Whitehead was among the first initiates into the 20th century's 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 book therefore situates Whitehead’s organic 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 the traditional materialistic-mechanistic metaphysical interpretation of them, 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 human civilization. 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.
Physics of the World-Soul: Alfred North Whitehead’s Adventure in Cosmology


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Physics of the World-Soul

Alfred North Whitehead’s Adventure in Cosmology

Third Edition

By Matthew T. Segall
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Preface to the Third Edition

This book originated as a comprehensive examination submitted as part of my doctoral studies at the California Institute of Integral Studies in San Francisco. I edited it for readability by a wider audience and published it for the first time in 2013. Following the completion of my dissertation in 2016, titled Cosmotheanthropic Imagination in the Post-Kantian Process Philosophy of Schelling and Whitehead, I decided to republish a new edition as a natural scientific supplement. These editions focused exclusively on Whitehead’s organic cosmology, but Schelling’s cosmological vision was never far from my mind. The title of this book, Physics of the World-Soul, is itself a nod toward Schelling’s search for what he called a “higher physics” rooted in “universal organism.” The publication of a third edition in 2018 is in part a result of my growing recognition that Whitehead’s philosophy of organism becomes more comprehensible when read as an inheritor of Schelling’s post-Kantian Naturphilosophie. The present edition thus expands the narrative to include Schelling’s groundbreaking contributions to the task of reimagining the mind’s relationship to nature in the aftermath of the Scientific Revolution. But my decision to publish yet another edition deserves further explanation.

On July 5th, 2017, I received an email from Dr. Andy Letcher, author of Shroom: A Cultural History of the Magic Mushroom (2006). Andy, who holds doctorates in ecology as well as religious studies, had recently become head of the Ecology and Spirituality Masters degree program at Schumacher College in Totnes, UK. After first being introduced to Whitehead by Terence McKenna during a workshop in London in the mid-90s, Andy struggled to find a way into this notoriously difficult thinker’s radically novel ideas. Sometime in early 2017, Andy got ahold of the
second edition of my book. I was delighted to hear that it had helped him to finally begin making sense of Whitehead’s philosophy of organism. He felt his students would benefit from an introduction to this important and until recently neglected thinker, so he invited me to teach for a week at Schumacher as part of a course called Evolution and Spirituality in the West. I happily accepted his invitation.

I am writing this preface a year after receiving Andy’s invitation having just spent five enchanting days at Schumacher with a group of students eager to understand Whitehead’s organic cosmology. Joining the MA students was a diverse group of other course participants, including an artist, a software engineer, a lawyer, a mycologist, a body worker, and a psychotherapist. This confirmed for me what I had already believed, that Whitehead’s vision of the universe is relevant to more than just those of us queer enough to devote our lives to speculative philosophy.

It may sound paradoxical to those who haven’t had the opportunity, but in my experience, trying to teach the history of philosophy is by far the best way to learn it. As Schelling, the Schlegel brothers, Novalis, and the rest of the German Romantic circle knew, philosophical ideas are best worked out in the midst of passionate interpersonal dialectic. Such entanglements quicken consciousness into a form of co-creativity the Romantics called “symphilosophy.” Speaking thoughts into a room of dedicated co-inquirers focuses and intensifies my thought process, generating new conceptual connections. The well-articulated questions and points of contention voiced by other minds forces mine to reconsider its own well-worn habits of thought and to generate novel ideas and neologisms. At various moments during classroom discussions at Schumacher, normally abstract concepts about the cumulative nature of time or the ingression of possibility into actuality began to
sink into and transform our perception. These moments are a precious gift, and I must thank Andy and the other course participants who made them possible.

It was my experience at Schumacher that convinced me that a third edition is warranted. The cosmos itself is an unfinished creative process, so it is not surprising that this book, too, has remained an open-ended adventure of ideas.

June 23, 2018
Oxford, UK
Introduction: Whitehead’s Schellingian Inheritance

“The organic principle, because it is everywhere present, is nowhere; and because it is everything, it cannot be anything determinate or particular; language has no appropriate term for it, and the earliest philosophies have handed down to us an idea of it only in a figurative guise.”
-Schelling¹

“Viewed from this height, the particular successions of causes and effects (that delude us with the appearance of mechanism) disappear as infinitely small straight lines in the universal curvature of the organism in which the world itself persists.”
-Schelling²

At first glance, F. W. J. Schelling’s and A. N. Whitehead’s approaches to philosophy might appear to have little in common: the former is normally thought of as a radical inheritor of Kant’s transcendental idealism, while the latter is known to most as a collaborator with Bertrand Russell on the Principia Mathematica. Until quite recently, few were aware of Whitehead’s later metaphysical work, and even fewer attempted to understand it. Even Russell makes no mention of his friend Whitehead’s process philosophy in his 900-page history of Western philosophy. When Schelling is mentioned in histories of philosophy, it is usually only as a footstool between Fichte’s subjective and Hegel’s absolute idealism. This typical

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¹ On the World-Soul, 70.
² On the World-Soul, 70.
account stems from Hegel’s own influential version of the history of philosophy, which has it that the whole Western tradition culminates in himself. There are notable exceptions to this standard narrative, however. Heidegger, for example, argues that Schelling “drives German idealism from within right past its own fundamental position.” Similarly, according to Terry Pinkard, Schelling’s work is premised on the idea that “post-Kantian idealism [went] too far in [its] attempt to create a form of idealism that was fully self-contained.” Unlike the other German idealists, Schelling did not believe the rational mind could ground itself or that it could account for the world’s existence purely in terms of logical categories. Schelling was convinced that something deeper and darker was at play beneath the daylight consciousness of Enlightenment Reason. Pinkard follows many historians of philosophy in dividing Schelling’s work into seemingly discontinuous phases, including his youthful allegiance to Naturphilosophie, his mid-life flirtation with neoplatonism, and his mature fascination with mythology and revelation. This common perception of the winding course of Schelling’s admittedly experimental approach to philosophizing probably stems, again, from Hegel, who once dismissively quipped that his old friend Schelling “carried out his education in public.” Some scholars, like D. C. Schindler, dampen Hegel’s reading of Schelling as “the proteus of philosophy” by insisting that, underlying the lifelong evolution of his thinking, it was always the question of “a properly ontological notion of freedom” that drove his restless philosophizing. Other scholars have contended that, despite protean appearances, Schelling remained, in Jason Wirth’s words,

3 Beiser, After Hegel, 9.
4 Heidegger, Schelling’s Treatise, 4.
5 Pinkard, German Philosophy, 324.
6 Pinkard, German Philosophy, 325.
“first and foremost a thinker of the question of Nature.” 9 In that Schelling’s quest for an adequate philosophical expression of freedom drove him “beyond the strictly human sphere all the way into the deepest crevices...of the world,” 10 these two perspectives on his work are not necessarily contradictory. As Schelling put it: “Only one who has tasted freedom can feel the longing to make everything analogous to it, to spread it throughout the whole universe.” 11

As for Whitehead, Iain Hamilton Grant lists him alongside Schelling as one of the most promising examples of speculative cosmologizing “beyond the epistemological concerns of the philosophy of science.” 12 Whitehead shared with Schelling a desire to break free of the epistemic shackles Kant had placed around philosophical speculation. 13 George Lucas further confirms their philosophical affinity by reading Schelling’s Naturphilosophie as a historical precursor to Whitehead’s philosophy of organism. 14 Arran Gare goes even further, labeling Whitehead a “[Schellingian] of some stripe.” 15 Even though Whitehead does not seem to have studied Schelling’s writing directly, Gare’s label is defensible in light of Whitehead’s use of an excerpt from an essay of Schelling’s in The Concept of Nature, which he came across second hand in a work by N. O. Lossky:

In the ‘Philosophy of Nature’ I considered the subject-object called nature in its activity of self-constructing. In order to

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9 Wirth, “Schelling’s Contemporary Resurgence,” 594n6. See also the work of Iain Hamilton Grant, Dalia Nassar, and Bruce Matthews.
11 Schelling, Human Freedom, 22.
12 Grant, After Schelling, vii, ix.
13 My dissertation, Cosmotheanthropic Imagination in the Post-Kantian Process Philosophy of Schelling and Whitehead (2016), treats Kant as the guardian of the threshold through which Schelling and Whitehead, with help from the power of imagination, were able to pass.
15 Gare, “The Roots of Postmodernism,” 36.
understand it, we must rise to an intellectual intuition of nature. The empiricist does not rise thereto, and for this reason in all his explanations it is always *he himself* that proves to be constructing nature. It is no wonder, then, that his construction and that which was to be constructed so seldom coincide. A *Natur-philosoph* raises nature to independence, and makes it construct itself, and he never feels, therefore, the necessity of opposing nature as constructed (i.e. as experience) to real nature, or of correcting the one by means of the other.  

Whitehead leans on Schelling’s conception of Nature as a self-constructing “subject–object” as support for his move beyond modern science’s bifurcated mode of thought, wherein reality is assumed to be divided in two, with the experiential dream of the mind on one side and its conjectured physical cause on the other. Though Whitehead’s early philosophy of science tried to hold such metaphysical questions at bay, he eventually came to argue, like Schelling, that Nature must be conceived of, not merely as a dead object or collection of objects, but as a living and dynamically evolving community of subjects. I explore Whitehead’s philosophy of science and critique of the bifurcation of Nature in more depth in chapter 2.

Maurice Merleau-Ponty is a striking example of a 20th century thinker who saw through standard readings of the history of philosophy in order to retrieve the powerful insights of Schelling and Whitehead. In their book *Nature and Logos*, William Hamrick and Jan Van Der Veken detail how Schelling’s and Whitehead’s

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process philosophies inspired Merleau-Ponty during his lectures on Nature at the Collège de France in the late 1950s.\textsuperscript{17} Merleau-Ponty approved of their shared intuition that, rather than being a random and improbable accident, “the human being [is] a species of the recreation of the world,” and further, that rather than being merely an idea of Reason reflected upon by the understanding as Kant had it, “God [is] an empirical fact...at the base of all experience.”\textsuperscript{18} Hamrick and Van Der Veken also argue that Whitehead “incorporated important Schellingian insights” into his philosophy.\textsuperscript{19} In support of this claim they point to Antoon Braeckman’s work linking Whitehead’s philosophical scheme to Schelling’s through the intermediary of the Schellingian philosopher-poet Samuel Taylor Coleridge.\textsuperscript{20} Coleridge’s role in the formation of William Wordsworth’s aesthetic vision of Nature is well known. Though he was familiar with Coleridge, the deepest impact on Whitehead came through the poetry of Wordsworth, which he returned to throughout his life. According to his daughter’s testimony, Whitehead would read \textit{The Prelude} almost daily “as if it were the Bible, poring over the meaning of various passages.”\textsuperscript{21} Along with the impact of Schelling through Coleridge and Wordsworth, Whitehead was deeply influenced by the British idealists John McTaggart and F. H. Bradley. In light of his idealistic inheritances, Whitehead admits in the opening pages of \textit{Process and Reality} that his own cosmology might be considered “a transformation of some main doctrines of Absolute Idealism onto a realistic basis.”\textsuperscript{22}

\textsuperscript{17} Hamrick and Van Der Veken, \textit{Nature and Logos}; Merleau-Ponty, \textit{Nature}.
\textsuperscript{18} Merleau-Ponty as quoted in Hamrick and Van Den Veken, \textit{Nature and Logos}, 140; Merleau-Ponty, \textit{Nature}, 47.
\textsuperscript{19} Hamrick and Van Den Veken, \textit{Nature and Logos}, 228.
\textsuperscript{22} Whitehead, \textit{Process and Reality}, xiii.
The philosophies of Schelling and Whitehead can evidently be understood to orbit around a common intuition, that the ontological bifurcation separating the physical from the psychical can be healed only through an aesthetic act of creative imagination, an act that allows us not only to think but to feel the world in a new way. Modern philosophy since Descartes has blocked the way toward such healing by severing reflective thought from bodily affect and perception, elevating the former to the only source of truth and dismissing the latter as philosophically irrelevant or at best of secondary importance. Schelling and Whitehead sought a new truce between thinking and feeling, an integration that would welcome both modes back into philosophy as species of knowing essential to our comprehension of humanity, the cosmos, and the divine. They recognized that new modes of thinking lead to new modes of perception, and vice versa, since there is no ontological chasm separating the two.

