of these absential features would suggest that nature is in some sense “incomplete.” The recognition of this incompleteness leads Deacon to flirt with something like Whitehead’s panexperientialist process ontology, where

> no object, event, or interaction–down to the most fundamental physical interactions, such as between elementary particles–is complete in itself, [meaning that] all aspects of physical causality implicitly depend on something extrinsic that is not physically present “there.”[208]

But in the end, Deacon remains unsatisfied with Whitehead’s approach, since it seems to assume what he is setting out to explain, namely, how experience and value emerge later on up the scale of complexity from otherwise numb, purposeless matter. Deacon attempts to avoid what he calls “homuncular” accounts of the emergence of complexity from physical processes, which he says include information theoretic accounts as well as Whitehead’s. Information theory suggests that all physical processes can be interpreted as computation-performing

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[204]Ibid., 17.

[205]Ibid., 198.

[206]*Process and Reality*, 100.

[207]Deacon*, Incomplete Nature*, 3.

[208]Ibid., 78.

operations.[209] As a result, physical processes "can be treated as though [they have] mentalistic properties."[210] Although Deacon admits to being favorably influenced by Whitehead early in his career, especially in respect to his attempt to save realism as against nominalism in natural philosophy, he eventually became dissatisfied by Whitehead's seeming need to "[sneak] in homunculi at a very, very low level. . .the level of subatomic quantum events."[211] From Deacon's scientific perspective, building in anything like purpose or feeling at the basement level of actuality doesn't explain anything; rather, only "if you can show how [these are] generated [will] you have an explanation for [them]."[212]

From Whitehead's philosophical perspective, science cannot explain the emergence of experiential qualities like value, purpose, and feeling out of dumb physical activity. Whitehead's understanding of what constitutes a proper explanation seems to be the reverse of Deacon's, in that for Whitehead, natural philosophy cannot explain the emergence of what is concrete (i.e., value and experience), but only of what is abstract. New possibilities are always emerging into actuality (or in Whitehead's terms, novel eternal objects are always ingressing); actuality itself, on the other hand, must be intrinsically evaluative for explanations of such emergence to remain rational instead of miraculous. The emergence of complex forms of organization like galaxies and stars, for example, already requires an explanation in terms of some aim intrinsic to physical activity. "The element of value," writes Whitehead,

> of being valuable, of having value, of being an end in itself, of being something which is for its own sake, must not be omitted in any account of an event as the most concrete actual something. 'Value' is the word I use for the intrinsic reality of an event.[213]

In other words, no value, no reality. Akin to Deacon's scientific desire to avoid humuncular explanations is Whitehead's philosophical desire to avoid employing the dubious concept of "vacuous actuality." This concept "haunts realistic philosophy,"[214] according to Whitehead, which is borne out by the example of Deacon's realism, where experience is purported to emerge from dumb matter. "Apart from the experience of [actual occasions]," writes Whitehead, "there is nothing, nothing, nothing, bare nothingness."[215]

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[209]Ibid., 75.

[210]Ibid., 374.

[211]Deacon, personal communication on April 26, 2012.

[212]Ibid.

[213]*Science and the Modern World*, 89.

[214]*Process and Reality*, 29.

[215]Ibid., 167.

This fundamental divergence of metaphysical first principles may at first seem like a matter impossible to settle other than by subjective preference. As mentioned earlier, aside from their metaphysical differences, Deacon's account of the emergence of biological and psychological forms of organization can be read as adding much needed specificity to Whitehead's more general account. In this sense, their approaches are complementary. But there are other criteria from which to judge the overall coherence of each of their approaches.

Deacon claims to prefer a perspective of radical emergence, wherein infinitely many novel forms of organization are possible, while he regards Whitehead's cosmological scheme as somehow restricting the open-endedness of emergent evolution.[216] On the other hand, Deacon admits that there are limits on the evolution of this novelty, offering a rather sophisticated account of these limits based upon the notion of hierarchically nested constraints.[217] The question is, what constrains the emergence of novelty at the *cosmic*, rather than specifically biological or psychological scale? According to Deacon's scientific account, cosmic constraint is afforded by the interplay between the biased probability of entropic orthograde processes and the emergent contragrade processes supported by thermodynamic work.[218] Once constraints at the thermodynamic level are established, higher-order constraints can emerge to secure what Deacon calls "morphodynamic", and then "teleodynamic," modes of organization.

