

# From Law and Chance in Nature to Ultimate Reality

*Wesley J. Wildman*

## **Introduction**

This chapter argues that there is some traction between an ontology of nature<sup>1</sup> based on the reality of law and chance in nature, on the one hand, and a metaphysics of ultimacy,<sup>2</sup> on the other. Contrary to the strategy of traditional natural theology, which aims at direct entailment from aspects of an ontology of nature to theories of ultimacy, the traction I speak of has only the limited effect of making some views of ultimacy less plausible and others more plausible. This is partly because there are so many uncertainties both about the adequacy of any ontology of nature and about the completeness of the set of relevant ultimacy hypotheses that might have a claim in the discussion. Consequently, the argument presented here will not select out a decisive winner in any of the long-running competition among philosophical

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1 For the purposes of this chapter, “ontology of nature” could be called “philosophical cosmology”; in both cases the point is to establish basic categories for understanding all of nature and its operations. I use the former phrase to avoid the confusion of “philosophical cosmology” with “scientific or physical cosmology.” Moreover, “ontology” focuses on the character of what exists, which is hospitable to my aim to ask about the character of ultimacy as Being Itself.

2 I use “ultimacy” rather than “ultimate reality” or “God” in deference to the results of the Comparative Religious Ideas Project. See Robert Cummings Neville, ed., *The Human Condition* (vol. 1), *Ultimate Realities* (vol. 2), and *Religious Truth* (vol. 3) (Albany, NY: SUNY, 2001). That project sought to identify through a rigorous process of comparison and analysis which categories work best to describe what is important about the ideas of world religious traditions, minimizing distortion and arbitrariness. One of the conclusions of the project, though for practical reasons not reflected in the title of the second volume, is that the term “ultimate realities,” while more generous and more useful than the term “God,” is nevertheless biased against religious traditions that focus on the discovery and living out of ultimate ways or paths and on freeing people from an unhealthy obsession with ultimate realities. A vaguer category encompassing both “ultimate realities” and “ultimate paths” is preferable – thus “ultimacy.” My interest here is in metaphysical theories of ultimacy, of course, and this leans heavily toward “ultimate realities,” and yet I will persist in using the term “ultimacy” as a vital reminder of the complex diversity of religious thought in this area. The title and abstract retain “ultimate realities” for the sake of broader understanding. Elsewhere, I use “ultimate realities” rarely, and always as a specification of “ultimacy” that explicitly rules out “ultimate ways.”

visions of ultimacy. But the argument does pose serious challenges to some views of ultimacy while favoring others.

I shall proceed in three stages. First, I summarize what is known about law and chance in nature from the viewpoint of contemporary science (Section 2). Second, I propose an ontological framework capable of contextualizing our scientific beliefs about law and chance in a convincing way, which I will call the “laws canalizing chance” ontology of nature, borrowing the widely used image of “canal” to suggest constraint-without-determination (Section 3).<sup>3</sup> This will involve a close look at chaos theory to illustrate the difficulties and opportunities involved (Section 4) and an evaluation of challenges to this ontology (Section 5). Finally, I discuss how the “laws canalizing chance” ontology generates traction with theories of ultimacy (Section 6). This involves showing how some ultimacy hypotheses fare worse than others in this ontologically mediated conversation with law and chance in science (Section 7).

### Law and Chance in Nature

Science allows us to explain reality, it is said, but the results are extraordinarily complex. In fact, the scientific view of reality is an ingenious, semi-consistent, contestable, publicly accountable patchwork of explanations of *parts* of reality – and only those parts that are tractable for scientific methods of inquiry. Relations among scientific explanations vary from highly coordinated to vaguely connected to frustratingly incompatible to completely independent of one another. Principles of scientific explanation vary in style from universal to contextual, rigid to statistical, descriptive to ontological.

This impression of diversity of explanation only increases when we take into account the full range of ways people explain reality, within and beyond science, from art to music, from economics to law, and from literature to psychotherapy. The diversity of explanatory styles is an empirically driven response to the textured character of our experience. Yet formal cooperative inquiry also leads us to prize broadly public accountability along with empirical adequacy, even at the risk of minimizing insights from private modes of reflection on reality.

The explanations that we invoke to make sense of our world, when limited by the two criteria of empirical adequacy and commitment to intersubjective inquiry, make for fascinating study. The principles invoked in those explanations serve as hypotheses for synthesizing all that we have discovered about nature into encompassing ontologies of nature. Among principles that recur in scientific explanations, “laws of nature” and “operations of chance” are especially prominent and worthy of special attention.

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3 I may have first encountered the idea of canalizing chance, if not the phrase itself, in the writings of Jacques Monod, especially *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology* (New York: Knopf, 1971), and Ilya Prigogine, especially (with Isabelle Stengers) *Order Out of Chaos: Man's New Dialogue with Nature* (New York: Bantam Books, 1984).

To speak of “laws of nature” suggests an ontologically aggressive form of explanation, invoking universal rational structures and alluding to a law giver beyond nature. These are now strongly contested associations, especially by those who interpret “laws of nature” in regulative fashion, as merely describing regularities in natural processes. But these associations have always been present, even prior to the emergence of the modern idea of laws of nature. In fact, the idea of lawful or law-like order in nature is ancient and has been important across cultures. Philosophers have often ascribed the power to make and enforce such cosmological laws of order to beings (West and South Asia) or processes (East Asia) that ontologically transcend ordinary particular reality. In the era of modern science, laws of nature usually take mathematical form whereby rigid or statistical regularities are both linked to explanatory frameworks and made vulnerable to measurement and testing. This mathematical voicing of many laws of nature explains why seventeenth-century thinkers conceived the presumed law giver as a Great Mathematician.<sup>4</sup> The mathematical structure of natural laws continues to demand an explanation in our time. Proponents of regularist approaches to laws of nature display no shortage of wonder at the mathematizability of those laws but they resist positive attempts to furnish any deeper ontological explanation for it, presumably because they view taking that next ontological step as intellectually futile.<sup>5</sup>

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4 A classic example is Pierre Simon Laplace’s idea of physical-causal determinism, which he articulated by imagining perfectly determinate particles and motions, a perfect snapshot of all particles and trajectories, perfectly accurate physical laws, and an infinitely competent mathematical-calculator intellect who use this information to predict the motions of particles indefinitely into the future. Perfect knowledge of the future by a Great Mathematician who calculates in this way implies physical-causal determinism. See P. S. Laplace, “Philosophical Essay on Probabilities” (1814): “An intellect which at any given moment knew all the forces that animate Nature and the mutual positions of the beings that comprise it, if this intellect were vast enough to submit its data to analysis, could condense into a single formula the movement of the greatest bodies of the universe and that of the lightest atom: for such an intellect nothing could be uncertain ...” Subsequent developments in physics suggest that at least the first three conditions for Laplace’s imaginative demonstration of physical-causal determinism are lacking.