While Schelling and Whitehead were both system-builders seeking comprehensive scientific insight into the formation of the actual processes of Nature, neither of them conceived of systematic philosophy as a finite task with a definite end. No system of philosophy can ever claim completion because reality itself is not a closed system. The natality of Nature is always slipping through the net rationality tries to cast upon the world. The cosmological scope of Whitehead’s “free and wild creation of concepts”\textsuperscript{23} makes him one of the twentieth century’s most important inheritors of the nomadic spirit of Schelling’s \textit{Naturphilosophie}. Schelling was steeped in the most advanced natural science of his day. Unfortunately, in the decades following Schelling’s death in 1854, the gulf between speculative philosophy and mechanistic science widened and his organic approach

\textsuperscript{23} Deleuze and Guattari, \textit{What Is Philosophy?}, 105.
to understanding Nature was dismissed by the scientific and philosophic communities. For reasons explored in the next chapter, the positivistic method and mechanistic metaphor won the day. The chapters to follow make the case that an alternative *organic* science inspired by Schelling and Whitehead is not only possible, but that the findings of 20th century physics have made such an alternative vision necessary for the reassembly of a coherent a cosmological scheme.
Chapter 1: 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.”
-Whitehead\textsuperscript{24}

“Philosophy begins in wonder. And, at the end, when philosophic thought has done its best, the wonder remains.”
-Whitehead\textsuperscript{25}

According to Whitehead, one of philosophy’s most important roles in our age is to serve as 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."\textsuperscript{26} Instead, the philosopher must always be at work attempting to harmonize the abstract sciences (e.g., physics, chemistry, biology, psychology, sociology, and theology), both internally among themselves, and more generally with our deep moral intuitions and aesthetic feelings regarding the archetypal values inherent to the universe. It follows that philosophy’s reach is broader than that of natural science, since while

\textsuperscript{24} Whitehead, \textit{Process and Reality}, xiv.
\textsuperscript{25} Whitehead, \textit{Modes of Thought}, 168.
\textsuperscript{26} Whitehead, \textit{Science and the Modern World}, 83.
a philosophical scheme must integrate the findings of physics and biology, it must also strive for a greater coherence, namely, “the fusion of religion and science into one rational scheme of thought.”27 After all, the data associated with humanity’s religious and spiritual experiences are also part of the becoming of this cosmos.

One of my main motivations for composing this essay is the troubling recognition, rarely acknowledged by physicists, that contemporary scientific cosmology has passed into an epicyclic phase of theoretical development.28 This has been the case for at least a century, as two of the most mathematically beautiful and empirically predictive theories yet articulated by science, quantum theory and relativity theory, still cannot be reconciled with one another and thus appear to offer two incompatible perspectives on the ultimate nature of the universe. Two of the most obvious examples of epicycles in contemporary cosmology are so-called “dark matter” and “dark energy.” These hidden causes have been invented ad hoc in order to account for the divergences from Einstein’s equations in the observed rotational velocity of galaxies and the rate of inflation of the universe, respectively. I refer to these as “epicycles” because they are analogous to the hypothetical devices used by Ptolemaic astronomers to deal with unexpected planetary motions. These pre-Copernican astronomers attempted to “save the appearance” of disorder in the heavens by conjecturing as many hidden circles upon circles as was necessary to assure that the model continued to match observations. 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

27 Whitehead, Process and Reality, 15.
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 the 20th century’s 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 book therefore situates Whitehead’s organic 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 the traditional materialistic-mechanistic metaphysical interpretation of them, 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 human civilization. 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.29 Ecology—that is, the study of the evolving relationships constitutive of organisms—should thus become the most general of the natural sciences, replacing physics.

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

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as a result “degenerate into a medley of ad hoc hypotheses.”\textsuperscript{30} Despite the conceptual revolutions of the 19th and 20th centuries (e.g., evolutionary, relativity, quantum, and complexity theories), scientific materialism remains the \textit{de facto} natural philosophy of Western civilization. It encourages us to imagine 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.\textsuperscript{31}

Such a picture of ultimate reality leaves no room for life or consciousness. Many have argued that this metaphysical mistake contributes to the worsening ecological and socio-economic crises of our contemporary (post)modern civilization. The mechanistic mode of thought alienates sensitive, value-seeking, purpose-driven human organisms from their own planet. It’s no wonder we’ve gone about destroying it for the last several centuries.

A coherent philosophy of Nature has yet to take root among our civilization’s intelligentsia. Several centuries from now, if historians still exist, and if a new image of the universe 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 ecological devastation, but for its disorienting scientific discoveries (like relativity and quantum theory) and the earthshaking technological inventions which resulted (like

the atom bomb and the microchip). During this period, it seems that the greater part of the thinking heads of our civilization have been distracted by the electronic gadgetry and wartime glory afforded by technoscience.  

Perhaps this distraction is what has allowed them to overlook the philosophical incoherence of mechanistic materialism. Whitehead, one of the handful of historically grounded 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.

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 non-modern cosmologies, modern scientific materialism has been predicated upon a metaphysical bifurcation separating human consciousness from the surrounding universe. This dualism between consciousness and cosmos is the fatal flaw in the source code of modern scientific

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32 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, 11).

33 Whitehead, Science and the Modern World, 23 (italics mine). By way of comparison, Schelling’s Naturphilosophie was similarly an attempt “to allow natural science itself to arise philosophically” (Schelling, Ideas for a Philosophy of Nature, 5).
materialism. Whitehead’s philosophy of science is essentially a protest against the widespread deployment of the fundamental fallacy of bifurcation, along with its daughter fallacy, that of misplaced concreteness. In effect, modern science has sacrificed intuitive understanding of the concrete passage and organic purposiveness of the actual universe for abstract knowledge of mathematically constructed 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 fragmented. “Coherence,” writes Whitehead, “is the great preservative of rationalistic sanity.”34 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. “For most of the twenty-five centuries since written history began,” writes Freeman Dyson, “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, [20th and 21st century philosophers] are a sorry bunch of dwarfs...So far as the general public [is] concerned, philosophers [have become] invisible.”35

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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.” Lawrence Krauss similarly argues that much of contemporary philosophy suffers from “intellectual bankruptcy”:

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.

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].

In response to such criticisms, it is important to remember that Whitehead was driven by the same desire to understand Nature as these contemporary scientists.

37 Lawrence Krauss, *A Universe from Nothing*, 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 *Incomplete Nature* (2012).
He had no interest in restricting the inquiries of physicists into the norms of Nature. His interest in metaphysics arose only when he realized that nineteenth and twentieth century revolutions in physics, biology, and psychology had made the old Cartesian metaphysics of dualistic mechanistic materialism obsolete. Whitehead’s adventure in cosmology makes sense only in the transformative wake of evolutionary, relativity, quantum, and complexity theories. In a thermodynamically open, self-organizing, time-developmental universe like ours, natural scientists can no longer unironically refer to a mind-independent realm of dead matter in motion. A non-Cartesian ontology and epistemology are needed that do not disintegrate mind from the material it evolves with. Schelling called for an organic, participatory conception of natural science and of Nature more than a century before Whitehead (see his Ideas for a Philosophy of Nature [1797]). Whitehead’s major philosophical accomplishment was to further systematize and bring up to date a basically Schelllingian Naturphilosophie.

Krauss is right to differentiate the “operational” knowledge of practicing physicists from the “ontological” definitions of philosophers. His mistake is in assuming that the need for a philosophical inquiry into Being can just be replaced or superseded by the latest technical paradigmatic definitions of scientific objects and their behavior. It is fine to examine the laws of Nature, to seek to mathematize Nature’s patterns, but what, after all, is a “law” in an otherwise exhaustively material cosmos? As soon as we question the status of “laws” as such, we leave the techniques of science behind and begin to practice metaphysics. Whitehead’s especially potent metaphysical imagination made him well aware of the danger of supposing that our present scientific definitions, whether they be in the language of mathematical physics or of experimental psychology, 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”\textsuperscript{40}: “We experience more than we can analyze. For we experience the universe, and we analyze in our consciousness a minute selection of its details.”\textsuperscript{41}

For Whitehead, the role of the philosopher is akin to that of the poet: to introduce novel fundamental ideas and verbal expressions as an aid to the ongoing adventure of civilization.\textsuperscript{42} This makes philosophy’s goals a great deal broader than those of physics. But as I hope to spell out in the course of this book, it is essential to the health of an advanced civilization that lines of communication between philosophy and science remain open and amicable. A mathematical physicist by training, Whitehead had just as much criticism of the habits of his own discipline as he did of academic 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 nineteenth and twentieth 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.”\textsuperscript{43}

Whitehead’s approach to philosophy and science are not typical of his age. A natural born integrator, he came to them from several angles at once: as a mathematician seeking truth in harmonious pattern, as a physicist attempting to

\begin{itemize}
\item \textsuperscript{40} Whitehead, \textit{Modes of Thought}, 173.
\item \textsuperscript{41} Whitehead, \textit{Modes of Thought}, 89.
\item \textsuperscript{42} Whitehead, \textit{Modes of Thought}, 174.
\item \textsuperscript{43} Whitehead, \textit{Science and the Modern World}, 58.
\end{itemize}
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.”

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 potential of abstractions to explain away the abyssal darkness of our universe. In contrast to the triumphant attitude fostered by scientific materialism, Whitehead does not look to natural science, or to philosophy, for reductive explanations or final theories of everything. Rather, his philosophizing seeks “direct insight into depths as yet unspoken.” The purpose of philosophy is not to explain away mystery, but to add to mystery “some grasp of the immensity of things, some purification of emotion by understanding.”

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

Chapter 2: 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

“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

“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

For ancient poets like Homer, the Sun was a being of tremendous spiritual significance. The intense beauty of its rising and setting brought forth a dramatic display of the abiding moral and aesthetic harmony driving 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,

47 Homer, *The Odyssey*, bk. 3, lines 1-4.
the Moon and other stars) to bring forth the beauty and splendor of the universe.\textsuperscript{50} Plato’s was a participatory account of our knowledge of Nature wherein soul and world were understood to 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.\textsuperscript{51}

Not only was Plato’s cosmology inclusive of perceptual experiences in its account of Nature, it felt divine \textit{Eros} and saw eternal \textit{Eidos} at work throughout the cosmos. The circling stars, Sun, and Moon were considered 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 enduring influences on all subsequent Western thought.\textsuperscript{52} In the main, Plato’s cosmological scheme and account of visual perception, as articulated most profoundly in the dialogue \textit{Timaeus}, reigned among Europe’s intelligentsia for more than 1,500 years.\textsuperscript{53} It was not until the height of the Scientific Revolution in the seventeenth century that Plato’s ancient participatory premises were rejected as the next wave of great geniuses gave birth to mechanistic philosophy. Plato’s participatory vision was only briefly revived by Goethe and Schelling in the late eighteenth and early

\textsuperscript{50} Plato, \textit{Timaeus}, 45a-d.
\textsuperscript{51} Plato, \textit{Timaeus}, 47a
\textsuperscript{52} Whitehead, \textit{Science and the Modern World}, 38.
\textsuperscript{53} Arthur Zajonc, \textit{Catching the Light}, 21.
nineteenth centuries (and then carried forward by James and Bergson into the twentieth).

“In the year 1500,” writes Whitehead, “Europe knew less than Archimedes who died in the year 212 BCE.”\textsuperscript{54} The commonsense assumption of a person living in 1500 was that Earth was stationed 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 \textit{Principia} had been written and the world was well started on the modern epoch.”\textsuperscript{55} The new analytic methods of Descartes, Galileo, and Newton succeeded in severing the bond between the numinosity of the soul and the phenomenality of the world, bifurcating Nature into two entirely distinct substances: extended matter and intentional mind. Humanity’s understanding of its relationship with the universe (or lack thereof) underwent a fundamental transformation.

Three hundred years later, despite the evidences of modern physical science, the average twenty-first 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.” The warmth and hue of a sunset, continues Galileo, “are no more than mere names so far as the object in which we locate them are concerned.” They reside not in the intrinsic 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 here degraded into the dualistic modern theory of “two natures...one the conjecture and the other the dream.” Scientific materialism, in other words, has come to oppose our intimate 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 of Nature (res extensa), 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 like us (res cogitans). Secondary qualities like color, sound, and taste were left to the free play of artists to be combined and recombined for the purpose of

57 Galileo, The Assayer, 274.
heightening the pleasure of appearances, rather than penetrating deeper into the archetypal roots of reality.\textsuperscript{59}

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 the middle of the nineteenth century, 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, education, architecture, transportation, communication, and religion. “[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 gave the answer of Cain—“Am I my brother’s keeper?”; and they incurred Cain’s guilt.\textsuperscript{60}

Today, at 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-

\textsuperscript{59} Prior to modernity’s differentiation of art, science, and religion, art served primarily a religious function as a sort of window from the earthly into the archetypal realm (see Whitehead, \textit{Science and the Modern World}, 20). Art also served science by mastering perspective, allowing for realistic representations of nature (see ibid., 45).