Whitehead also offers an account of limitation, but his rests on a far more general, and therefore metaphysical, basis. As discussed in a preceding section, the unfathomable potency of Creativity being the ultimate category of his scheme, Whitehead needed a principle of limitation, or concretion, to account for how anything of definite value could come to exist. Whitehead calls his principle of limitation, or concretion, "God." Instead of basing limitation on some particular tendency in the physical world, as Deacon does, Whitehead asks what must be the case, metaphysically speaking, for physical "tendencies" to be possible at all: "What is the status of the enduring stability of the order of nature?"[219] Whitehead's answer to this question depends, again, on what is to count as a valid means of explanation. From his perspective, the aim of any genuine philosophical explanation is to produce "self-evidence," or "sheer disclosure."[220] This aim can never be finally realized due to the fact that "language halts behind intuition."[221] In this sense, "all explanation must end in an ultimate arbitrariness."[222]

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[216]"I see emergence as an open-ended process, while [Whitehead] does not," Deacon, personal communication on April 26, 2012.

[217]Deacon, *Incomplete Nature*, 423.

[218]Ibid., 230, 247.

[219]*Science and the Modern World*, 88.

[220]*Modes of Thought*, 49.

[221]Ibid., 49.

Nevertheless, although total disclosure cannot finally be achieved, the penetration of our understanding can be increased.[223]

Many contemporary scientists, Deacon included, would seem to have little patience for traditional theology. Whitehead generally shares their distaste for those philosophers and theologians who, "anxious to establish the religious significance of God," succumbed to the unfortunate habit of paying him "metaphysical compliments."[224] The God of Western religion has tended to be fashioned in the image of an imperial ruler.[225] Rather than making God an exception to the principles holding true of every other actual occasion, Whitehead's God is "their chief exemplification."[226] Why then does Whitehead risk the scorn of atheistic or agnostic scientists and philosophers by calling his principle of concretion "God"? "Because," writes Whitehead,

> the contemplation of our natures, as enjoying real feelings derived from the timeless source of all order, acquires that "subjective form" of refreshment and companionship at which religions aim.[227]

God's primordial act of concretion cannot be rationally explained, since this divine act provides the foundation for rationality.[228] That the universe has some definite character, some order, realized along certain limits despite the onrush of Creativity possessing no intrinsic reasons of its own, requires explanation. But in attempting to explain how this definite order could be possible, we come to the very limits of reason. As a panexperientialist, Whitehead's allegiance is ultimately to empiricism. "The general principle of empiricism," he writes,

> depends upon the doctrine that there is a principle of concretion which is not discoverable by abstract reason. What further can be known about God must be sought in the region of particular experiences, and therefore rests on an empirical basis.[229]

It follows from Whitehead's allegiance to empiricism that the progress of the general science of metaphysics and the special sciences alike depends upon a certain faith, or "ultimate moral intuition into the nature of intellectual action."[230] Whitehead's approach also has rationalist

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[222]*Science and the Modern World*, 88.

[223]*Modes of Thought*, 51.

[224]*Science and the Modern World*, 161.

[225]*Process and Reality*, 342.

[226]Ibid., 343.

[227]Ibid., 31-32.

[228]*Science and the Modern World*, 161.

[229]Ibid., 161.

aspects, but he always checks the impulse for theoretical explanation with the requirement that "there be 'given' elements so as to form the material for theorizing."[231] God is such an element, the primordial reason conditioning the creative flux, though not itself rationally explainable.

As discussed earlier, God is that actual entity responsible for grading the relevance of the infinite multiplicity of eternal objects. "Apart from God," writes Whitehead, "there could be no relevant novelty."[232] In other words, it is God's primordial role to provide each concrescing actual occasion with possibilities graded as relevant to the givenness of its unique situation. Without this provision, eternal objects yet to be realized in the actual world would be all but non-existent for the occasion in question.[233] It follows from Whitehead's ontological principle that as of yet unactualized possibilities, or eternal objects, cannot float into actuality from nowhere.[234] Eternal objects yet to be actualized by any finite actual occasion have already been conceptually prehended by the divine non-temporal actual occasion. God is that non-temporal actual occasion which conceptually prehends, and thereby evaluates, the infinite set of eternal objects, thereby adjusting, or conditioning, creativity so as to allow a definite order to emerge in the ongoing course of cosmogenesis. "The adjustment is the reason for the world," writes Whitehead; he continues:

> It is not the case that there is an actual world which accidentally happens to exhibit an order of nature. There is an actual world because there is an order in nature. If there were no order, there would be no world. Also since there is a world, we know that there is an order. The ordering entity [God] is a necessary element in the metaphysical situation presented by the actual world.[235]

In respect to Deacon's desire both to "save Plato, or to save realism,"[236] and to describe a cosmos with open-ended possibilities of emergent order, it is difficult to see how this could be achieved without some cosmic principle of concretion to provide the basis for the emergence of forms of order relevant to the actual occasions, or societies of occasions, in question. That biological and psychological forms of order have emerged in the course of time would be nothing short of a miracle unless the tendency to harmony was basic to creation itself, already there "in the beginning." Epperson likens this harmonious tendency, or "subjective aim" provided by God "by which nature regulates herself without determining herself," to the

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[230]*Process and Reality*, 42.

[231]Ibid., 42.

[232]Ibid., 164.

[233]Ibid., 31.

[234]Ibid., 244.

[235]*Religion in the Making*, 91.

[236]Deacon, personal communication on April 26, 2012.

concept of "effective complexity" employed in complexity theory.[237] It could be said that this tendency is "built in" to the universe, but this phrase is likely to foster an image of a transcendent divine craftsman who programmed every detail of the universe, "building in" its properties before the moment of creation even occurred. In his famous cosmological dialogue *Timaeus*, Plato uses a similar image to tell his "likely story" about the genesis of the cosmos. *Timaeus* also employs other images to account for cosmogenesis, including that of an indwelling World-Soul, and that of a formless mediatrix for form called the Receptacle. Were Plato alive today, he may have emphasized these latter images as the more appropriate rhetorical choices for mythologizing his cosmology. Whitehead not only attempts to "save Plato" from the myth of a transcendent demiurge, but also to save modern theology from the jealous tyrant imagined by Job, and modern science from the deistic mechanical engineer imagined by Newton. To do so, he re-imagines God as immanent to every finite actual occasion, the cause of their feeling an "urge towards the future based upon an appetite in the present."[238] God does not determine the specific decision each finite occasion will make regarding this "initial aim." God only supplies each occasion with the complex feeling of the graded relevance of all the possibilities available to it in any given moment. Which of these possibilities it chooses to realize is a free decision on its part, a freedom conditioned also by the objective immortality of the past decisions of all the other historical routes of concrescence populating its cosmic community. God's valuation is persuasive enough that a cosmos with not only stars and galaxies, but living planets and intelligent civilizations has emerged. In the final section, the implications of Whitehead's reformed Platonism will be explored, with special attention paid to the need to mythologize his metaphysics so as to excite the aesthetic, emotional, and moral appetites in a way that purely rational discourse cannot.

[237]Epperson, 236.

[238]*Process and Reality*, 32.

TOWARD A PHYSICS OF THE WORLD-SOUL

In my view the creation of the world is the first unconscious act of speculative thought; and the first task of a self-conscious philosophy is to explain how it has been done.

—Whitehead[239]

The religious insight is the grasp of this truth: That the order of the world, the depth of reality of the world, the value of the world in its whole and in its parts, the beauty of the world, the zest of life, the peace of life, and the mastery of evil, are all bound together–not accidentally, but by reason of this truth: that the universe exhibits a creativity with infinite freedom, and a realm of forms with infinite possibilities; but that this creativity and these forms are together impotent to achieve actuality apart from the completed ideal harmony, which is God.

—Whitehead[240]

This, then, in keeping with our likely account, is how we must say divine providence generated the actual world as a truly living thing, endowed with soul and intelligence.

—Plato[241]

Whitehead suggests that Newton's *Scholium* and Plato's *Timaeus* "are the two statements of cosmological theory which have had the chief influence on Western thought."[242] Although the *Scholium* provides "an immensely able statement of details" applicable to the deduction of truths within a specific domain of physical activity, its deductive prowess "conveys no hint of the limits of its own application."[243] Newton's abstract conceptions of space, time, and matter as ready-made, and of eternal laws imposed by a transcendent designer, were undeniably useful, in that they provided the paradigmatic basis for two centuries of scientific progress. But the tremendous instrumental success of the Newtonian scheme had the practical effect of leading many to fall into the fallacy of misplaced concreteness by overgeneralizing its simplified

[239]*Aims of Education*, 164.