5 There is a complex story to be told about the theological significance of ontologizing laws of nature (not so much operations of chance). During and after the Enlightenment, thinking of the laws of nature as having independently real existence played a key role in making atheism and religious naturalism credible alternatives to theism as metaphysical frameworks for interpreting reality. After all, if laws were ontologically real, natural regularities did not depend on God to make everything regular moment by moment, place by place. If you could further posit an ontologically self-grounding universe to evade the theistic implications of divine creation, a reverent atheism or a religious naturalism could seem quite appealing. With this earlier history in mind, it would seem that weakening the ontological status of the laws of nature should draw God closer into the explanatory fabric of nature, and thus that the regularist view of natural law would be the friend of the theist. Yet, in practice, it seems to be the opposite. Apparently in our time realist interpretations of laws of nature so strongly suggest a God who created these laws and gave them being that a regularist view is the preferred strategy by which to spoil theistic enthusiasm. It would take survey data to establish this more recent correlation between regularist views of natural laws and naturalistic, atheistic,

Scientific principles of explanation also include “operations of chance,” for want of a better phrase. In fact, there is no well-established name for this idea, unlike the case of “laws of nature,” so there is something necessarily arbitrary about the phrase I have chosen. But the idea itself is crucial in contemporary science. To speak of “operations of chance” connotes more than mere ignorance of causal connections. The phrase pictures an ontologically open world in which some events are not causally determined, even if they are causally constrained. It has potent associations with disorder and ignorance, and being at the mercy of unpredictable forces beyond our control, but these religiously potent connotations are now strongly contested. The idea of operations of chance is as ancient as the idea of laws of nature and is similarly important across cultures. It recently has undergone a revival in the West thanks to evolution, quantum physics, and complexity theory (it has always been a significant in East Asian philosophy). Its prior neglect – marginalized by the triumph of early modern physics and its new-found mathematical and experimentally testable laws of nature – is the reason we still do not have a standard phrase for the explanatory principle of operations of chance. Directly mathematizing the operations of chance is impossible. Statistical regularities in nature allow mathematical modeling of the way chance and order interact and mutually constrain one another, however, so the operations of chance are indirectly comprehended in mathematical form through stochastic laws.

There are other principles of explanation in contemporary science, such as force, interaction, matter, energy, particle, wave, contiguity, number, space-time, and geometry. Few are as important or as basic as law and chance, however, and not only because of the venerable history of these ideas. Laws of nature and operations of chance are complementary concepts that express the dynamic structures and processes of nature and thereby have relatively direct implications for what one might go on to say about an overarching ontology of nature.

How do laws of nature and operations of chance jointly express the dynamics of nature? Most basically, the interplay of laws and chance appears to be a precondition of novelty and life.<sup>6</sup> Without chance there is the death of rigidity and without constraints there is the death of uniform disorder. The lawful constraints somehow hold the seething complexity of reality in check in just the right way to enable complex systems to achieve stability in the face of chance events. The tuning of a complex system such as a planetary ecology is such that the achieved stability of an organism can render most chance events irrelevant to its existence. In particular, the kinds of random events that destroy the organism (predation or cosmic collisions) are rare enough that a species of such organisms can adapt to life niches within the

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or metaphysically short-circuited views of ultimate reality. Here I merely speculate that it is so, based on informal conversations, and note that this newer correlation reverses the one dominant in a previous era. If nothing else, this shows that the metaphysical and theological edges of philosophy of science are as much a matter of fashion and context, and as much slaves to ironic plot twists in intellectual history, as are many other intellectual ventures.

6 Holmes Rolston III has done an outstanding job of describing the interplay of law and chance in his writings. The most compact example probably is H. Rolston III, “Naturalizing and Systematizing Evil,” in *Is Nature Ever Evil? Religion, Science, and Value*, ed. W. B. Drees (New York: Routledge, 2002).

ecology. Meanwhile, the organism stably directs smaller, manageable chance events, from quantum events to chance molecular collisions at the sub-cellular level, into the structured flow of its own existence.

This stability can only be a passing achievement because there is too much for the organism to control, within and without, for permanent stability. Sooner or later another wondrously stable creature will support its own existence by eating the organism in question for food, destroying the organism's higher-level structures in order to access lower-level structures of organized energy within the organism to fuel its own dance on the edge of chaos and order. Or a virus will disrupt the organism's internal workings, defeating its inbuilt molecular defenses against the invasions of smaller creatures and their astonishing biochemical attacks. Or the organism's own biochemical programming will go cancerously haywire and the stability will be destroyed from within.

For all of its moral or existential overtones, biosphere collapse in this perspective is merely the closure of an amazing loophole within the inhospitality to complex stability that is almost everywhere evident in nature, whether it is the vacuum of space or the surface of stars, the lifeless face of rocky planets or the poisonous atmosphere of gas giants. But it is a loophole that nature seems destined to produce in its fecund experiments with laws and chance. In the same way, speciation and extinction within a biosphere are first of all historical markers of evolutionary development, geographical markers of niche transformations, and social markers of the patterns of incessant predation and resource competition. Birth and death are first of all the preconditions for transitional achievement of complex forms of stability in these miraculously fruitful ecologies. Our judgments of value and disvalue of aspects of ecological systems cannot be freed from these most basic constraints on our interpretation of nature, on pain of irrelevance.