\textsuperscript{60} Whitehead, \textit{Science and the Modern World}, 181.
destruction. What seemed like the cure for all ignorance in the seventeenth century has since become a curse. Our technoscientific way of knowing—constructed on the metaphysical assumption of the bifurcation of subject from object, fact from value, meaning from matter—threatens the continued existence of the community of life on Earth.

Beginning in the early 1920s, Whitehead interrogated modern science and techno-industrial capitalism, not to dismiss them, 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.

Whitehead creatively retrieves the history of natural philosophy and redeployes it as what he calls a “philosophy of organism” that is organized around a new concept of Nature and a novel interpretation of the activity of science. Instead of construing the task of science as that of overcoming subjective illusion in order to reach objective reality, Whitehead takes the speculative risk of defining Nature otherwise: Nature becomes, quite simply, “what we are aware of in perception.” “Everything perceived is in nature,” says Whitehead, “We may not pick and choose.”

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61 “I assume as an axiom that science is not a fairy tale” (Whitehead, The Concept of Nature, 40).
62 Stengers, Thinking With Whitehead, 14.
reframing of science’s understanding of the ontology of Nature cannot be judged as “true” or “false” *a priori*, as to judge it fairly, we must first trust it enough to take the “leap of the imagination”\(^65\) 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 of our experience, establishing its relevance to the values of actual life. Materialist enemies of his philosophy tend to lack the negative capability\(^66\) 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 posed questions and poorly composed problems (e.g., “how does the brain produce consciousness?”, or “what shape is 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 as elements ingredient in the passage of Nature. They release scientific materialism from the irrational and polemical compulsion to replace concrete experience with abstract explanation. In this sense, Whitehead’s scientific method can be compared with Goethe’s “gentle empiricism,” an approach that similarly rejected mechanical explanations, instead pursuing Nature’s reasons by learning to participate more fully in the archetypal patterns woven into our embodied and aesthetic encounters with natural processes.\(^67\) “The divergence

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\(^66\) See John Keats’ letter to his brothers, December 21, 1817: “Negative Capability, that is, when a man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason...”

\(^67\) Zajonc, *Catching the Light*, 203.
of [scientific] formulae about nature from the appearance of nature,” argues Whitehead, “has robbed the formulae of any explanatory character.”

Equipped with Whitehead’s new organic philosophy, 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.

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 of 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 poorly posed problems, such as the so-called “hard problem” of how the brain produces consciousness. Posing such a problem immediately drags science into metaphysics, into reflection upon “both what is perceived and

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what perceives.’’ 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.’’ 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 account of 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.’’ 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.’’

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,’’ Whitehead defines the truth of science in terms

70 Stengers, Thinking With Whitehead, 34-36.
72 Stengers, Thinking With Whitehead, 35.
74 Whitehead, Process and Reality, 23.
of its experimental achievements and experiential disclosures.\textsuperscript{75} 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 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.\textsuperscript{76}

The “photon,” for example, is not just an invention of the physicist, nor is it simply a fact in 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” to which it belongs and through which it endures.\textsuperscript{77} From the perspective of Whitehead’s philosophy of science, the abstract will never be able to offer a satisfactory explanation for the concrete.\textsuperscript{78} The wavelength of a photon does not explain the scientist’s perception

\textsuperscript{75} Or in William James’ terms (a major influence on Whitehead), scientific truth becomes subject to the tests of pragmatism and radical empiricism, respectively.
\textsuperscript{76} Whitehead, \textit{Science and the Modern World}, 58.
\textsuperscript{77} Whitehead, \textit{The Concept of Nature}, 170-171.
\textsuperscript{78} Stengers, \textit{Thinking With Whitehead}, 99.
of redness, nor does a cybernetic model of neurochemistry explain the artist’s aesthetic encounter with a beautiful sunset or the mystic’s encounter with God. Whenever scientific materialists attempt to provide such heroic explanations, they succeed only in offering descriptive commentaries in terms of the scientific objects most fashionable in their age—commentaries presupposing 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 experiences and perceptual events from which they emerged.  

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 bridge the fissure bifurcating Nature into real physical facts on one side and apparent psychical values on the other. In order to achieve this reconciliation, he struggled to imagine a participatory mode of attending to Nature—a Nature no longer objectified as the inert stuff instrumentally manipulated by an alienated technoscientific mode of knowing. Instead, Whitehead sought to disclose Nature to awareness as an ecological network shaped by the social desires and individual decisions of evolving organisms. Living organisms cannot be explained merely in terms of their mass, extension, and velocity. They are creatures enjoying the value of their own experience, an experience inherited from and ongoingly entangled

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80 Stengers, *Thinking With Whitehead*, 38.
with 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.”81 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 ingredients 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 chapter, 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.

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Chapter 3: 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 the entire star-myriads roll through the sky...For it the partial to the permanent flowing, For it the real to the ideal tends. For it the mystic evolution...”
- Walt Whitman\(^{82}\)

“Everything happens for the first time, but in a way that is eternal.”
- Jorge Luis Borges\(^{83}\)

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.”\(^{84}\) 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.\(^{85}\)

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\(^{84}\) Whitehead, *Process and Reality*, xi.

\(^{85}\) Whitehead, *Process and Reality*, xii.
Already an important difference can be marked between contemporary scientific cosmology and Whitehead’s philosophical cosmologizing. Following his metaphysical turn in the late 1920s, Whitehead pursued 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 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 natural science have allowed it to precisely measure and carefully dissect much of the known world, but the materialistic ontology providing its imaginative background has led it to “exclude itself from relevance to the ordinary stubborn facts of daily life.” 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 deny in theory what we must affirm 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 inextricably relevant to daily life. Indeed, the technological applications of science have come to dominate not only human life, but the lives of every organism. They have even begun to alter the very geology of the planet.

86 Whitehead, Process and Reality, xiii.
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. It may be,” writes 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.

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. 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 and 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 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.

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life, such as moral responsibility, aesthetic appetite, 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.90

Whitehead’s philosophy of organism rejects the bifurcation of nature. 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 certain instances. Whitehead criticizes Descartes’ mind/matter dualism for its incoherence and excessive abstraction, but adds that “[his] system obviously says something that is true.”91 Whitehead appropriates much from the modern natural philosophical tradition, all the while keeping in mind that “the chief error in philosophy is overstatement.”92 By way of his method of imaginative generalization, Whitehead is led to experimentally93 construct 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

90 Bruno Latour, Foreword to Thinking With Whitehead, xiii.
91 Whitehead, Process and Reality, 6.
92 Whitehead, Process and Reality, 7.
93 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” (Whitehead, Process and Reality, 11).
problematic is not thereby eliminated or explained away, but transformed.94 The relationship between actual occasions and eternal objects is no longer one of duality, where neither category of being 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”95) by recognizing that every organic occasion or ecosystem of occasions—whether it be an electron, a bacterial 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. Nature is thus a hybrid process inclusive of both physical and mental activities.

As for the special significance of the human sphere, the conscious mental pole of highly complex organisms like Homo sapiens is said to be so advanced in degree that it appears also to become different in kind. 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 cosmic capacity for 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.”96

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95 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.
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.”\footnote{Whitehead, \textit{Science and the Modern World}, 138.} 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 cosmogenesis. 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,”\footnote{Whitehead, \textit{Science and the Modern World}, 137.} such that they come to find themselves related to one another in an extended space-time manifold according to certain invariant topological principles,\footnote{Whitehead, \textit{Science and the Modern World}, 145.} principles which are explored in a subsequent section in the context of a discussion of Whitehead’s philosophical critique of Einstein’s mechanistic cosmology.

“The solidarity of the universe,” writes Whitehead, “is based on the relational functioning of eternal objects.”\footnote{Whitehead, \textit{Science and the Modern World}, 137.} As relational entities, eternal objects cannot themselves cause actual occasions, they can only characterize the \textit{how} of prehension. “[Eternal objects] are adverbial, rather than substantive,” according to Whiteheadian interpreter Steven Shaviro, in that “they determine and express \textit{how} actual [occasions] relate to one another, take one another up, and ‘enter into each
others’ constitutions.” 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 onlyprehends 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 satisfaction of each occasion of experience. By way of concrescence, a particular actual occasion’s many prehensions of other occasions becomes one, thereby adding one more realized unity of experience—another “here I am!”—to the ongoing creative advance of the cosmic community: “The many become one, and are increased by one.”

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.” This would inevitably lead back to the classical bifurcated conception of mental subjects qualified by their private representations of external material objects. “If this be granted,” argues Whitehead, “there is no escape from solipsism.” 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.” 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 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.’”

Actual occasions are thus 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.” 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 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 universe of other organisms is broken.

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Before moving on from the metaphysical categories of Whitehead’s philosophy of organism to further explicate their 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.\(^{109}\)

Whitehead here makes reference to the realm of “eternal objects,” or “pure potentials,” which “connote a kind of cosmic geometrical/genetic code.”\(^{110}\) 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].”\(^{111}\) 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 process alone. They are surprised by his introduction of the relational hierarchy of eternal objects, not to mention the divinity envisaging it, both of which can at first seem to be rather \textit{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.¹¹²

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 value of the concrete passage of Nature as by the ghostly traces of “colors, sounds, scents, [and] geometrical characters...required for nature and...not emergent from it.”¹¹³ 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 concretely prehended superjective values achieved by 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-in-question 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

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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.114

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 ingresson of what “is not” but may be alongside the prehension of “what is.” In this sense, the prehension of actuality and the ingresson of possibility cannot be defined in isolation.115 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 many again). The open-ended creative advance of the universe in this way depends on both conjunction and disjunction, both unification and differentiation.116

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 had to reconceive the function of

115 Stengers, Thinking With Whitehead, 189.
divinity in the process of world-making. Rather than imagining God as a special exception to the metaphysical categories defining all other actualities, Whitehead sought parity. God is a creature of Creativity like all others. The only difference between God and every other actual occasion is that divine experience appears to occur in the reverse direction as that of finite experiences, such that God’s mental pole is primary while God’s physical pole is consequent. 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.

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 infinite realm of possibilities as relevant to it. In this way, those

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117 Or perhaps it is finite experience that appears backwards?
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. According to Whitehead’s “ontological principle,” “the general potentiality of the universe must be somewhere...this ‘somewhere’ is the non-temporal actual entity”: God.

God is a dipolar actual occasion like every other, “finding [itself] in the double role of [agent] and [patient] in a common world.” God’s primordial envisagement 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.” 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.” Whitehead’s imaginative description of God has more in common with the intermediary World-Soul of Plato’s Timaeus and Schelling’s Naturphilosophie than it does with the “wholly transcendent” Jehovah of Newton’s Scholium, “creating out of nothing [by fiat] an accidental universe.” I continue the comparison between Whitehead’s God and Plato’s World-Soul in the final chapter of this essay. The next chapter concerns

119 Whitehead, Process and Reality, 32.
120 Whitehead, Process and Reality, 46.
121 Whitehead, Process and Reality, 315.
122 Whitehead, Process and Reality, 346.
123 Whitehead, Process and Reality, 346, 351.
124 Whitehead, Process and Reality, 95.
the relevance of Whitehead’s philosophy of organism to evolution, relativity, quantum, and complexity theories, each in turn.
Chapter 4: 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

Since its eruption in the 17th century, modern science has instigated profound re-orientations in the outlook and self-conception of European and increasingly global 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 ontology of organism, 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 that would later come to be known more generally as the theory of evolution:

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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.\textsuperscript{126}

In the early 1880s, when Whitehead was 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!”\textsuperscript{127} 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 theory. “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.\textsuperscript{128}

Arguably, almost a century after Whitehead’s remark, physical science still lacks anything approaching such a systematic account of the whole of Nature. While several candidate theories uniting relativistic and quantum phenomena have been

\textsuperscript{126} Charles Darwin, \textit{The Origin of Species}, 384. Darwin added the words “by the Creator” in the second edition.
\textsuperscript{127} Lucien Price, \textit{The Dialogues of Alfred North Whitehead}, 277.
proposed, due to lack of empirical confirmation or mathematical coherence, none of them has succeeded in garnering the unanimous support of 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.\textsuperscript{129}

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.\textsuperscript{130}

Though it remains mechanistic in orientation, QED, unlike nineteenth century physics, can longer claim that its mechanical accounts reflect a reality independent of its experimental instruments. What was originally a materialist 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 presupposed materialist ontology. Instead, as Whiteheadian physicist Michael Epperson suggests, instrumentalists

\textsuperscript{129} Lederman, \textit{The God Particle}, 277 cf.

\textsuperscript{130} Lederman, \textit{The God Particle}, 99.
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.” Even if its mechanistic models cannot be unambiguously proven to reflect the reality of Nature in itself, “matter” (whatever it is) can be made, at least under laboratory and/or technologically mediated 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.”