[240]*Religion in the Making*, 106.

[241]Plato, *Timaeus*, 30b-c.

[242]*Process and Reality*, 93.

[243]Ibid., 93.

abstractions as if they could explain the full complexity of concrete reality. "The *Scholium* betrays its abstractness," writes Whitehead,

> by affording no hint of that aspect of self-production, of generation, of φύσις, of *natura naturans*, which is so prominent in nature. For the *Scholium*, nature is merely, and completely, *there*, externally designed and obedient.[244]

As was discussed in the prior section, Whitehead's generalization of evolutionary theory requires that both potentiality and actuality be ingredient in any concrete depiction of nature. Nature as already produced, as *natura naturata*, as simply *there* and entirely *actualized*, provides only half the picture. Unlike the static cosmos of Newton, who Whitehead believes would have been confused by the modern doctrine of evolution, Plato articulated a cosmological scheme involving the emergence of order out of an original chaos, an account which already implicitly suggests an evolutionary process.[245] There are aspects of Plato's *Timaeus* that may seem foolish today, but "what it lacks in superficial detail," according to Whitehead, "it makes up for by its philosophic depth."[246] This depth has allowed Plato's speculative cosmology to outlast Newton's more arbitrary construction. The theory of cosmogenesis offered by the latter, involving "a wholly transcendent God creating out of nothing an accidental universe," has been abandoned by contemporary physicists and process theologians alike as gratuitous.

Plato's account of cosmogenesis, in contrast, avoids the Newtonian theory of *creatio ex nihilo*. Instead, the cosmos is said to emerge from the interplay of divine intelligence (νοῦς) and physical necessity (ἀνάγκη), such that the divine cannot violently command but must erotically persuade the cosmos to take shape out of chaos.[247] The Greek word ἀνάγκη means not only "necessity," but also connotes "need" or "urge": apropos Whitehead's creative retrieval of Plato's scheme, this suggests that God, whose primordial conceptual pole is itself deficient in actuality, necessarily experiences a *yearning* after concrete fact.[248] This yearning is productive of the consequent physical pole of God, which lovingly *receives* the freely actualized decisions

[244]Ibid., 93.

[245]Ibid., 93, 95.

[246]Ibid., 93.

[247]John Sallis, *Chorology: On Beginning in Plato's Timaeus* (Bloomington: Indiana University Press, 1999), 91.

[248]*Process and Reality*, 33.

of every finite occasion, no matter how discordant, into the harmony of its completed nature.[249] "The action of God is its *relation*," writes process theologian Catherine Keller,

> by feeling and so being felt, the divine invites the becoming of the other; by feeling the becoming of the other, the divine itself becomes [affirming] an oscillation between divine attraction and divine reception, invitation and Sabbath.250

There are many other parallels to Whitehead's cosmotheogony in *Timaeus*. The usual translation of one particularly relevant passage is as follows:

> The god wanted everything to be good and nothing to be bad so far as was possible, and so he *took over* (παραλαμβάνω) all that was visible–not at rest but in discordant and disorderly motion–and brought it from a state of disorder to one of order. . .[251]

The phrase "took over" (παραλαμβάνω) is misleading if interpreted only actively and not also passively: in this case, as both *taking over* responsibility for forming, and at the same time *receiving* the givenness of chaos.[252] This double sense of παραλαμβάνω mirrors Whitehead's dipolar conception of divinity as both conceptually active in envisaging the abstractive hierarchy of eternal objects and physically passive in receiving the multiplicity of finite concrescent occasions into its everlasting concrescence. The divine, for both Whitehead and Plato, is not an all-powerful creator, but an all-preserving co-creator:

> He does not create the world, he saves it: or, more accurately, he is the poet of the world, with tender patience leading it by his vision of truth, beauty, and goodness.[253]

Although Plato attempts in *Timaeus*, and Whitehead in *Process and Reality*, to articulate the most rational account possible of the genesis of the universe, in the end they found it necessary, due to the obscurity of their topic, to speak mythically by telling a "likely story" (εικώς μύθος). The Greek word εικώς is sometimes translated as "probable," meaning likely but not entirely certain ("it goes something like this. . ."). As with the translations above, this choice can be misleading. The translation of εικώς as "likely" conveys the superficial meaning of "probable," but this rendering should not obscure the subtler meaning of "likeness," closely associated with the Greek word for "icon" or "image" (εἰκών). In Plato's cosmogenic myth, the universe is said to be the most beautiful image that it was possible for the divine to co-create. The beauty of a thing being a result of the noetic order and harmony it radiates, it follows that the divine had to find some way to imbue the cosmic image with intelligence. Because "νοῦς

[249]Ibid., 349.