### **The "Laws Canalizing Chance" Ontology of Nature**

A host of questions flow from all of this. We want to know about the reality of this or that explanatory principle, the levels of complexity at which we can meaningfully speak of one or another system property, the structured interdependence of levels of complexity, and the adequacy of the entire picture for explaining reality as we encounter it. But we cannot properly address such questions unless we venture another kind of philosophical reasoning. Endless description is just that, endless, unless we ask about the overall conditions for, and meaning of, nature thus described, and identify principles of explanation that artfully integrate these conditions and meanings into a compelling picture of natural reality. This is ontology of nature.

A common kind of ascetically minded philosopher might warn us off ontology of nature, recommending the endlessness of description and analysis as good for the soul and truer to the impenetrability of the depths of reality and to the limitations of human reason. Many scientists try to remain neutral to ontological questions, with limited success. But there is more than one way to honor the wonders of reality. Ontology has a place in rational reflection on nature. In fact, we have already begun the task of ontology of nature, because the explanatory principles mentioned above

are more or less artful integrations of what we have learned about the conditions and meanings of nature. There is a continuum of explanation from simple description to ontologically principled explanation and all kinds of explanations on the continuum have value.

With all this in mind, consider the following ontological hypothesis about law and chance in nature, which we shall call the “laws canalizing chance” ontology of nature. We suspect, omitting many caveats, that chance drives novelty when lawfully constrained in complex systems. We think that a finely tuned interplay of law and chance promotes system properties that define what novelty means – such as selection from among alternative paths of systemic behavior, with “selection” understood in a variety of ways depending on the level of complexity involved. Moreover, we might further suppose that the novelty and stability produced in this entanglement of law and chance are sufficient to account for the emergence of complex organisms, including human beings with their experiential and value-laden form of existence. This hypothesis may need elaboration to make explicit connection to the realms of life and mind, but all elaborations would be consistent with the ontological vision of chance driving novelty when lawfully constrained in complex systems. The key explanatory principles involved in this hypothesis are chance and law, interplay and constraint, complexity and selection. The basic claim of the hypothesis is that these principles of explanation reach deeply into the character of nature and sponsor a rich and compelling rational model of natural reality. The foregoing suggests that we might voice it in terms of interdependent symmetries and their breaking but I shall steer around such possibilities and cleave to the categories used here.

The most obvious payoff of the “laws canalizing chance” ontology is the understanding of nature that it brings. A less obvious payoff is the leverage it confers on philosophical-theological debates about ultimacy, which is where we are headed in this chapter. For this latter purpose, this ontology of nature is appealing especially because metaphysical thinkers of many different persuasions can accept it, even though they would account metaphysically for the possibility of such wondrous dynamic harmony very differently. It is compatible with all forms of naturalism, for example, and with the forms of theism that can support theistic evolution. It is compatible with metaphysics of process such as Whitehead’s, or the panpsychism of Charles Hartshorne; with metaphysics of substance such as Aristotle’s, or the ontological dualism of Descartes; and with metaphysics of harmony such as Robert Cummings Neville’s or the Daodejing’s. It does rule out the idea of intentional divine action to insert crucial information into the natural process supernaturally, in violation of the sufficiency of ordinary operations of nature as described by this ontology. But it is amenable to the possibility that ordinary operations of nature involve divine action in a continuous and nature-defining way, as they do in Whitehead and theistic evolution. Thus, the “laws canalizing chance” ontology of nature is a good basis for conversation among thinkers defending diverse metaphysical views of ultimacy. We shall see later that it also supports finer discriminations among theories of ultimacy.

To be sure, this conversation between ontological theories of nature and theological theories of ultimacy is far from simple. The scientific difficulties alone are prodigious and endless challenges face those who would tell the story of the “laws canalizing chance” ontology of nature in detailed fashion. Producing

working models of constrained selection processes has proved difficult, as artificial intelligence research shows. Figuring out what constraints promote functional complex systems is equally difficult, as the controversies over selection units within evolutionary theory and the study of protein function demonstrate. Applying any of these generic ideas to empirical features of actual complex systems presently seems well beyond our reach. Witness the mind-bending difficulty of the so-called “hard problem” of consciousness,<sup>7</sup> or the prodigious complexity of the symbol-wielding gymnastics of human language.<sup>8</sup> Yet this ontological hypothesis at least promotes conversation where otherwise we would have only the sub-rational chaos of provincial disagreement.

### A Case Study: Chaos Theory

To investigate the “laws canalizing chance” hypothesis further, we need to plunge into some details to track the move from science to ontology. Chaos theory is a particularly useful case study for my purposes because it is a relatively simple instance of connections among law, chance, and ontology, and because it recurs in the science-religion and complexity literatures. Its implications for the ontological interpretation of laws and chance in nature are thoroughly controverted and often misunderstood, however, so retracing the arguments should be illuminating.

Chaos theory promises relevant insights into chance in nature via the philosophical problem of metaphysical determinism. If the thesis of metaphysical determinism in any form<sup>9</sup> is correct, then the operation of chance is nothing more than the unanticipated coincidence of otherwise apparently independent causal paths, as when a pedestrian going about his ordinary business is hit by a falling brick as he passes a building site. On this view of the world, chance is a chimera, an artifact of our ignorance about the complicated entanglement of causes in complex systems, and it should have no role as a principle in scientific explanations. We could still speak “as if” chance plays a role in complex systems but we should not ontologize such “as if” contrivances beyond the level of deterministic coincidence.

Does our scientific study of the natural world lend support to the thesis of determinism or make it implausible? This is a classic example of the logical journey from the study of nature to ontology and what we conclude about it dramatically affects the details of the “laws canalizing chance” hypothesis. I shall speed my way through the story, pausing briefly on key episodes.

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7 On the “hard problem” see D. J. Chalmers, *Conscious Mind: In Search of a Fundamental Theory* (New York: Oxford University Press, 1996). A more compact presentation of the main points is D. J. Chalmers, “Facing up to the Problem of Consciousness,” *Journal of Consciousness Studies* 2/3 (1995), pp. 200–19.