Supposing a properly physical (if not fully metaphysical) “grand unifying theory” is eventually discovered, there would still remain the philosophical problem of unifying physics with biology, psychology, and human life. During the latter half of the twentieth century, a number of explanatory and descriptive strategies were 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 became possible, not because humanity suddenly developed a finer imagination, but rather because we developed faster computing technology. 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.

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131 Epperson, Quantum Mechanics and the Philosophy of Alfred North Whitehead, 33.
132 Karl Popper, Quantum Theory and the Schism in Physics, 100.
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 that are greater than the sum of its parts. One of the most recent attempts 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.134

Deacon’s path-breaking scientific work in this area provides an ideal comparison with Whitehead’s philosophy of organism. Both seek to articulate a processual account of the universe that is no longer limited by a nominalist and instrumental epistemology or by the strict mechanism of efficient causation but instead remains 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 different

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134 Terrence Deacon, Incomplete Nature, 549.
metaphysical footings. Whitehead balances his thinking upon the speculative stance that *experience* pervades the natural world, which is to say that a universally communicable texture of experience links everything in the cosmos.¹³⁵ Deacon begins his climb toward knowledge of Nature from an off-kilter materialist 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 section. The philosophical commitments differentiating their approaches to the emergence of complexity will become clearer if I first unpack Whitehead’s startlingly novel interpretations of twentieth 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\textsuperscript{136}

The main outlines of the doctrine of evolution, on Whitehead’s reading, must be “[absorbed]...as the guiding methodology of all branches of science.”\textsuperscript{137} 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 Nature. 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.\textsuperscript{138} Like physics, metaphysics should be engaged as an experimental practice, only the experiments are to be

\textsuperscript{136} Whitehead, \textit{Religion in the Making}, 100, 144.
\textsuperscript{138} Whitehead, \textit{Process and Reality}, 11.
performed on the medium of 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.”

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, not just the biological. In this sense, as was mentioned earlier, biology becomes the study of the evolution of the larger organisms, while physics becomes the study of the evolution of the smaller organisms. “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.

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. And 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?” That is, if energetic activity is to be

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understood in its full concreteness, and not just as mathematical functions in an equation, then some reference must also be made to the mental functions of the self-realizing butprehensively 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].

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 historical routes, whereby a specific occasion’s conformal physicalprehensions of past actualities (=the cause of structural inheritance) become synthesized with its novel conceptualprehensions of future possibilities (=the source of structural variation) into some enduring pattern of experiential value. In Whitehead’s words, “There is a rhythm of process whereby creation produces natural pulsation, each pulsation forming a natural unit of historic fact.

144 Whitehead, Modes of Thought, 88.
These processes of evolutive concrescence “repeat themselves to the crack of doom in the creative advance from creature to creature.”\textsuperscript{145} 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.\textsuperscript{146} Also, whereas in the Darwinian theory the competitive struggle for existence among separate organisms is considered the primary engine of evolution, in the Whiteheadian version, endosymbiotic cooperation 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.”\textsuperscript{147} 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.\textsuperscript{148}

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

\textsuperscript{145} Whitehead, \textit{Process and Reality}, 228.
\textsuperscript{146} Whitehead, \textit{Science and the Modern World}, 105.
\textsuperscript{147} Whitehead, \textit{Science and the Modern World}, 104.
mesocosm, but also to wider micro- and macrocosmic ecologies of self-organizing energetic activity. Evolution, in its most general outlines, is a theory relevant to the entire scope of cosmic history. Just as Copernicus’s 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 infinitely creative potential of literally nothing (i.e., quantum potential), 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. 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 and infects each and every one of its creatures with sparks of potentiality. 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.

149 Thomas Berry and Brian Swimme, The Universe Story, 21.
150 Whitehead, Process and Reality, 164.
151 Berry and Swimme, The Universe Story, 17.
In Whitehead’s scheme, even God is creaturely and thus 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 creature with erotic lures encouraging the sort of harmonious functioning that has led to the stages of enduring social organization characteristic of the universe.\textsuperscript{152}

Whitehead’s organic primates—or, speaking metaphysically, actual occasions—cannot exist 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 emergent 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.\textsuperscript{153}

\textsuperscript{152} Whitehead, \textit{Process and Reality}, 244.
\textsuperscript{153} Berry and Swimme, \textit{The Universe Story}, 21.
The primate organisms 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.\textsuperscript{154} 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, “vibratory locomotion” and “vibratory organic deformation.”\textsuperscript{155} Organic deformation describes the wave-like aspect of primate organisms (i.e., their continuous transition 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.\textsuperscript{156} At the center of these early galaxies there emerged what astrophysicists call “black holes,” entities whose gravity was so intense not even light could escape. Their emergence further secured the next stage of evolutionary complexity. According

\textsuperscript{154} Lederman, \textit{The God Particle}, 62.
\textsuperscript{156} Current evidence suggests a few very large but short-lived stars may have formed before the galaxies (Berry and Swimme, \textit{The Universe Story}, 34).
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.\textsuperscript{157} Star formation was first catalyzed by the rapid rotation 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.”\textsuperscript{158} 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.\textsuperscript{159} 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 too hot and not too cold.”\textsuperscript{160} Black holes have played a fundamental role in the evolutionary adventure that gave rise to our present cosmic ecology.\textsuperscript{161} According to Scharf,

The fact that there are \textit{any} galaxies like the Milky Way in the universe \textit{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 environments might be overly full of young and exploding stars—or too little stirred up to produce anything.\textsuperscript{162}

\textsuperscript{157} Caleb Scharf, \textit{Gravity's Engines}, 210.
\textsuperscript{158} Berry and Swimme, \textit{The Universe Story}, 34.
\textsuperscript{159} Scharf, \textit{Gravity's Engines}, 202.
\textsuperscript{160} Scharf, \textit{Gravity's Engines}, 143.
\textsuperscript{161} Scharf, \textit{Gravity's Engines}, 164.
\textsuperscript{162} Schwarf, \textit{Gravity's Engines}, 204.
Galaxies and black holes can be understood as analogous to massive cellular systems, where the cybernetic 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. Nonetheless, the general analogy seems to hold. The organic analogy is scalable.
Space-Time in an Ontology of Organism

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

- Stengers\textsuperscript{163}

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 container of space and the universal flow of time could 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 duration of time for its unfolding.\textsuperscript{164} The abstract point-instants of mechanistic materialism, be they Newtonian or Einsteinian, are replaced by concrete events or 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.”\textsuperscript{165}

\textsuperscript{163} Stengers, \textit{Thinking With Whitehead}, 168-169.
\textsuperscript{165} Whitehead, \textit{Modes of Thought}, 145.
By 1920, Whitehead had already published two books exploring the implications of relativity theory for the philosophy of science.\textsuperscript{166} In June 1921, Whitehead met and had several in depth 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.”\textsuperscript{167} 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 \textit{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 \textit{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.”\textsuperscript{168} It was also a \textit{political} debate about the proper roles of science and philosophy in society, especially with respect 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

\textsuperscript{166} \textit{An Enquiry Concerning the Principles of Natural Knowledge} (1919/1982) and \textit{The Concept of Nature} (1920/1964).


eventually resign, partially as a result of his disagreement with Bergson concerning relativity.\(^{169}\)

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 philosophical intuitions. This orthodox narrative, retold most recently by the anti-philosophical physicist Alan Sokal,\(^{170}\) 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,\(^{171}\) the orthodox narrative is increasingly being called into question.\(^{172}\) The specifics of Bergson’s alleged “mistake” regarding the details of Einstein’s twin paradox are beyond the scope of this 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.\(^{173}\) His critical approach to relativity theory was based on *metaphysical* rather than *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.\(^{174}\)

\(^{169}\) Canales, “Einstein, Bergson, and the Experiment that Failed,” 1175.


\(^{171}\) Largely a result of the influence of Gilles Deleuze (see [http://plato.stanford.edu/entries/bergson/#7](http://plato.stanford.edu/entries/bergson/#7) [accessed 11/18/2012]).


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.175 “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.176

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.”177 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

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175 “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 (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?”, in New York Times [March 27, 1990]: http://www.nytimes.com/1990/03/27/science/did-einstein-s-wife-contribute-to-his-theories.html [accessed 11/18/2012]).


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,\textsuperscript{178} he came late in life to respect the 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?\textsuperscript{179}

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.”\textsuperscript{180} 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.\textsuperscript{181} This taming is achieved, according to Whitehead, by holdings one’s “flight in the thin air of imaginative generalization” accountable, upon

\textsuperscript{178} Stanley Jaki, The Road of Science and the Ways to God, 182.
\textsuperscript{179} Einstein, Foreward to Max Jammer, Concepts of Space; xiii-xiv.
\textsuperscript{180} Whitehead, Modes of Thought, 49.
landing, to “renewed observation rendered acute by rational interpretation.”

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. 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.

Whitehead differs from Bergson in that he sought to re-construct science itself on an organic basis, whereas Bergson was content to leave physical science to its mechanical models and instrumental methods, so long as it did not trespass into metaphysics. Bergson conceived of science as the result of “intelligence,” rather than “intuition,” meaning that its approach to nature is necessarily mediated by reflective thought, artificial instrumentation, and laboratory techniques, which prevent it from having any direct insight into the life of things. “For [natural

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183 Bergson, “Discussion avec Einstein,” 1346
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.” 186 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 the four-dimensional geometrical coordination 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.” 187

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 a carbon atom to a star to the person who consults it—is aging. To be aging is to be caught up in an irreversible organic process. One cannot step out of this process so as to gain an objective measure of its progress from outside. 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

186 Henri Bergson, Creative Evolution, 93.
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.188

Even a physicist who has mastered all the mathematical formulas and techniques of measurement cannot avoid the philosophical quandaries that arise from a moment’s reflection upon the fact that his or her conscious presence is necessary in order for the clock, or any measuring instrument, to get itself read.189 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.”190

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:

188 Whitehead, Modes of Thought, 84.
190 Einstein to Vero and Mrs. Bice, March 21, 1955. Einstein Archive, reel 7-245; reprinted in Albert Einstein-Michele Besso Correspondence, 537-538.
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.\(^{191}\)

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 a single time-flow happening right now that binds together the meadow out his window, the solid iron core of Mars, and the most distant clouds of gas in the universe, even though all the theoretical and experimental evidence of relativistic physics suggests that distant happenings are not instantaneously communicated to our concrete experience.\(^{192}\) 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

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\(^{191}\) N. V. Hansen, “Spacetime and Becoming: Overcoming the Contradiction Between Special Relativity and the Passage of Time,” in *Physics and Whitehead*, 150.

\(^{192}\) It takes anywhere between four and twenty 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 ingestion 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.
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 four-dimensional space-time “fabric” into which actual occasions would be woven, or through which the plane of the present would slide as an indication of global simultaneity (as Bergson seems to have believed\textsuperscript{193}). Actual occasions are not to be pictured as if they were bits of matter located *in a* four-dimensional spatiotemporal “loaf.” Rather, the abstract geometry of space-time described by the Lorentz transformations, or by Whitehead’s alternative tensor equations,\textsuperscript{194} 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. Actual occasions of experience are not determined by the physical structure of space-time; rather, the physical structure of space-time is an emergent product of the experience of actual occasions. These self-creating and other-prehending drops of experience are the final real things of which reality is composed. They are what is concrete, while “space-time” is an abstraction, a way of measuring and talking about the field of potentiality through which actual occasions relate. “Whitehead is explicit about the idea,” writes Hansen,

\begin{quote}
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
\end{quote}

\textsuperscript{193} See Gilles Deleuze, *Bergsonism* (1991), 82.
\textsuperscript{194} See Whitehead, *The Principle of Relativity*, 139cf.
space and time at all, but in the concrete processes whose web of relations gives rise to space and time.\textsuperscript{195}

Metaphysically speaking, that space-time is \textit{abstract} doesn’t mean it isn’t \textit{real}, only that it isn’t concretely \textit{actual}. Space-time is a system of modalities, a configuration of forms, or, in Whitehead’s terms, a definite patterning of eternal objects that ingresses through 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.\textsuperscript{196} Among the most fundamental sets 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 most fundamental set of adverbs are the mathematical fields of force known to physics as gravity and electromagnetism\textsuperscript{197}:

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,

\textsuperscript{195} Hansen, “Spacetime and Becoming,” 154.
\textsuperscript{196} Whitehead, \textit{Process and Reality}, 164.
\textsuperscript{197} 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 (Whitehead, \textit{The Principle of Relativity}, 91cf).
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.198

Whitehead’s reference to our “cosmic epoch” is important, since it is a reminder
that the four-dimensional character of space-time as we experience and measure it
today is historically 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.199 They are the result of widespread,
habitual forms of organization achieved by the mutual prehensions of the most
encompassing society of actual occasions communicating with our experience.200
“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.201

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 human beings and other multicellular animals) because
they are derived from the statistically aggregated 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.  