[250]Keller, 198.

[251]Plato, *Timaeus*, 30a.

[252]Sallis, 57.

[253]Whitehead, *Process and Reality*, 346.

[intelligence] cannot be present in anything without soul [ψυχή]," the God made the universe as a living creature or animal (ζῷον), a being endowed with soul.[254]

It is at this point that a tension emerges in Plato's story. Although not all-powerful, the Demiurge in Plato's Timaeus is described as a maker, or artisan. It is strange that the Cosmic Animal, or World-Soul, is said to have been *made* by the Demiurge, since normally living creatures are not fabricated by an artisan, they are *born*. This raises questions about how Plato conceives of divinity. "To find the maker and father of this universe is hard enough," writes Plato, "and even if I succeeded, to declare him to everyone is impossible."[255] There has been much commentary over the ages concerning the meaning of this double designation of the Platonic God as both "maker" and "father." Plutarch's interpretation is helpful, if not entirely elucidatory:

> [In] the case of a maker, his work, when done, is separated from him, whereas the origination and force emanating from the parent is blended in the offspring . . . which is a . . . part of the procreator. [The] cosmos is not like products that have been molded and fitted together but has in it a large portion of vitality and divinity, which god sowed from himself in the matter and mixed with it.[256]

The Demiurge, then, is a maker, but a *fatherly* maker whose life force is wedded with that which has been brought to birth. Still, it seems awkward, to say the least, that the cosmos is said to have been born from a single male parent. Plato resolves this tension by introducing another cast member into his cosmogonic drama: the Receptacle (ὑποδοχή), or "wetnurse of all becoming."[257] Whereas the fatherly Demiurge is said to *beget* the beautiful form of the cosmos, the motherly Receptacle is said to *bear* it.[258] Plato's account of the Receptacle is meant to be an accessible image for a closely related, but far more obscure concept, that of the Khora (Χώρα). The Khora is described as the "third kind" mediating between the eternal being of the Ideas and the becoming of the cosmic image. "Its nature," writes Plato,

> is to be available for anything to make its impression upon, and it is modified, shaped and reshaped by the things that enter it. . . . The things that enter and leave it are images of those things that always are [Ideas/ειδών], imprinted after their likeness in a marvelous way that is hard to describe . . . . It is in fact appropriate to compare the receiving thing to a mother, the source to a father, and the nature [physis/φύσις] between them to their offspring.[259]

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[254]Sallis, 57-58.

[255]Plato, *Timaeus*, 28c.

[256]Plutarch, *Platonic Questions*, II, 1, quoted in Sallis, *Chorology*, 52 note 7.

[257]Plato, *Timaeus*, 49a.

[258]Sallis, 58 note 14.

[259]Plato, *Timaeus*, 50c-d.

The Cosmic Animal or World-Soul, then, is the offspring of the khoric mother and eidetic father. While standard readings of Plato's written corpus tend to fall into a two-world interpretation, where physical becoming is said to poorly imitate perfect metaphysical being, ambiguities in Plato's account make it difficult to determine whether, in generating an ensouled cosmos, the separation between the eternal Ideas and the becoming of the physical cosmos is canceled.[260] From Whitehead's perspective, this ambiguity can be hermeneutically massaged to save Plato from the incoherence of dualism. After all, Plato himself explicitly disclaimed "the possibility of an adequate philosophical system" that might permit the "variousness of the Universe . . .to be fathomed by our intellects."[261] Whitehead's reformed Platonism insists upon the worldly immanence of the divine, thereby erasing any ultimate separation between the Demiurge and the Receptacle. Instead, their supposed offspring, the World-Soul, is said to supply the universe's harmonious tendencies through the dipolarity of its own nature. Conceiving of the World-Soul as an *emanation* issuing from a transcendent deity, as some Platonic interpreters have done, "obscures the ultimate question of the relation of reality as permanent with reality as fluent"; the coherence of Whitehead's scheme requires, in contrast, that the Cosmic Animal be understood as a *mediator*, sharing in the natures of eternity and time alike.[262] The Cosmic Animal is not a free creation of an acosmic divine architect, but a creature of Creativity.