8 T. W. Deacon, *The Symbolic Species: The Co-Evolution of Language and the Brain* (New York and London: W. W. Norton & Company, 1997), introduces these complexities.

9 Antecedent natural causes might be sufficient causes, or else divine knowledge or intentions may constitute a sufficient cause for all events, resulting in two dramatically different kinds of metaphysical determinism.

Debate on the thesis of metaphysical determinism was relatively ineffective worldwide, stymied by a welter of conflicting preferences and arguments, until the discovery and mathematical formulation in the seventeenth century of laws of nature that permitted rigorous, repeatable testing. In this process, scientists also realized that laws already known in one domain could be applied to other domains, also. The most famous example of this phenomenon of domain extension is English physicist Isaac Newton's integration of terrestrial and celestial mechanics under an inverse-square law of gravity but it has recurred often in the last three centuries. With experiments and observations supporting the new-found laws, and with their domain of application expanding outward to the cosmos, it seemed that the entire universe must be governed by the same laws of mechanics that Newton had discovered. In this way, the thesis of metaphysical determinism became appealing in a way that it hadn't been before, enjoying the plausibility that the prestige of scientific support confers.

There were difficulties here and there, of course. Newton mistakenly assumed that a law-governed system should also be predictable. Thus, he became deeply worried that he could not demonstrate mathematically the stability of orbits in a three-body system such as Sun-Earth-Moon. Being religiously motivated to expect divine providence to rule out the possibility of devastating solar-system collisions, Newton conjectured that God must adjust orbits periodically as necessary to protect orbit stability. This did not undermine scientific support for metaphysical determinism so much as join determinism already operative in the natural world with equally deterministic divine action aimed at particular providential ends. But it did complicate the case for determinism. Not even the most ardent determinist of that era – and this early period of modern physics did inspire some keen determinists – would be eager to defend a determinism that might allow for the end of all life on earth just because of planetary orbit wobbles. This is because such thinkers understood divine providence and determinism in nature as interwoven threads in a single cord. This instinct was promoted by the predestinarian thought of influential Reformed Christian theologian John Calvin, and also by similar but much older ideas in the thought of influential early fifth-century North African Christian theologian Augustine. In the centuries after Newton, the widespread assumption of providential theism would weaken to the point that determinists would have little religious difficulty imagining collisions among solar-system objects but by then the evidential balance in favor of determinism had shifted due to twentieth-century developments in physics, and the possibility of human management of solar-system collisions had become more than a silly fantasy, if not yet a practical technology.

Newton's mistake was a telling one. To associate law-governed behavior and predictability was a manifestation of the understandable yet finally self-deceptive technological conceit that reality would prove rational on human terms and that human beings could gain control of the world through knowledge of its future. It is an appealing view, in some ways. The indeterminist can see it as an aspect of human growth toward self-awareness and mastery of the environment through predicting the future and deciding what to do in advance. Even the determinist can appreciate the association of lawfulness and predictability as a beautiful and potent expression of God's providential will, with everything grandly playing out according to a divine

plan. All that happens testifies to the glory of God, in Augustinian and Calvinistic and Qur'anic terms, or is a flourish of divine self-enjoyment or *lila* (play), in Hindu terms. But Newton's assumption was mistaken.

In fact, a century after Newton, French mathematician Pierre Laplace demonstrated the stability of solar-system orbits of planets using perturbation theory.<sup>10</sup> This occasioned a famous exchange with Napoleon Bonaparte, who upon reading Laplace's book asked where God fits into the theory. Laplace is said to have replied "Sir, I have no need of that hypothesis."<sup>11</sup> The novel development here is that the unpredictability of a deterministic system had been recognized yet also coped with, at least to the point that scientists could demonstrate basic stability of the solar system (neglecting those pesky asteroids). Not only was Newton's association of law-governed behavior and predictability mistaken, his specific fears about a conflict between natural determinism and divine providence were overblown. Had he been less brilliant, he would have assumed that his failure to solve the three-body problem was just a sign of intellectual weakness rather than an indictment on the Creator's engineering skills.

The realization of the compatibility of determinism and unpredictability is the keystone in the arch of chaos theory. Some simple non-linear mathematical systems turn out to be unpredictable eventually, despite that fact that they evolve perfectly deterministically in the sense that they are governed by a mathematical equation, so that their next state can always be calculated with precision limited only by knowledge of their current state. Just as Newton extended the domain of terrestrial gravitation to explain planetary orbits, so chaos theory promised to extend the reach of deterministic explanations from the domain of the predictable into the domain of the unpredictable.

As far as the thesis of metaphysical determinism is concerned, this was a spectacular development. Unpredictable phenomena formerly made determinism in nature seem less plausible. Either unpredictability smacked of chaos and randomness or else it conflicted with the reigning sense of divine providential purposes. With the advent of chaos theory, all that changed. Now unpredictability was no longer a threat to the thesis of determinism; the two were perfectly compatible and, moreover, we learned to expect complex deterministic systems to be unpredictable. Never is the thesis of metaphysical determinism more compelling than when it is conceived in partnership with chaos theory.

Yet the subtleties of chaos theory complicate the case for metaphysical determinism and halt its attempts at victorious entry at the gates of nature's palace. Most obviously, we cannot use a system that evolves in an eventually unpredictable way to test the long-term accuracy of mathematical models of natural processes.

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10 P. S. Laplace, "Mécanique Céleste" (1799–1825). Laplace demonstrated orbit stability on short time-scales neglecting tides and asteroids.

11 This exchange is recorded, among many other places, in C. Boyer and I. Asimov, eds, *A History of Mathematics*, Second ed. (New York: John Wiley & Sons, 1991). Laplace was probably referring specifically to Newton's famous hypothesis that God adjusts orbits and not making a sweeping claim on behalf of religious skepticism, which is how the tantalizing phrase has sometimes been interpreted.