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. Through an abstractive process of geometrical construction and the technological coordination of clocks embedded within the pluriperspectival historical routes inherited in the experience of individual organisms, the general character of space-time holding true for our cosmic epoch can be produced. 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. 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

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202 Whitehead, Process and Reality, 245.
203 Epperson, Quantum Mechanics, 5.
205 Stengers, Thinking With Whitehead, 168.
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.\footnote{Stengers, \textit{Thinking With Whitehead}, 169.}

Whitehead terms the general character of space-time “the uniformity of the texture of experience.”\footnote{Whitehead, “Space, Time, and Relativity,” 163.} “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.\footnote{Whitehead, “Space, Time, and Relativity,” 165.}

Here, Whitehead directly contradicts Einstein’s famous statement that our direct 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 \textit{physical} formulations, but a denial of the unconscious imaginative background shaping Einstein’s \textit{metaphysical} interpretation of these formulations. Following Stengers, it can be said that Whitehead’s philosophy of organism 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.209

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\textsuperscript{210}

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.\textsuperscript{211} Unlike the instrumentalist interpretations that have spun off Niels Bohr’s account of quantum effects in terms of epistemological complementarity, quantum decoherence offers a fully fledged ontological description of quantum reality.\textsuperscript{212} 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 \textit{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 prior to, utterly independent of, and somehow responsible for generating concrete actuality.\textsuperscript{213} Whitehead, as discussed earlier, also describes something akin to the “quantum void” or plenum from which all

\textsuperscript{210} Whitehead, \textit{Religion in the Making}, 80.
\textsuperscript{211} Epperson, \textit{Quantum Physics}, 129.
\textsuperscript{212} Epperson, \textit{Quantum Physics}, 33.
\textsuperscript{213} Epperson, \textit{Quantum Physics}, 18; Krauss, \textit{A Universe From Nothing}, xiv.
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.\textsuperscript{214} The primordial creature of Creativity is God. Subsequently to God,Creativity also comes to be conditioned by the passage into objective immortality of the finite actual occasions composing our cosmic epoch.\textsuperscript{215} Potentiality, in other words, has never existed independently of actuality.

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

\begin{quote}
...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.\textsuperscript{216}
\end{quote}

In other words, quantum mechanical descriptions \textit{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

\textsuperscript{216} Epperson, \textit{Quantum Physics}, 7
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.\textsuperscript{217} 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.\textsuperscript{218} It is a process of “evolutions from actuality to potentiality to actuality.”\textsuperscript{219}

In Whitehead’s terms, the concrescence of an actual occasion is a description of the metaphysical means by which God and the world continually co-create one another. Whitehead’s account of the concrescence of Creativity is a secularized creation myth, an attempt to elucidate philosophically the mysterious fact that anything exists at all, that \textit{creation happens}. Keeping in mind that such an analysis risks collapsing a living process into a mechanical algorithm, we can characterize the process of concrescence as passing through several phases:

1) concrescence begins as a swarm of prehensions arising from the environing multiplicity of perished occasions to feed a novel feeling longing for actuality;

2) the new feeling unifies itself through a process of integration of simpler prehensions into more complex prehensions, thereby coalescing the environing multiplicity of the perished past and resurrecting it in the form of a newborn subjectivity enjoyable in the present: “Thus every

\textsuperscript{217} Heisenberg, \textit{Physics and Philosophy}, 185.

\textsuperscript{218} Epperson, \textit{Quantum Mechanics}, 8-9.

\textsuperscript{219} Epperson, \textit{Quantum Mechanics}, xii.
actual entity springs from *that* universe which there *is for it*…[It becomes] a mode of the process of ‘feeling’ the world, of housing the world in one unit of complex feeling”\textsuperscript{220};

3) the subjective form is a complex qualitative pattern of eternal objects characterizing how the occasion-in-question experiences its world, and so, in its perished superjective form, the subject objectively immortalizes a certain perspective on possibility, handing itself over as an artistic expression framing the field of possibilities for subsequent subjectivities.\textsuperscript{221}

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 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 potenia of distant actual occasions. These are *conceptual* causes. To illustrate the difference, Epperson uses the thought experiment of an asteroid that has just been knocked by a comet into a collision course with Earth.\textsuperscript{222} Although in terms of physical influence, we will not be affected by the incoming asteroid until the photons reflecting off its

\textsuperscript{220} Whitehead, *Process and Reality*, 80.
\textsuperscript{221} Whitehead, *Process and Reality*, 221.
\textsuperscript{222} Epperson, *Quantum Mechanics*, xii-xiii.
surface reach Earth, in conceptual, or potential, terms, the asteroid’s change of course has instantaneously affected the potenia 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.223

If the local relativistic relationships of causal influence among actual occasions were not supplemented by the non-local quantum relationships of logically ordered potenia, the reality of an asymmetrical passage of time out of the closed past and into an open future through an eternally concrescing present 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, the irreversibility of time is an inescapable fact.224

The physical account of the decoherence of a wave-function and the metaphysical account of the concrescence of an actual occasion both require a panexperientialist

223 Epperson, Quantum Mechanics, 228.
224 Epperson, Quantum Mechanics, 234.
ontology of constructive becomings, rather than a materialist ontology of ready-made point-instants. In a materialist ontology, reality and actuality are equated.\footnote{Epperson, \textit{Quantum Mechanics}, xii.} Potentiality has no real effect on what happens, since only what happens is real. The reduction of reality to actuality thus implies that nothing new ever really emerges, because all that can be has already been actualized. Change is merely apparent, the re-shuffling of static parts with no essential or internal relationships with one another. 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 deep past is all but settled, the future remains radically open. New forms of fact are always emerging, though none ever exists in isolation from its inherited past. “In sharp contrast [to mechanistic materialism],” writes Epperson,

\begin{quote}
[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.\footnote{Epperson, \textit{Quantum Mechanics}, 17.}
\end{quote}

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 different scales of Nature. 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).

For contemporary complexity scientist Terrence Deacon, mentioned earlier, coherent accounts of emergence also depend upon accepting potentiality along side actuality as necessary ontological categories. 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. The role of these absential features would suggest that actualized 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.”

In other words, the many self-organizing systems emergent in Nature are not simply “there” to be observed by knowing scientists, but also seem to assert themselves: “here I am!,” they say, claiming some modicum of awareness of and

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for themselves. The capacity to experience seems “extrinsic” to the fully actualized systems studied by materialist science. It is indeed “absent” from the model of Nature scientific materialism has been studying for centuries. But in the end, Deacon remains unsatisfied with Whitehead’s insertion of mentality into Nature’s simplest systems. Such an insertion, Deacon argues, assumes in advance 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 operations.231 As a result, physical processes “can be treated as though [they have] mentalistic properties.”232 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.”233 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].”234

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

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231 Deacon, Incomplete Nature, 75.
233 Deacon, personal communication on April 26, 2012.
234 Deacon, personal communication on April 26, 2012.
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. Concrete experience is intrinsically evaluative. Every occasion of experience includes physical feelings of what has already been actualized and conceptual feelings of what could have been and may still be actualized. Actuality and potentiality are thus the poles of the dynamo powering concrescence. Feeling and value cannot be added to actuality later on up the scale of nature’s evolutionary self-organization. To explain any emergence at all, *Nature must be conceived as an agent of its own evolution* and not just a collection of inert stuff. 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.235

In sum: 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,”236 according to Whitehead, which is born out by the example of Deacon’s emergentist realism, where experience is purported to emerge from dumb matter. “Apart from

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the experience of [actual occasions],” writes Whitehead, “there is nothing, nothing, nothing, bare nothingness.”237

This fundamental divergence of metaphysical first principles may at first seem like an entirely speculative issue impossible to settle other than by subjective (aesthetic or moral) 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 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.238 On the other hand, Deacon also admits that there are limits to the evolution of this novelty, offering a rather sophisticated account of these limits based upon the notion of hierarchically nested constraints.239 The question is, what constrains the emergence of novelty at the cosmic scale (a limit inherited by the biological or psychological scales, making them specializations on a general theme)? 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.240

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238 “I see emergence as an open-ended process, while [Whitehead] does not,” Deacon, personal communication on April 26, 2012.
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. 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?”\(^\text{241}\) 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.”\(^\text{242}\) This aim can never be finally realized due to the fact that “language halts behind intuition.”\(^\text{243}\) In this sense, “all explanation must end in an ultimate arbitrariness.”\(^\text{244}\) Nevertheless, although total disclosure is never finally achieved, the penetration of our understanding can be increased.\(^\text{245}\)

Many contemporary scientists, Deacon among them, have little patience for traditional theology. Whitehead generally shares their distaste for those philosophers and theologians who, “anxious to establish the religious significance


\(^{242}\) Whitehead, *Modes of Thought*, 49.

\(^{243}\) Whitehead, *Modes of Thought*, 49.


\(^{245}\) Whitehead, *Modes of Thought*, 51.
of God,” succumbed to the unfortunate habit of paying him “metaphysical compliments.”

The God of Western religion has tended to be fashioned in the image of an imperial ruler. Rather than making God an exception to the principles holding sway over every other actual occasion, Whitehead’s God is “their chief exemplification.” 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.

God’s primordial act of concretion cannot be rationally explained, since this divine act provides the foundation for rationality. 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

247 Whitehead, Process and Reality, 342.
248 Whitehead, Process and Reality, 343.
249 Whitehead, Process and Reality, 31-32.
known about God must be sought in the region of particular experiences, and therefore rests on an empirical basis.\textsuperscript{251}

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.”\textsuperscript{252} Whitehead’s approach also has rationalist 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.”\textsuperscript{253} God is such an element, the primordial fact conditioning the creative flux that is 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.”\textsuperscript{254} In other words, it is God’s primordial role to provide each concreting 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.\textsuperscript{255} It follows from Whitehead’s ontological principle that as of yet unactualized possibilities, or eternal objects, cannot float into actuality from nowhere.\textsuperscript{256} Eternal objects yet to be actualized by any finite actual occasion have already been conceptually prehended by the divine non-temporal actuality. God is that non-temporal actuality that conceptually prehends, and thereby evaluates, the infinite set of eternal objects, thereby adjusting or conditioning Creativity so as to

\textsuperscript{252} Whitehead, \textit{Process and Reality}, 42.
\textsuperscript{253} Whitehead, \textit{Process and Reality}, 42.
\textsuperscript{254} Whitehead, \textit{Process and Reality}, 164.
\textsuperscript{256} Whitehead, \textit{Process and Reality}, 244.
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.257

In respect to Deacon’s desire both to “save Plato, or to save realism,”258 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 concept of “effective complexity” employed in complexity theory.259 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, formally “coding” its properties before the moment of creation even occurred. In his famous cosmological dialogue Timaeus, Plato uses a similar

257 Whitehead, Religion in the Making, 91.
258 Deacon, personal communication on April 26, 2012.
259 Epperson, Quantum Mechanics, 236.
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 mediator of 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.”

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 creatures 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 chapter, the implications of Whitehead’s reformed Platonism are 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.

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Chapter 5: Towards 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\textsuperscript{261}

“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\textsuperscript{262}

“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\textsuperscript{263}

Whitehead suggests that Newton’s \textit{Scholium} and Plato’s \textit{Timaeus} “are the two statements of cosmological theory which have had the chief influence on Western thought.”\textsuperscript{264} Although the \textit{Scholium} provides “an immensely able statement of details” applicable to the deduction of truths within a specific domain of physical

\textsuperscript{261} Whitehead, \textit{The Aims of Education}, 164.
\textsuperscript{262} Whitehead, \textit{Religion in the Making}, 106.
\textsuperscript{263} Plato, \textit{Timaeus}, 30b-c.
\textsuperscript{264} Whitehead, \textit{Process and Reality}, 93.
activity, its deductive prowess “conveys no hint of the limits of its own
application.” 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 operational 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 abstractions as if they could explain the full
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.266

As was discussed in the prior chapter, 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
discipline 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.267 There are aspects of Plato’s Timaeus that may
seem foolish today, but “what it lacks in superficial detail,” according to

265 Whitehead, Process and Reality, 93.
266 Whitehead, Process and Reality, 93.
267 Whitehead, Process and Reality, 93, 95.
Whitehead, “it makes up for by its philosophic depth.”268 This depth has allowed Plato’s speculative cosmogony to outlast Newton’s more arbitrary cosmological 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.269 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.270 This yearning is productive of the consequent physical pole of God, which lovingly receives the freely actualized decisions of every finite occasion, no matter how seemingly discordant from a finite perspective, into the everlasting harmony of its completed nature.271 “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.272

268 Whitehead, Process and Reality, 93.
269 John Sallis, Chorology, 91.
270 Whitehead, Process and Reality, 33.
271 Whitehead, Process and Reality, 349.
Their are many other parallels to Whitehead’s cosmological scheme 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.\(^{273}\)

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* or being taken over by the givenness of chaos.\(^{274}\) 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 concrecent 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.\(^{275}\)

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

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\(^{273}\) Plato, *Timaeus*, 30a; italics mine.