Whitehead reads *Timaeus* as offering an account of a World-Soul

> whose active grasp of ideas conditions impartially the whole process of the Universe [and] on whom depends that degree of orderliness which the world exhibits.[263]

Without this active grasp by the living intelligence of the mediating World-Soul, the ideas would remain frozen and lifeless and would have no way of characterizing actuality or partaking in the creative process of cosmogenesis. Plato further describes the way the Cosmic Animal "contains within itself all the living things whose nature it is to share its kind."[264] As Whitehead puts it, the organic process of each actual occasion "repeats in microcosm what the universe is in macrocosm."[265] It is this correspondence between the World-Soul and the varying grades of finite souls, including humans, that affirms the co-creative role of every organism, no matter how seemingly insignificant: "all [play] their part in conditioning nature by the inherent

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[260]Sallis, 69-70.

[261]Whitehead, *Adventures of Ideas* (New York: The Free Press, 1961), 52 (originally published in 1933). Whitehead is here referring to Plato's discussion in his Seventh Letter written to Dion's followers.

[262]Ibid., 130.

[263]Ibid, 147.

[264]Plato, *Timaeus*, 31a.

[265]*Process and Reality*, 215.

persuasiveness of ideas."[266] An erotic ferment inwardly permeates every creature, persuading all ever onward toward novel intensities of harmonic experience. In this sense, Eros, the divine element in the world, functions less to preserve stability than to evoke intensity.[267] For example, even stars, our sidereal ancestors, are not everlasting: only by way of their sacrificial death could the heavier elemental creatures required for biological life have been brought forth. Similarly, the upward trend of biological evolution towards more complex species depends upon a selective process whereby the inability of an individual organism to adapt its way of life to changing circumstances "[entails] the death penalty for impertinence."[268] The cosmic desire for the intensification of experience is more powerful than the private fear of death. "It is in this way," writes Whitehead,

> that the immediacy of sorrow and pain is transformed into an element of triumph. This is the notion of redemption through suffering which haunts the world.[269]

Whitehead calls the process of erotic evocation of intensities by the World-Soul, whereby egoistic aims are sublimated by their inclusion in a greater whole, a "Supreme Adventure."[270] He describes the Adventure as an inverted renovation of Plato's Receptacle, a "medium of intercommunication" necessary for the unity of all things.[271] While the Receptacle is "void," "bare of all forms," "and abstract from all individual occasions," the Adventure includes "the living urge towards all possibilities [realizable by] the [actual] occasions of the advancing world each claiming its due share of attention."[272] The divine dimension of the cosmos, the World-Soul, is the "Great Fact" explicatory of our Supreme Adventure. As discussed above, the divine nature is dipolar, including a primordial and a consequent aspect, or as Whitehead also describes them, an "initial Eros" and a "final Beauty." Whitehead's poetic genius reaches its highest pitch when he reflects upon this Great Fact in the concluding lines of *Adventures of Ideas*:

> It is the immanence of the Great Fact including this initial Eros and this final Beauty which constitutes the zest of self-forgetful transcendence belonging to Civilization at its height. At the heart of the nature of things, there are always the dream of youth and the harvest of tragedy. The Adventure of the Universe starts with the dream and reaps tragic Beauty. This is the secret of the union of Zest with Peace:–That the suffering attains its end in a Harmony of Harmonies. . . . In this way the World receives its

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[266]*Adventures of Ideas*, 148.

[267]*Process and Reality*, 105.

[268]*Stengers*, 112.

[269]*Process and Reality*, 350.

[270]*Adventures of Ideas*, 294-295.

[271]Ibid., 134.

[272]Ibid., 295.