Our predictions and our measurements would always veer apart sooner or later and we could never know whether this was due solely to necessarily limited precision in our knowledge of initial conditions or also to fundamental inadequacies of the mathematical model itself. If we can't test, then neither can we confirm or contradict the deterministic hypothesis. Thus, chaos theory may promise to strengthen the thesis of metaphysical determinism through domain extension into the hazy world of unpredictable phenomena but it also sets a decisive limit on the deterministic hypothesis. In other words, thanks to chaos theory, we know that we can never make the case for determinism extremely compelling.

More subtly, there is an important question about whether chaos even occurs in nature the way it appears in the world of non-linear mathematical systems. Of course, we know we can never *demonstrate* that chaos occurs in nature; the testing difficulties posed by eventual predictability guarantee that. But we also have strong reasons to suspect that chaos in the strict mathematical sense *cannot* occur in nature. Chaotic motion is a delicate state with fractal geometry and intense sensitivity to initial conditions. It occurs in non-linear dynamical mathematical systems in which a feedback process repeatedly stretches and folds the input domain. Often those systems have multiple regimes, some chaotic and others not, depending on tuning constants that regulate system behavior. The non-chaotic regimes of these non-linear dynamical systems have repeatedly proved useful for modeling real-world processes. It is this fact that tempts us to suppose that the chaotic regimes of the same dynamical systems also model the weirder phases of natural systems, and this despite the fact that we know we can never evaluate this supposition effectively. But the infinite sensitivity to initial conditions of chaotic behavior means that, were chaos to appear in nature, the gravitational influence of an electron in a galaxy far, far away would eventually prove relevant to the evolution of the system. The thermodynamic openness of every system within the universe means that there can be no chaotic subsystems. Only the universe as a whole could have chaotic regimes, in the strict mathematical sense of the term, and what an equation that would be. But at this point, the idea of chaos in nature is no longer useful. I conjecture that mathematical chaos is like the mathematical ideas of point, line, plane, and hypersurface: they are all mathematical abstractions that appeal to us because they are beautiful and we can work with them theoretically, but they are abstractions from nature's complexity nonetheless. In short, nature is too messy for chaos.

It follows from this that the spectacular features of mathematical chaos<sup>12</sup> – such as eventual unpredictability; strange attractors; fractal geometry; infinite closeness of orbits; and varying densities of periodic, fixed, and repelling points; depending on the system in question<sup>13</sup> – tell us virtually nothing about the characteristics of

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12 Note that some find mathematical chaos not beautiful but repulsive and sinister; see, for example, Carlos Puente's unpublished writings on chaos theory.

13 For a compact introduction to these issues, see W. J. Wildman and R. J. Russell, "Chaos: A Mathematical Introduction with Philosophical Reflections," in *Chaos and Complexity: Scientific Perspectives on Divine Action*, ed. R. J. Russell, N. Murphy, and A. R. Peacocke (Vatican City State: Vatican Observatory; Berkeley: Center for Theology and the Natural Sciences, 1995), pp. 49–90.

complex systems in nature. Neither does the discovery of roughly fractal structures in nature, such as branching in plants, imply that chaotic dynamics must be involved. Such fractal-like characteristics are never perfectly fractal in the mathematical sense and, in any case, can be produced in ways other than as high-level artifacts of complex dynamical systems in chaotic regimes. Indeed, the most famous examples of fractal geometry in mathematics occur not in chaotic regimes of non-linear dynamical systems but in the decidedly non-chaotic phenomena of so-called bifurcation cascades.

Perhaps, then, chaos theory is completely irrelevant to any question about nature, including whether or not the thesis of metaphysical determinism is correct. But this would be a seriously mistaken conclusion. Mathematical chaos may not occur in nature but non-linear dynamical systems are not exclusively about chaos. The aspects of non-linear dynamical systems that are most useful for modeling are also the aspects that are most informative about nature: phase transitions between regimes of behavior, bifurcation cascades with their fractal structures, and the fact that the behavior of complex systems is subject to simple tunable constraints. Thus, there is every reason to think that non-linear dynamical systems are as informative for understanding and explaining nature as they are useful in modeling natural processes – just not the chaotic regimes of those systems.

Non-linear dynamical systems inspired complexity theory because they suggest how relatively simple constrained systems in nature can produce many regimes of complex behavior, mutating from one to another as system constraints vary. Thus, we might expect the right kinds of changes in system-level tuning factors to produce not only different behavior but an entirely different type of behavior by shifting the system into another regime, within which it operates as stably as it did previously. The stability of regimes of behavior means that even quite violent random events in the environment may not interfere with the high-level features of a complex system, while certain quite subtle changes in environmental factors can transform system behavior dramatically. Many instances of this have been discovered, especially in biochemistry, medicine, genetics, ecology, and economics. We may think of the way in which an animal might survive massive injury inflicted by a predator and yet not survive an unnoticed encounter with a single microorganism. Of course, a random event could also destroy the structural integrity of a system, causing it to cease high-level functioning, as when a predator successfully kills its prey.

So what do we learn about the laws of nature and operations of chance from the parts of chaos theory that we can use in modeling real-world dynamics? Chaos theory makes plausible the triple hypothesis that (1) relatively simple components can produce astonishingly complex behavior, if the conditions are right; (2) relatively subtle changes in external conditions can flip a massively complex system from one type of behavior into another; and (3) regimes of system function can be highly stable and resistant to unexpected interference from random events in the external environment. It is along these lines, which is to say by means of complexity theory, that chaos theory lends strong support to the “laws canalizing chance” hypothesis.

Elaborating the “laws canalizing chance” ontology along the lines of chaos-theory-inspired complexity theory looks something like the following. Laws constrain randomness in such a way that their mutual entanglement produces

enormously complex systems with ordered regimes of higher-level, stable behavior emerging from specially organized, stable, lower-level components. Subtle changes in environmental conditions can flip components into spectacularly different regimes of behavior, thereby changing the tuning of systemic components all the way up the hierarchy of complexity. Such dynamic harmonies of stable components arranged in nested hierarchies (systems, for short) potentially shelter spectacularly varied modes of operation, potentially accessible through tiny environmental changes. For example, point mutations in DNA can dramatically change the phenotypical expression of a genetically based system, profoundly altering the protein assemblies that determine body plan or metabolism. Some of these simplest of mutations are deadly and some produce bizarre results but others may confer survival advantages. The promise of the “laws canalizing chance” ontology of nature lies particularly in its alignment with the aspirations of complexity theory to explain emergent structures without recourse to interventionist forms of intelligent design.