\(^{274}\) Sallis, *Chorology*, 57.

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 cosmogonic 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 [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.276

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.”277 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:

276 Sallis, Chorology, 57-58.
277 Plato, Timaeus, 28c.
[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.278

The Demiurge, then, is a maker of sorts, but specifically a parental maker whose life force is wedded to that which has been born. 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.”279 Whereas the fatherly Demiurge is said to beget the beautiful form of the cosmos, the motherly Receptacle is said to bear it.280 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 cosmos. “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/εἴδων], imprinted after their likeness in a marvelous

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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.281

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.282 From a Whiteheadian 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.”283 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.”284 The coherence of Whitehead’s scheme requires, in contrast, that the Cosmic Animal be understood as a mediator, sharing

281 Plato, *Timaeus*, 50c-d.
283 Whitehead, *Adventures of Ideas*, 52. Whitehead is here referring to Plato’s discussion in his Seventh Letter written to Dion’s followers.
in the natures of eternity and time alike. 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.”285 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 becoming ingredients 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.”286 As Whitehead puts it, the organic process of each actual occasion “repeats in microcosm what the universe is in macrocosm.”287 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 persuasiveness of ideas.”288 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 as much to preserve stability as to evoke intensity.289 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

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of life to changing circumstances “[entails] the death penalty for impertinence.”\textsuperscript{290} 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.\textsuperscript{291}

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.”\textsuperscript{292} He describes the Adventure as an inverted renovation of Plato’s Receptacle, a “medium of intercommunication” necessary for the unity of all things.\textsuperscript{293} 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.”\textsuperscript{294} 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 \textit{Adventures of Ideas}. \textsuperscript{290 Stengers, Thinking With Whitehead, 112. 291 Whitehead, Process and Reality, 350. 292 Whitehead, Adventures of Ideas, 294-295. 293 Whitehead, Adventures of Ideas, 134. 294 Whitehead, Adventures of Ideas, 295.}
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 persuasion towards such perfections as are possible for its diverse individual occasions.295

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.296 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.”297 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.298 The ensouled universe is therefore best described not simply as Whole, or as One, but as an

295 Whitehead, Adventures of Ideas, 296.
296 Whitehead, Process and Reality, 345.
open movement of wholeness that cannot be united by any rational account [because it] harbors the Eros of unpredictable novelty and incommensurable diversity.\textsuperscript{299}

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,\textsuperscript{300} rather problematic. 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.\textsuperscript{301}

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


\textsuperscript{300} Following Plato, \textit{Republic} 509b and \textit{Parmenides} 137cf.

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.302

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.303 For Whitehead, not only does philosophy begin in wonder, “at the end, when philosophic thought has done its best, the wonder remains.”304 Whiteheadian rationality is guided by an unwavering commitment to relationality, whereby “there is an essence to the universe which forbids relationships beyond itself.”305 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

302 Price, Dialogues of Alfred North Whitehead, 297.
303 Whitehead, Process and Reality, 42; Adventures of Ideas, 174.
304 Whitehead, Modes of Thought, 168.
305 Whitehead, Process and Reality, 4.
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.”

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.”

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Appendix—*The Place of Life in the Cosmos*

“A philosophic outlook is the very foundation of thought and of life. The sort of ideas we attend to, and the sort of ideas which we push into the negligible background, govern our hopes, our fears, our control of behavior. As we think, we live. This is why the assemblage of philosophic ideas is more than a specialist study. It moulds our type of civilization.”
-Whitehead 308

“The doctrine I am maintaining is that neither physical nature nor life can be understood unless we fuse them together as essential factors in the composition of ‘really real’ things whose interconnections and individual characters constitute the universe.”
-Whitehead 309

“We must conceive the Divine Eros as the active entertainment of all ideals, with the urge to their finite realization, each in its due season. Thus a process must be inherent in God’s nature, whereby [God’s] infinity is acquiring realization.”
-Whitehead 310

“To dismiss love as the biologic basis of social life, as also the ethical implications of love, would be to turn our back on a history as living beings that is more than 3.5 billion years old. We may resist the notion of love in a scientific reflection because we fear for the objectivity of our rational approach. Yet…such fear is unfounded. Love is a biological dynamic with deep roots. It is an emotion that defines in the organism as a dynamic structural pattern, a stepping stone to interactions that may lead to the operational coherences of social life.”
-Maturana and Varela 311

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308 Modes of Thought
309 Modes of Thought.
310 Adventures of Ideas.
311 The Tree of Knowledge.
The time has come for a radical re-imagination of life’s place in the cosmos. The Whiteheadian mode of thought given expression in this appendix presupposes that an adequate understanding of biology requires properly situating it not only in relation to physics, but also in relation to psychology, anthropology, and indeed, theology. The universe, Whitehead recognized, does not come neatly packaged into the disciplinary silos of the modern research university. In addition to the cosmological scope of his organic realism, Whitehead also recognized the need for what today is referred to as a participatory approach to studying the universe.312 Other thinkers drawn into conversation with Whitehead in this essay include Friedrich Schelling, Hans Jonas, Francisco Varela, Evan Thompson, and Robert Rosen. These thinkers are similarly participatory in orientation, as they recognize an obvious but for that very reason often neglected point.313 Aaran Gare summarizes this point in the simplest terms possible: “scientists must see themselves as part of the world they are striving to understand.”314 This may seem an unnecessary point to make, but the objectifying methods of modern science, now second nature for many of us, violently conflict with what should be common sense. We human knowers are participants within the creative cosmos we study, co-creators who actively contribute to or retard the ongoing evolutionary adventure of cosmogenesis. What there is to be known is reciprocally bound up with the way that we attempt to know it. According to Varela and Maturana,

312 See Jorge Ferrer's Revisioning Transpersonal Theory (SUNY, 2001) or Participation and the Mystery (SUNY, 2017). See also Ferrer and Jacob Sherman, eds., The Participatory Turn (SUNY, 2008).
313 Whitehead: “It requires a very unusual mind to undertake the analysis of the obvious” (Science and the Modern World, 5).
ignoring this intimate connection isolates the human knower from the living world he or she is attempting to know, as though some “pure knowledge” were sought in a transcendental realm before or beyond our concrete experience of embodied action in Nature: “to disregard the identity between cognition and action, not to see that knowing is doing…is not to see human beings as living entities.”

It is not only in biology, psychology, and anthropology that researchers must become attuned to the interactive effects their own methods and attitudes have on the objects of their study. The same attunement is required in physics and in theology. This chapter thus argues that a proper understanding of the place of life in the cosmos requires a way of studying Nature and even God that places ourselves within what we are trying to study (i.e., an endophysics and an endotheology). From Whitehead’s point of view, even God lacks a “God’s eye view.” “There is an essence to the universe,” Whitehead says, “which forbids relationships beyond itself, as a violation of its rationality.”

To rationally study the cosmos, then, is not to study it “objectively,” as if from outside, but rather to study it relationally. Embodied minds like ours find themselves always in media res, “in a buzzing world, amid a democracy of fellow creatures.” There is, in Maturana and Varela’s words, an “unbroken coincidence of our being, our doing, and our knowing,” such that “every act of knowing brings forth a world” and “everything we do is a structural dance in the choreography of coexistence…We have only the world that we bring forth with others, and only love helps us bring it forth.”

315 The Tree of Knowledge, 248
316 Process and Reality, 4
317 Process and Reality, 50.
Life: Unique Anomaly or Universal Principle?

With the founding of the modern secular research university, biologists came for the most part to approach life as an object of neutral scientific investigation. Now that the existential threat of planetary ecological collapse has dawned on our species, the study of life can no longer remain a merely theoretical affair. It must also become an ethical and spiritual concern of central importance to everything we do. Modern humans are technologically transforming the planet at every measurable scale, forever altering the complex feedback loops that integrate geological, chemical, meteorological, and biological processes into a self-organizing Gaian ecosphere. Our species now finds itself in a tragically ironic situation: humans, originally creatures of Earth, have constructed a second Nature, an artificial Earth that we thought made first Nature passive before our political and economic projects. Moderns assumed first Nature would patiently endure modern industrial progress, but alas, we are witnessing “Gaia’s revenge” (as James Lovelock refers to it): our presumed status as creators is being rudely revoked as we realize we are just as vulnerable to extinction as any other of Earth’s creatures.

A properly participatory and cosmological study of the organic realm has now become a matter of life and death, something that still requires plenty of careful theorization, but which can no longer be approached in a disinterested or objective way (if it ever truly could be). The question, “What is life?,” is a rather recent invention in the history of humanity’s inquiries into the nature of things. Jonas argued that the inverse question, “What is death?” preceded it by many millennia. Primal people perceived the blooming, buzzing world around them as

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319 Under the political and economic conditions of late capitalism, theoretical understanding has itself largely taken a backseat to instrumental manipulation with an eye toward corporate profits, military applications, or both.
incontrovertibly animated or ensouled. They felt embedded within a generative cycle wherein death surely received its due, but as an interval between life and rebirth, rather than as life’s complete and utter annihilation. Jonas thus suggested that “panpsychism,” the doctrine that the world is alive, is really the most natural view.320 “To the extent that life is accepted as the primary state of things, death looms as the disturbing mystery. Hence the problem of death is probably the first to deserve this name in the history of thought.”321 All culture—all religion, art, science, and technology, and indeed our very humanness—is arguably the result of our becoming conscious of and responding to the problem of death. Our sense of who we are as human organisms and the driving force of all our meaning-making endeavors may be rooted in a desire to overcome the contradiction of death by somehow integrating it into the more primary process of life. Every human society, primal or modern, to the extent that it remains viable finds some cultural means of integrating death back into the life process.

Archaeological anthropologists know for sure they are dealing with human remains when they find them buried in graves. Burying the dead and preparing them for an afterlife of some kind appears to be an essential feature of our species.322 Jonas describes the paradox by which the anomaly of death stood out for the primal panpsychist imagination: “This is the paradox: precisely the importance of the tombs in the beginnings of mankind, the power of the death motif in the

321 The Phenomenon of Life, 8.
322 Ethologists have observed primates, elephants, giraffes, whales, birds, and other species mourning their dead, so this behavior cannot be said to be entirely unique to Homo sapiens. But the awareness of death, and its ritual elaboration, has undoubtedly intensified with our species. See Marc Bekoff’s essay “Grief in Animals” in Psychology Today (October 2009): https://www.psychologytoday.com/us/blog/animal-emotions/200910/grief-in-animals-its-arrogant-think-were-the-only-animals-who-mourn
beginnings of human thought, testify to the greater power of the universal life
motif as their sustaining ground.”

It was only after the Copernican Revolution, according to Jonas, that the
“proportional place of life in the scheme of things” began to be questioned. Prior
to this cosmological displacement of the living Earth from the center of things, it
had never occurred to human beings “that life might be a side issue in the
universe,” rather than “its pervading rule.” Galileo, Descartes, and Newton
wielded the weapons of mathematical analysis to vanquish the core intuition of
pre-modern cosmology—an indwelling World-Soul—thus ushering in a new world
view, that of the clock-work universe designed by a transcendent demiurge. To the
modern question, “What is life?,” came the modern answer: life is a machine
(whether designed by God, as early moderns assumed, or by Darwinian Nature, as
late moderns prefer).