> persuasion towards such perfections as are possible for its diverse individual occasions.[273]

While the World-Soul's primordial valuation of the multiplicity of eternal objects is unchanging "by reason of its final completeness," its consequent feeling of the evolving multiplicity of actual occasions remains always incomplete.[274] In this sense, although the community of finite organic occasions makes up the unity of the Cosmic Animal, the latter "is not a static organism"; rather, "[it] is an incompletion in process of production."[275] Process theologian Roland Faber has described Whitehead's theology of becoming as an "*eschatological ad-vent*" wherein the divine is caught up in the always ongoing adventure of all that was, is, and will be.[276] The ensouled universe is therefore best described not simply as Whole, or as One, but as an

> open movement of wholeness that cannot be united by any rational account [because it] harbors the Eros of unpredictable novelty and incommensurable diversity.[277]

Whitehead's emphasis on openness and diversity makes comparisons with neo-Platonist schemes of the emanation of the Cosmic Animal from the "One beyond being and non-being," as Plotinus and Proclus often described it,[278] rather troublesome. Nonetheless, physicist Simon Malin argues that Whitehead's approach is in some ways complemented by such schemes, wherein a process of divine effulgence or "overflowing" leads to the ordered involution of a series of stages:

> Thus the One produces Nous, Nous produces Soul, Soul produces nature, and nature produces the sensible world. . . . In the case of the World Soul . . . it is the contemplation of the perfect intelligence and order of the Nous that gives rise, as a kind of unintentional overflow, to the order of nature.[279]

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[273]Ibid., 296.

[274]*Process and Reality*, 345.

[275]Ibid., 214-215.

[276]Roland Faber, "De-ontologizing God: Levinas, Deleuze, and Whitehead," in *Process and Difference: Between Cosmological and Poststructuralist Postmodernisms*, eds. Catherine Keller and Anne Daniell (Albany: State University of New York Press, 2002), 222-223.

[277]Roland Faber, "Surrationality and Chaosmos: For a More Deleuzian Whitehead," in Roland *Secrets of Becoming: Negotiating Whitehead, Deleuze, and Butler*, eds. Roland Faber and Andrea Stephenson (New York: Fordham University Press, 2011), 158, 163.

[278]Following Plato, *Republic* 509b and *Parmenides* 137cf.

[279]Simon Malin, *Nature Loves to Hide: Quantum Physics and the Nature of Reality, a Western Perspective* (Singapore: World Scientific Publishing, 2012), 201-202.

While some analogy can be drawn between the Nous and Whitehead's conception of the primordial nature of God, in the emanationist scheme, the many actual occasions of the physical world are given no agency or co-creative role whatsoever, nor is God attributed with a consequent nature allowing it to *become-with* the many occasions of the world as our fellow-sufferer. Whitehead dismissed such overly rationalized schemes because they lack the experiential adequacy demanded by our religious intuitions of a God who feels and can be felt, and our aesthetic intuitions of a continually creative cosmos. "God is *in* the world, or nowhere," writes Whitehead,

> creating continually in us and around us. This creative principle is everywhere, in animate and so-called inanimate matter, in the ether, water, earth, human hearts. . .In so far as man partakes of this creative process does he partake of the divine, of God, and that participation is his immortality, reducing the question of whether his individuality survives death [to] irrelevancy. His true destiny as co-creator in the universe is his dignity and his grandeur.[280]

The rationality of Whitehead's cosmological scheme remains provisional, experimental, imaginative, and always pluralistic. It is an "adventure of hope," not a search for the certainty of a final systematic theory that would "explain away" mystery.[281] For Whitehead, not only does philosophy begin in wonder, "at the end, when philosophic thought has done its best, the wonder remains."[282] Whiteheadian rationality is guided by an unwavering commitment to *relationality*, whereby "there is an essence to the universe which forbids relationships beyond itself."[283] To search for a "beyond" is to violate the rationality of relationality. Instead of anxiously running from the abyssal chaos at the root of all things in search of the secure Ground offered by traditional accounts of a One beyond being, or an omnipotent Creator, Whitehead celebrates the "within-beyond" of a groundless "creative drive undermining any static dichotomy between cosmos and chaos."[284] God, a creature of Creativity like each of us, suffers and enjoys the unpredictable adventures of a chaosmos in which "everything happens for the first time, but in a way that is eternal."[285]

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[280] Price, 297.

[281] *Process and Reality*, 42; *Adventures of Ideas*, 174.

[282] *Modes of Thought*, 168.

[283] *Process and Reality*, 4.

[284] Faber, "Surrationality and Chaosmos," 165.

[285] Borges, "Happiness," 441.

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