Having incorporated this lesson from chaos theory into the “laws canalizing chance” hypothesis, we must return to the other aspect of chaos theory with purported ontological import, namely, its explanation of eventually unpredictable behavior within a mathematically deterministic framework. I have argued that this fact about mathematical chaos theory is compatible with both deterministic and indeterministic metaphysics. Ideally, then, I would like the “laws canalizing chance” hypothesis to make sense on either metaphysical view, just as complexity theory seems to make sense on either metaphysical view. In fact, this is possible because we can make sense of chance and randomness in both deterministic and indeterministic metaphysical frameworks, albeit very differently. In a deterministic setting, chance and randomness refer to the interaction of otherwise independent causal chains, and chance is an “as-if” way of speaking, a lexical shortcut rather than an ontological principle. In an indeterministic setting, chance and randomness additionally embrace the idea of causally constrained but not fully causally determined events.

At minimum, then, the chaos and complexity-inspired ontological hypothesis I am defending involves laws optimally canalizing the dynamism of chance events (in the indeterministic case), or laws producing sufficient structure and denseness of causal entanglement (in the deterministic case), to create stable complex systems with emergent properties at many levels. The compatibility of the “laws canalizing chance” hypothesis with both deterministic and indeterministic metaphysical frameworks is doubly virtuous. On the one hand, the question of metaphysical determinism is very much open in contemporary science – even in quantum theory there are viable deterministic, albeit necessarily non-local, interpretations. On the other hand, reinforcing the point made earlier, an ontological hypothesis that is vague about metaphysical determinism is a good basis for metaphysical conversation because of its minimalism: it activates connections with science while remaining hospitable to (not all but) a wide range of metaphysical and theological views of ultimacy.

## Assessing the “Laws Canalizing Chance” Ontology of Nature

A few intellectuals contest the universal applicability of the “laws canalizing chance” view of complex behavior. In our time, this is particularly true of intelligent design (ID) theorists, at least when they imagine supernatural, divine design rather than natural, alien design. But most scientifically informed intellectuals accept something like the “laws canalizing chance” hypothesis and regard it as a necessary condition for the highly desirable functional naturalism of the natural sciences – that is, science attempting to explain emergent features of complex systems without recourse to “designer” hypotheses or “supernatural” influences.

To see how powerful the “laws canalizing chance” ontology has become in the last couple of centuries, consider the development of the biological wing of design argument during the modern period. In 1802, Anglican priest and theological apologist William Paley published *Natural History: or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature*. This was an extremely popular and influential book. Paley argued that it was possible to conclude from the design of nature both that a divine being exists and that this being is benevolent and intelligent. At the time, Paley’s arguments seemed enormously plausible, to the point of being almost incontestable, even to future luminaries of evolution such as the young Charles Darwin. The few who disputed them were maverick philosophers out of sync with the science of their day.

By contrast, in our time, ID theorists propose a design argument that far exceeds Paley’s in terms of close analysis of evidence and precision of argument. In particular, they make no claims on behalf of God’s existence or attributes, being far less sanguine than Paley about the strength of theological inferences from natural structures and processes, and thereby incurring the wrath of fundamentalist creationists. They limit themselves to arguing for the validity of the so-called design inference, which asserts that specified forms of complexity entail the work of an intelligent designer, about whom or which we can know nothing more, based on design considerations alone. Even with this striking contraction of the scope of the design argument, however, most scientists consider it a losing proposition to bet against the advance of scientific knowledge as it steadily explains more and more of the workings of complex systems.<sup>14</sup> To have a chance at winning a bet against advancing science, choose a wager with better odds! For example, bet with official

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14 I consider the success of intelligent design an extremely unlikely outcome. In fact, I find it difficult even to conceive what the success of the intelligent design program would mean. All of its calculations about the unlikelihood of spontaneous organization of organic units manifesting specified complexity turn on knowledge of how good evolutionary theory, leveraged by complexity theory, can get. Since we do not know how good evolutionary theory, leveraged by complexity theory, can get, and especially since no limits seem to be on the horizon, the intelligent design hypothesis necessarily takes up territory in a closing gap of human knowledge. There is no in-principle argument that this gap cannot be closed, at least not without begging the very question intelligent design theorists seek to answer. The prospects for intelligent design seem dim, accordingly, in the special sense that it is not clear how they could ever win the competition with evolutionary theory to produce a satisfying explanation of specified complexity.

Roman Catholic teaching against a materialist explanation of the moral and spiritual essence of human beings,<sup>15</sup> with all surviving forms of traditional South Asian philosophy<sup>16</sup> against the reduction of the qualia of self-consciousness to physical causes, or with the ancient Greek philosopher Pythagoras against science's ability ever to explain the ontological basis for the mathematizability of natural regularities.<sup>17</sup> Current science seems out of its depth on such issues. But don't bet against science at precisely the point where it is advancing quickly and effectively. Yet ID theorists do make precisely this bet, and thus continue to paddle far outside the mainstream of contemporary science.

The cosmological wing of the design argument has another history, running from mathematized eternal universes through big-bang cosmology to quantum cosmology and multiverses. The grand centerpiece of the argument is cosmological fine-tuning, wherein numerous apparently independent physical constants need to be set just right for there to be a life-supporting universe. I suspect that the appeal of the cosmological design argument may be cresting at the moment. We can expect quantum cosmology, especially string theory and multiverses in some form or another, to relativize the superficially astonishing fine-tuning of laws of nature. This will weaken the cosmological design argument in the same way evolutionary theory weakened the biological design argument after Paley's time.

Eventually, I expect that the design argument in both its biological and cosmological forms will return to the mode in which it is most compelling, namely, insisting that the ultimate contingency of nature itself, along with the principles by which we attempt to explain nature, demand a deeper metaphysical explanation. It is in this mode that the design argument has abiding significance for metaphysics and theology. In more aggressive modes the design argument has historically overreached, inspired by new scientific discoveries that bring with them transitional ignorance about nature's workings. I think this pattern will hold with respect to both the intelligent-design version of the biological design argument and the fine-tuning version of the cosmological design argument.