Five hundred years later, the emergence of the Anthropocene—a perspective on
our planet that is perhaps even more consequential than Copernicus’

323 The Phenomenon of Life, 9.
324 The Phenomenon of Life, 8-9.
325 The modern mechanistic world-picture is rooted in a Faustian bargain, that where religious worship of God
had apparently failed to defeat death, technological mastery of Nature might succeed. Ernest Becker famously
argued that all human culture is ultimately in service to an elaborate “immortality project.” While pre-modern
societies had religious means of achieving a sort of symbolic immortality, modern societies have replaced
appeals to God with science and technology, which are, we are told by Ray Kurzweil and the Transhumanists,
on the verge of providing us with real immortality. For Becker, both theologically and technologically oriented
societies are driven by the same denial of death. Pre-moderns sought the shelter of the Church and the grace of
the Mass to grant them some taste of transcendence, while moderns dream of terraforming Mars or, less
grandiosely, surf Amazon and Facebook and through the miracle of transsubstantiation turn data into a
consumable goods. The “thoughtless Prometheanism” of modern techno-capitalism is for Becker only a
turbocharged version of the premodern “immortality project.” It is rooted in the same “rage against our
impotence, a defiance of our animal condition, our pathetic creaturely limitations” (The Denial of Death [The Free
Press, 1975], 85).
revolution—invites us to consider Jonas’ problem anew. It is no coincidence that just as we find ourselves entering the 6th great mass extinction event in Earth’s history, one which may claim our own species as one of its victims, philosophers are once again beginning to take seriously the prospect of panpsychism. Jonas was familiar enough with the Whiteheadian variety of panpsychism to remind his readers that taking the idea seriously does not mean setting aside centuries of modern scientific inquiry by returning to Aristotelean metaphysics. Whitehead was led to articulate his philosophy of organism in the early 20th century because physics itself had begun to outgrow the old mechanical world-picture (e.g., no more “simple location” in absolute space, no more “nature at an instant” in durationless time, no more “laws” of physics imposed from eternity, etc.). Unfortunately, many biologists continue to conceive of the object of their study as a rare anomaly within the physical universe, a universe otherwise empty of value, devoid of purpose, and governed by externally imposed laws. Organisms, while exceedingly complicated, are thus thought to be ultimately reducible to their simpler component parts. They appear to be animate agencies, but really organisms are just another lucky combination of atoms falling in the void (or genes falling through fitness gradients), orphans of Monod’s chance and necessity. Biologists are wary of letting go of the mechanical metaphor, as to do so may put them at risk of being dismissed by their colleagues as unscientific Romantics. Whitehead admitted that “the appeal to

326 In Clive Hamilton’s terms, the Anthropocene marks the discovery of a new phenomenon hitherto unknown to science: “the appearance of this new object, the Earth System, has ontological meaning. It invites us to think about the Earth in a new way, an Earth in which it is possible for humankind to participate directly in its evolution by influencing the constantly changing processes that constitute it. It therefore brings out the conception of a joint human-earth story” (Defiant Earth: The Fate of Humans in the Anthropocene, 21).
327 The Phenomenon of Life, 2. Though of course there is plenty to be gained through a careful study of many of The Philosopher’s ideas, Whitehead decisively rejects Aristotle’s substance-quality ontology in favor of a process-relational alternative.
328 I would ask my scientific colleagues, perhaps already tempted to dismiss the panpsychist cosmology I am peddling, to provide me with even a single example of a scientific theory that does explanatory work without invoking metaphor. Quantum and relativistic phenomena are notoriously difficult to explain in common
mechanism on behalf of biology was in its origin an appeal to the well-attested self-consistent physical concepts as expressing the basis of all natural phenomena”; “But,” he continues (writing in 1925), “at present there is no such system of concepts.”329 Even Albert Einstein, in a letter written to nuclear physicist-turned-biologist Leo Szilard, admitted that it was in dealing with living things that he most felt the primitiveness of contemporary physics.330 Robert Rosen refers to Einstein’s feeling about physics to amplify the feelings of another physicist-turned-biologist Erwin Schrödinger. Schrödinger’s hunch, elaborated in his famous essay What is Life? (1944), was that the study of organisms would teach us a new physics.331 In Rosen’s terms, the old physics, that of mechanistic reductionism, was not generic enough to account for living organisms. Organisms are not the contingent result of more general laws that physicists have already explained; rather, they “are indications that these laws themselves are profoundly incomplete”:

The universe described by these laws is an extremely impoverished, nongeneric one, and one in which life cannot exist. In short, far from being a special case of these laws, and reducible to them, biology provides the most spectacular examples of their inadequacy. The alternative is not vitalism, but rather a more generic view of the scientific world itself, in which it is the mechanistic laws that are the special cases.332

language, since they appear at first to do violence to our habitual ways of perceiving and conceiving of visible Nature. Many modern physicalists therefore prefer to treat them as purely mathematical theories. I ask my scientific colleagues again, what is the meaning of a mathematical formula without that most powerful of metaphorical symbols, “=”?

330 Quoted in Essays on Life Itself by Robert Rosen (Colombia University Press, 1999), 7.
331 Essays on Life Itself, 9.
Rosen’s theoretical biology, when allied with Whitehead’s process philosophy, re-establishe a place for the organism not only in biological science, which has contented itself too long with mechanical models, but in physics, too. Rosen's theory of life’s place in the cosmos hearkens back to the intuition of another kindred thinker, Schelling:

the particular successions of causes and effects (that delude us with the appearance of mechanism) disappear as infinitely small straight lines in the universal curvature of the organism in which the world itself persists.\(^{333}\)

**Toward an Organic Ontology**

Schelling, who Gare has described as a process philosopher rather than an idealist,\(^ {334}\) developed his organic *Naturphilosophie* in the wake of Kant’s transcendental critique of metaphysics. Organism, for thinkers like Schelling, Whitehead, and Rosen, is not to be understood as a special kind of entity contingently emergent from an otherwise inorganic Nature. Organism, instead, is a universal speculative principle characterizing Nature at both micro- and macrocosmic scales.\(^ {335}\) Organism functions as a mediating concept integrating the modern dualisms of such seeming opposites as process v. substance, identity v. relationality, and body v. mind. In Kant’s *Critique of Judgment* (1790), the dualism between Nature and freedom running throughout his critical philosophy approached but did not finally achieve resolution in the idea of organism. Unlike

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merely mechanical Nature, which Kant argued could be understood according to efficient causes alone, living Nature displays a recursive form of organization that remains inscrutable without the application of formal and final causation. A living organism is an incarnating idea working to maintain the rule of the whole over the parts (in this way, organisms are analogous to Reason itself). Kant famously argued that mechanistic physics could never in principle explain the internal possibility of organic, that is, *self-organizing*, beings:

So certain is this that we may boldly state that it is absurd…to hope that perhaps some day another Newton might arise who would explain to us, in terms of natural laws…how even a mere blade of grass is produced (the ‘Newton of the leaf’).336

Kant was in the end unable to overcome the epistemological dualism between conceptually determined phenomena and unknowable noumena that shaped his transcendental method. He thus applied organism merely as a regulative principle of human judgment, unwilling to posit it as constitutive of Nature itself. He thought applying the concept in a constitutive way would require genius of a scientific sort, which he regarded as impossible. Only artists could attain the status of genius, according to Kant. Artists create art through intuitively participating in the creative formation of organic Nature, expressing wholeness without having to assemble it out of separate parts. In contrast, the reflective and objectifying mind of the scientist, transcendentally cut off from the living organization of the natural world, can only study and conceptually describe organisms piecemeal as though they were inanimate mechanisms.

Schelling followed the spiritual potential if not the dead letter of Kant’s third critique by articulating an intuitive science capable of knowing organism as constitutive of Nature. According to Schelling, “the less merely reflective [that is, objectifying] thought we give Nature, the more comprehensibly it speaks to us.”

Schelling re-imagined Kant’s *Critique of Judgment* as a new inauguration of the transcendental method, releasing philosophy from the dualistic determinations and duties of pure and practical reason by rooting it instead in the aesthetic feelings of living processes. Philosophy, for Schelling, became “nature itself philosophizing/*autophusis philosophia*.“ Rather than the categories of transcendental logic, Schelling affirmed living Nature as *a priori*. His question was no longer “What must mind be such that phenomenal knowledge of Nature is possible?,” but “What must Nature actually be for a knowing mind to have emerged from it?” Toward the end of his life, despite his own best efforts, Schelling had to admit that feeling, “the so-called inner sense of the emotions and the changes that take place within ourselves…still very much needs a critique.”

Whitehead’s philosophy of organism took up Schelling’s task: “to construct a critique of pure feeling, in the philosophical position in which Kant put his *Critique of Pure Reason*.“ The few pages Kant devotes to this in his “Transcendental Aesthetic” are, according to Whitehead, a deformed fragment of what should have been his primary topic.

There is an intimate connection between Whitehead’s critique of feeling and the construction of an organic or panpsychist cosmology. Though the essence of life

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338 Quoted in Iain Hamilton Grant, *Philosophies of Nature After Schelling*, 188.
cannot be known in a logically determinate way (i.e., what Rosen refers to as a Turing-machine simulable way\textsuperscript{341}), it can be felt intuitively in our own experience of being alive, of being a living organism among other living organisms. In his earliest writings on the philosophy of Nature (~1797), Schelling wrote:

So long as I myself am identical with Nature, I understand what a living Nature is as well as I understand my own life…As soon, however, as I separate myself, and with me everything ideal from Nature, nothing remains to me but a dead object, and I cease to comprehend how a life outside me can be possible.\textsuperscript{342}

The modern mechanistic world-picture, which physics itself has outgrown, nonetheless continues to shape the imagination of many biologists. Biological organisms are understood to be reducible to their mechanical parts, as though living things are not actually \textit{alive}, but rather amount to little more than highly improbable chemical reactions. From Rosen’s perspective, the collapse of mechanistic cosmology means we must dispense with the idea that

the gradient from simplicity to complexity is only a matter of accretion of simple, context-independent parts, and the analysis of more complex systems is merely a matter of inverting the accretions that produced them.\textsuperscript{343}

\begin{flushright}
\textsuperscript{341} Essays on Life Itself\textit{ by Robert Rosen, 268.}
\textsuperscript{342} Ideas for a Philosophy of Nature (Cambridge University Press, 1988), 36.
\textsuperscript{343} Essays on Life Itself, 36.
\end{flushright}
Instead, following Whitehead, we must reverse the process typical of reductionistic explanation by construing the evolutionarily earlier forms of physical organization by analogy to the later biological forms.\footnote{The Function of Reason by Alfred North Whitehead (The Free Press, 1929), 15.} There is now a new physics of irreversible, non-equilibrium processes\footnote{The End of Certainty by Ilya Prigogine and Isabelle Stengers (The Free Press, 1996), 3.} allowing biologists to re-imagine organisms, not as dead machines, nor as machines imbued with an immaterial “vital force,” but as entirely natural, thermodynamically open, historically emergent, and irreducibly \textit{complex}\footnote{To be “complex” is not just to be “complicated,” but, in Rosen’s terms, to be noncomputable or nonsimulable (\textit{Essays on Life Itself}, 17, 37).} energetic events. It turns out that such self-organizing energetic events pervade the physical universe at every scale. Atoms, stars, and galaxies are such events, as are bacteria, sequoias, and salmon. This is what I take Rosen to mean when he argues that complex self-organization is generic and not specific. Following Whitehead’s analogical reversal of the typical form of evolutionary explanation, if biological organisms are alive, then ontological coherence requires that physical and chemical events also be understood as already somehow lively:

Science is taking on a new aspect which is neither purely physical, nor purely biological. It is becoming the study of organisms. Biology is the study of the larger organisms; whereas physics is the study of the smaller organisms.\footnote{Science and the Modern World, 150.}

Organisms at every scale, whether particle, astrophysical, or biological, are precariously poised on thermodynamic gradients, surfing inner depths of feeling and lured by erotic potencies toward ever-more intense modes of existence. We
might then say that ecology—the study of organisms and their co-evolutionary
dynamics—should replace physics as the most generic science.

**Whither Panpsychism?**

Whitehead’s organic realism is not without its critics, even among those who
sympathize with major aspects of his project.348 Jonas—despite stating that
Whitehead’s philosophy of organism remains the only reasonable alternative open
to naturalism “after the loss of the transcendental counterpole provided by
dualistic metaphysics, in whose shelter alone an unadulterated ‘materialism’ in
physics was rationally possible”—nonetheless remained concerned that
Whitehead’s panpsychism left no room for the reality of death because of its denial
of “the deep anxiety of biological existence” and preference for “a story of
intrinsically secured success.”349 Contrary to Jonas, I do not believe Whitehead's
metaphysics is just another elaborate denial of death. Whitehead’s panpsychism,
on his own account, “is entirely neutral on the question of immortality,”
understood in its traditional Christian sense as a personal afterlife.350 His account
of the ontogeny of individual biological organisms fully acknowledges that such
complex forms of organization are fragile and dependent upon the “patience” of
their environment for their enduring stability.351 Whitehead doesn’t simply
establish *life* as the foundation of existence; rather, his dipolar account of process
in terms of subjective immediacy and superjective immortality could be described

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348 See, for example, John Dupré and Daniel Nicholson’s Introduction to their co-edited book *Everything Flows:*
Towards a Processual Philosophy of Biology (Cambridge University Press, 2018), wherein they acknowledge
Whitehead’s import role in the development of process thought but then go on to claim his work is a “liability”
best avoided by serious philosophers of biology: “the panpsychist foundations of Whitehead’s system, not to
mention its theological character, are hard to reconcile with the naturalistic perspective” (7). On the contrary,
the present essay has argued that a coherent naturalistic perspective in fact requires panpsychism.