In short, during the last couple of centuries the design argument has become far more precisely voiced, far more modest, yet simultaneously far less plausible. As far as the biological design argument is concerned, evolutionary theory unaided could not reduce its plausibility. After all, it is precisely the well-known difficulties

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15 Current Catholic teaching is that evolutionary theory suffices to explain the emergence of bodies from created nature but that God must supernaturally infuse souls, the seat of the moral and spiritual dimensions of human life, into human bodies.

16 I intend this formulation to rule out the materialist Carvakas as not surviving, and the currently widespread British analytical philosophy as not traditional. This leaves especially the orthodox Schools of Hindu philosophy (not all of which are interested in ontological matters), the Madhyakama and Yogacara schools of Buddhist philosophy, and Jainist philosophy, all of which would bet in one way or another against materialist explanations of the qualia of consciousness.

17 Pythagoras started a secret society on the basis of the mystery of the mathematical-musical harmonies he discovered, conveying the impression that the ultimate explanation for the world's mathematizability lies beyond our explanatory reach and should be revered and studied instead.

of evolutionary theory that inspire ID theorists. Rather, it is complexity theory that makes plausible the claim of the sufficiency of evolution to explain apparent design in nature. This claim is far from secure, of course; scientists must overcome many challenges, from the apparent evolutionary independence of major phyla in the fossil record to the prodigious complexity of cellular mechanisms. But complexity theory operationalizes the claim of evolution to explain apparent design in nature without reference to interventionist intelligent design.

In light of these considerations, the “laws canalizing chance” ontological hypothesis is extremely compelling. It is aligned with a vastly effective and proven scientific research program (evolutionary complexity, for want of a better name) that promises (and needs) to be even more potent in the future. It unites intellectuals with varied metaphysical accounts of ultimacy in conversation while being neutral on controversial and probably intractable metaphysical questions such as determinism.

### **From Ontology of Nature to Constraints on Theories of Ultimacy**

I have argued on behalf of a “laws canalizing chance” ontology of nature in such a way that we can interpret the key ontological terms so as to fit either determinist or indeterminist metaphysics, and either regularist or realist accounts of natural laws. This ontology lies at the heart of complexity theory and operationalizes a number of key scientific research programs, including using evolutionary theory with molecular biology and biochemistry to explain complexity, variation of life forms, and the function of organisms, all without assuming supernatural intelligent design. We probably will never secure knock-down arguments on behalf of a particular ontology of nature. But we may not be in the philosopher’s nightmare of hopelessly intractable disagreement, either. There is a lot to commend the “laws canalizing chance” approach to a convincing ontology of nature, especially thought of as a minimalist basis for fruitful debate among more adventurous metaphysical theories. So the question now is, how precisely does an ontology of nature constrain speculation about ultimacy? In particular, are some views of ultimacy more plausible and others less plausible in the presence of the “laws canalizing chance” ontology of nature I have been defending?

I argue in the following that this minimalist “laws canalizing chance” ontology of nature produces several meaningful constraints on proposals about ultimacy. The constraints are weak, in the sense of not individually or jointly entailing any particular metaphysics of ultimacy. But they are relevant considerations in any inference-to-best-explanation form of argument on behalf of a view of ultimacy. In this section I discuss eight such constraints and show how they flow from the “laws canalizing chance” ontology of nature. In the next section I shall argue that some views of ultimacy have difficulty accommodating some of these constraints, which counts against those views in the evaluative context of comparative metaphysics, while other views of ultimacy are highly consonant with all of the constraints, which gives them a competitive advantage.

First, and most basically, the “laws canalizing chance” ontology of nature demands a broader metaphysical framework to explain reality – an answer, in other words, to

the famous philosophical problem of the one and the many. The “laws canalizing chance” ontology is not satisfying by itself as a fundamental account of nature for three reasons. (a)The ontology is obviously incomplete in that it says nothing about an enormous amount of the natural world, including values, transcendentals such as goodness and truth and beauty, the experiential and existential dimensions of human and other life, and the meaning and future of the universe. (b)The stunning fine-tuning of complex systems such as organisms and ecologies demands explanation: this fine-tuning allows random events to enliven rather than overwhelm the achieved stability of complex emergent life forms and prevents law-like regularities from killing off novelty, which draws attention to the metaphysical conditions of the “laws canalizing chance” ontology of nature. (c)It leaves unanswered the famous “why is there something rather than nothing?” question, remaining silent about the source and origin of nature’s creativity and fecundity, its intelligence and beauty. A philosopher might resist the demand for a broader metaphysical framework but only because of an ascetic policy against such speculation, not because the “laws canalizing chance” ontology by itself gives satisfying answers to all reasonable questions.

Second, pertaining to the character of the complex systems that nature produces under the aegis of the “laws canalizing chance” ontology, we need to have a way of ascribing value to achieved stability in the natural process. We find a herd of gazelle wondrous and valuable and, in the context of ultimacy-talk, want to say that they are so not just because we find them to be so. For such intrinsic value assignments to have genuine significance, they must participate in or reflect ultimate value, and an adequate understanding of ultimacy must support this possibility. But every instance of achieved stability in nature is also transitory and an adequate understanding of ultimacy must reflect this transitory character also.

Third, pertaining to the inevitable suffering and chance cruelties of the natural process as described in the “laws canalizing chance” ontology, it might be desirable to achieve a view of ultimacy that demonstrated its humanly recognizable goodness. This would require defending (or at least having resources with which to defend) ultimacy from all-too-familiar and profoundly agonized charges of cruelty, neglect, barbarity, and evil. This, of course, is the classical problem of theodicy but it has two versions. On the one hand, we can ask about the goodness of God, which makes sense in theistic contexts only. On the other hand, we can ask about the goodness of ultimacy, which makes sense in all contexts (this version is also called the problem of evil or the problem of suffering). In theistic contexts, the two versions of the problem coincide when God is ultimacy, which is the case in classical theism, but is not the case in process theism.