349 *The Phenomenon of Life* by Hans Jonas, 96.


as affirming the life-death-rebirth cycle itself as the central cosmic mystery.\footnote{This mystery is affirmed in most primal world views, as well as in Vedic and Buddhist traditions. The Judeo-Christian tradition is rather unique in its denial of any form of rebirth, though there are exceptions (e.g., Origen and Rudolf Steiner). Thompson made the following comparison of panpsychist conceptions of creaturely death to Buddhist conceptions of death: "Panpsychism implies that, as an entirely natural matter of fact, aspects or elements of consciousness—not creature consciousness but more primitive or basal, constituent forms of consciousness—remain present after biological death. Indeed, the idea that creature consciousness at death undergoes a kind of phenomenal dissolution into constituent phenomenal elements—an idea central to Indian and Tibetan Buddhist conceptions of the dying process—may make more sense from a panpsychist perspective than from a neurophysicist one" ("Response to Commentators on Waking, Dreaming, Being," Philosophy East and West, Volume 66, Number 3, July 2016, 989. http://enlight.lib.ntu.edu.tw/FULLTEXT/JR-PHIL/phil567546.pdf).} Jonas’ fascination with Heidegger’s existential phenomenology is not misplaced: Dasein’s being-toward-death is indeed constitutive of our being human. Death opens us into the heart of Being. Whitehead’s unapologetic return to metaphysics is not necessarily in conflict with Heidegger’s turn toward Existenz, since he engages in philosophical speculation not in order to master or cover over death, as ontotheology does, but instead to seek some reconciliation between life and death via a coherent account of their integration in and as creative process, or what he termed Concrescence. Whitehead described an actual occasion’s concrescence in terms of three cumulative phases of feeling: first, the creative intensity of many objectively given past actualities initiates a new actual occasion or throb of experience; second, this occasion seeks its own form of aesthetic satisfaction in an immediately enjoyed presentation of the objective manifold by unifying this manifold into its own unique subjective perspective on the universe; finally, the occasion, having achieved satisfaction of its subjective aim toward unity, perishes into superjective immortality, becoming another objective expression to be prehended in the concrescence of subsequent throbs of experience. This process, whereby “the many become one, and are increased by one,”\footnote{Whitehead, \textit{Process and Reality}, 21.} is iterated endlessly "to the crack of doom."\footnote{Process and Reality, 228.} It marks for Whitehead the primary miracle of creation,
whereby the dry bones of the past are clothed again in the flesh of renewed purpose and zest for life.\textsuperscript{355} It is the miracle whereby actual occasions perpetually perish “and yet live for evermore.”\textsuperscript{356} Note that while Whitehead’s \textit{ontological} account of concrescence does include a kind of "immortality," this should not be confused with the distinct question of the post-mortem ontogeny of individual biological organisms. As mentioned above, Whitehead philosophy of organism is decidedly neutral on the question of ontogenetic or personal immortality.\textsuperscript{357} But it cannot be denied that Whitehead’s philosophy of organism stands in stark contrast to the nihilism of some modern and much postmodern philosophy. For Whitehead, beauty is the teleology of the universe. The concrescence of each actual occasion is goaded toward beauty by an indwelling Divine Eros. This Eros, also called the “primordial nature of God,” is inherited in the initial feelings of each occasion of experience. But because actual occasions are still self-creative, the Divine Eros does not determine the direction of Nature’s creative advance. Rather, by contributing to the initial phase of each concrescent occasion a graded envisagement of Creativity’s infinite value-potential as relevant to its finite situation, the Divine Eros lures occasions toward more intense actualizations of value-experience or beauty. Such actualizations are never assured, and any achievement of order is accomplished amidst a background of chaos that is forever threatening to shipwreck the whole endeavor. Whitehead rejects as fallacious the

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\item Whitehead, \textit{Process and Reality}, 85.
\item Whitehead, \textit{Process and Reality}, 351.
\item One form of immortality an individual can possess is achieved through its participation in and contribution to the larger cosmic personality or divine milieux which shelters its experience. In the end, Whitehead and Jonas converge rather intimately on the question of the possibility and nature of immortality. Indeed, Jonas was deeply influenced by Whitehead’s processual account of God’s relationship to the world (see \textit{The Life and Thought of Hans Jonas} by Christian Wiese, p. 126). Interested readers should compare the final pages of \textit{The Phenomenon of Life} in the chapter “Immortality and the Modern Temper” to Whitehead’s late essay “Immortality.”
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narrow religious conception of the universe as determined by some final order imposed by a transcendent and omnipotent God.\textsuperscript{358}

Despite its open-ended evolutionary character, Jonas, Varela, and Thompson do not go as far as affirming the cosmogenetic teleology of Whitehead’s panpsychism. They restrict the scope of teleology to biological phenomena, arguing for a kind of immanent purposiveness at work at least in the self-production and sense-making of individual living organisms down to the level of single cells. Self-production or autopoiesis is said to differentiate an organism from an “indifferent physicochemical” environment, while sense-making turns this environment into a world of “biological significance.”\textsuperscript{359} They allow teleology entrance into nature only through the emergent centers of “concern” wherein biological organisms “affirm and reaffirm [themselves] in the face of not-being.”\textsuperscript{360}

Thompson et al. here oppose the “otherwise neutral events” of external physics and chemistry governed by deterministic laws to the “internal norms” of biological organisms.\textsuperscript{361} Biological organisms, as sense-making, self-producing beings, are not posited as by any means exempt from the laws by which science understands the physical world, but nonetheless they are thought to add something special not found in or entailed by these laws. From Thompson’s perspective, the new sciences of complexity, unavailable in Kant’s day, allow contemporary theoretical biologists to grasp this extra something in a more rational, scientific way.\textsuperscript{362} Jonas, Varela,

\textsuperscript{358} Process and Reality, 111.
\textsuperscript{359} Thompson, Mind in Life (Harvard, 2007), 153.
\textsuperscript{360} Mind in Life, 153.
\textsuperscript{361} Mind in Life, 152-153.
\textsuperscript{362} Mind in Life, 129.
and Thompson thus go further than Kant in affirming immanent teleology as constitutive of at least biological organisms.

Thompson (a former student of Varela’s and the only living member of this triad) has followed one line of the post-Kantian tradition’s development through Husserl to its culmination in Merleau-Ponty’s embodied phenomenology. He also draws on Jonas’ discussion of biological space and time, which is in effect an evolutionary extension of Kant’s Transcendental Aesthetic beyond the human to include the subjectivity of all biological organisms. Whitehead, on the other hand, tried to go back to Kant and invert his founding principles. As we have seen, Whitehead’s process-relational ontology constructs a critique of pure feeling as a replacement for Kant’s critique of pure Reason. Something very similar ended up happening within the Kantian tradition itself, not just via Schelling, but via Merleau-Ponty, whose late ontology of the flesh could be described as a transition from Kantian disembodied reason as epistemologically foundational (with ontology bracketed) to embodied feeling as the ground of knowledge and existence. It could be that Schelling, Whitehead, and the embodied phenomenologists end up converging in the end.\(^\text{363}\) Even so, Thompson remains suspicious of claims that the relations between even the most microscopic physical events are somehow experiential. He worries that this sort of speculative claim overshoots the transcendental limitations Kant placed on human knowing.\(^\text{364}\) I am compelled to follow Whitehead, however, in seeing Kant as having prematurely limited our intuitive capacity to participate in Nature’s inner life.\(^\text{365}\)

\(^{363}\) Hamrick and Van der Veken's *Nature and Logos* argues as much.


\(^{365}\) Even Kant, in his last writings before death (published as the *Opus Postumum*), acknowledged that we do have intuitive access to the interiority of nature, since we ourselves, as natural beings, experience it directly in our
rejected the philosophical tradition which has it that “there are set limitations for human experience, to be discovered in a blue-print preserved in some Institute of Technology.” He grants the usual limitations set by the social habits that happen to be dominant in each epoch, and by the difficulty of verbally expressing, and thus recalling or communicating, unusual experiences; but in principle he cannot “discern any reason, apart from dogmatic assumption, why any factor in the universe should not be manifest in some flash of human consciousness.”  

After all, though difficult, the main task of philosophy is precisely that of translating into language what such flashes of insight reveal about the nature of the penumbral background encompassing our normal consciousness. In this way, philosophy strives to increase the generality of our metaphysical categories beyond their applicability to the tables and teacups of our everyday experience. Hidden in ordinary experience, Whitehead continues:

there is always the dim background from which we derive and to which we return. We are not enjoying a limited dolls’ house of clear and distinct things, secluded from all ambiguity. In the darkness beyond there ever looms the vague mass which is the universe begetting us.

The normally dim background enveloping our embodied experience, that which our sensitive membranes are supposed to put us in touch with, is evidently not a mere neutral “not-being.” Whitehead beseeches us not to be too quick to artificially

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own interiority. Kant’s late re-consideration of the limitations his earlier critiques had placed on knowledge may have been a result of Schelling’s influence.


limit our capacity to experience the deeper causal vectors animating the cosmic life from which we derive and to which we return.

Despite its tendency to impose such limits, there remains much that is of value in the transcendental orientation, particularly when it has been transformed into embodied phenomenology. Thompson’s approach invites reductionists to become more reflexive about how their objective way of knowing brings forth a specific, limited domain of significance, a domain wherein only the mechanical aspects of living phenomena are detectable, and wherein all value, meaning, and purpose evaporates from view. By epistemically ruling out a “feeling for the organism” as unscientific, mechanistic biologists become numb to the physical purposes at work within the living processes of Nature. If, as Thompson puts it, “empathy is a precondition of our comprehension of the vital order,” where empathy means the “spontaneous and involuntary resonance of two living bodies with each other,” then knowing the living interiority of Nature requires coming to aesthetically resonate with it, to sense it, or sense with it, from the inside out. Whitehead, like Schelling, arrived at his organic realism by inverting Kant's transcendental idealism so that intuitive feeling and aesthetic came to ground conceptual reflection and Reason. “The reaction of our own nature to the general aspect of life in the universe” is thus the primary experiential datum of and epistemological justification for Whitehead’s metaphysics.

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368 Mind in Life by Evan Thompson, referring to Evelyn Fox Keller’s biography of biologist Barbara McClintock, A Feeling for the Organism (1984).
369 Mind in Life by Evan Thompson, 165.
370 I referred to this Schellingian-Whiteheadian reversal as “descendental” philosophy in my dissertation, Cosmotheanthropic Imagination in the Post-Kantian Process Philosophy of Schelling and Whitehead (2016).
Thompson agrees that a more generic view of nature than the mechanical one is possible. In his more recent work, he has pursued a post-physicalist, non-dualist perspective, arguing that “physical being and experiential being imply each other [and] derive from something that is neutral between them.”  

He explicitly leaves the door open to panpsychism and neutral monism and suggests they may have advantages over neurophysicalist reductionism. Neutral monism is a position that William James fleshed out more than a century ago and that had an important influence on Whitehead’s philosophical development. James’ notion of a “pure experience” from out of which subject and object, mind and matter, emerge and constellate themselves into more or less stable patterns of perceptual habit is very close to Whitehead’s panexperientialism. But how can something “neutral” give birth to a creative cosmos of living organisms? It is this problem that led Whitehead to generalize the insights of James’ radically empirical psychology (which has much in common with embodied phenomenology) into a panpsychist cosmology. If experience goes all the way down, the challenge is to find some description general enough to avoid anthropomorphism but vectored and telic enough to still count as experiential. Whitehead threads the needle with his concept of prehension. Physical prehensionality, where memory and anticipation are present already in germ, thus becomes the precursor of biological intentionality (which itself is the precursor of conscious reflection). There is thus no neutral reality: for Whitehead, to be real is already to be the realization of some modicum of value, as “aesthetic attainment is interwoven in the texture of realization.”

372 Waking, Dreaming, Being, 105.
374 For more on the difference between prehensionality and intentionality, see my dissertation Cosmotheanthropic Imagination in the Post-Kantian Process Philosophy of Schelling and Whitehead (2016), 143.
375 Whitehead, Science and the Modern World, 94.
Placing Life Back in the Cosmos

There are clear parallels between Whitehead's philosophy of organism and the new paradigms of theoretical biology put forward by thinkers like Jonas, Rosen, Varela, and Thompson. There are also important differences regarding physical ontology, panpsychism, and the proper scope of teleology. My main motivation for bringing these thinkers into conversation with Whitehead is to lure those already critical of the idea that mechanistic reductionism offers an adequate account of life into the more constructive project of imagining a viable cosmological alternative. If living organization is taken seriously and given its proper place in the cosmos as ontologically generic, then our scientific conception of the universe requires a thorough re-imagining. Organism must replace mechanism as the root image or archetypal analogy guiding natural scientific investigation. Epistemologically, feeling (in the more generic, Whiteheadian sense) must be granted an enhanced status as our primary mode of relation to the life of the cosmos, such that a rational cosmology comes to mean the same thing as a relational one.
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