These first three criteria have classical standing in metaphysical debates of ultimacy. They correspond to the problems of the one and the many, the basis for moral values, and divine goodness. While they are related to the “laws canalizing chance” ontology, as I have shown, they are not as closely related as the five criteria that follow.

Fourth, pertaining to the self-contained or relatively autonomous character of the “laws canalizing chance” ontology, it rules out the *need for intelligent, occasional* intervention for nature to work as we know it. This has direct implications for metaphysical hypotheses about powerful supernatural beings such as gods, as has

already been mentioned. Each of the three key words is important for appreciating the scope of this constraint, as follows. (a) Regarding “need,” this constraint says nothing about intervention that is unnecessary to maintain nature’s workings, whether for the sake of achieving providential ends, for divine self-revelation, or just for the sheer play of miraculous self-expression. (b) Regarding “intelligent,” this constraint says nothing about intelligent design of the whole system of nature itself (this sort of intelligent design is standard in most forms of creation metaphysics and reflects divine intelligence). (c) Finally, regarding “occasional,” this constraint does not rule out universal divine action that is constitutive of natural processes themselves (as in Whitehead’s process metaphysics, for example). “Constitutive” here means (i) that universal divine action is necessary for nature to work at all, for natural events to be and natural interactions to occur, and (ii) that divine action happens in such a way as to define nature’s workings consistently with the “laws canalizing chance” ontology.

Fifth, pertaining to the processes and interactions that nature promotes under the aegis of the “laws canalizing chance” ontology, we require a conception of creativity in natural processes that is vested in ultimacy itself. This ultimate creativity cannot be a simple divine picturing or imagining or speaking or making, but must somehow be ontologically present in the drawn-out entanglement of law and chance that defines nature.

Sixth, pertaining to the role of chance as an ontological first principle, an adequate view of ultimacy cannot make chance an enemy of life or equate it with moral evil. On the contrary, in either the determinist or indeterminist interpretations, chance is an essential condition for life and creativity, and is good at least in this life-giving and value-creating sense. Likewise, law-like behavior cannot be reduced to its oppressive, spontaneity throttling aspect but must be understood as a condition for life and creativity. Thus, it too is good at least in this life-giving and value-creating sense.

Seventh, pertaining to the fine-tuning of complex systems, an adequate account of ultimacy must reflect the structure of possibilities that we ourselves exhibit and encounter in nature. Many things are not actually possible while many other things actually are possible. This makes structures of the possible particular and gives them character. Indeed, the “laws canalizing chance” ontology seeks to characterize this nature. A theory of ultimacy must ground these particular structures of possibility, including their tendency toward *apparent* design whereby they are simultaneously fine-tuned in relation to some events and relatively insensitive to others in just the right way to make for achieved stability within the flux of natural events. This is a kind of native intelligence in nature and an ultimacy theory must account for it.

Eighth, pertaining to the dualistic quality of the “laws canalizing chance” ontology, an adequate account of ultimacy will not prefer one side of this dualism over the other. Rather, it will support without distorting the co-primal character of law and chance in the ontology of nature.

For the sake of compact reference, I refer to these eight criteria by the following names:

- one and many;
- grounding of value;
- goodness/theodicy;
- worldly autonomy;
- symbiotic creativity;
- moral symmetry;
- intelligent design; and
- co-primal principles.

### **Evaluating Theories of Ultimacy in Light of the Constraints**

The fecund interplay of “Laws of Nature” and “Operations of Chance” within nature inspires the postulate that a Ground of Being is the ontological condition for law-like and chance-like phenomena, as well as for the comprehensibility of nature through perception, action, emotion, and reason. This is precisely parallel to other forms of natural theology with impressive heritages: apparent design begs for the postulate of a designer, motion for the postulate of an unmoved mover, finitude for the postulate of infinite being, and contingency for the postulate of a necessary being.

This kind of natural-theology impulse is widely shared but the views of ultimacy that it has inspired are strikingly diverse. We have conceptions of this ground as a personal being transcending nature (Polkinghorne, Murphy), as a mystical but structured ground of being internal to nature itself (Tillich), as a divine investment in self-organizing processes (Gregersen, Peacocke, Clayton), as a symbiotic harmony of chaotic and ordering principles (Manichaeism, Monod), as a value-producing process of creatively harmonizing essential and conditional features of creation (Neville), or most bluntly as the affirmation that nature just is what it is (Buddhist conceptions of suchness). Historically, most of these variations have derived substantially from ruling ontologies of nature, as theologians have sought to accommodate their worldviews to contemporary scientific world pictures, always mindful of the balancing realities of suffering and goodness, lifelessness and fecundity, purpose and blind natural processes. Thus, we have strong reason to think that the debate among views of ultimacy, when it is engaged, crucially turns on close analysis of ontological explanations of nature, and on finding ways to create traction between theories of ultimacy and ontology of nature.

For the sake of moving forwards in this argument, I collect and categorize these and other views of ultimacy into the following seven types:

- Ultimacy as suchness, or ungrounded nature (e.g. some forms of Buddhism);
- Ultimacy as self-grounding nature (e.g. many forms of religious naturalism);
- Ultimacy as ground of being (e.g. Platonic or Aristotelian theism);
- Ultimacy as personal being (e.g. personalist theism of Bible, Qur’an, Vedas);
- Ultimacy as symbiosis between world and God (e.g. process metaphysics);
- Ultimacy as non-moral dualism of chance and law (e.g. Monod);
- Ultimacy as harmony of irreducibly plural structures and processes (e.g. Daoism).

Table 9.1

	Generic Metaphysical Criteria			Criteria Most Strongly Connected to Law-Chance Ontology				
	1 one and many	2 grounding of value	3 goodness/ theodicy	4 worldly autonomy	5 symbiotic creativity	6 moral symmetry	7 intelligent design	8 co-primal principles
<b>A</b> ungrounded nature	--	--	- / NA	+	-	+	-	+
<b>B</b> self-grounding nature	+	-	- / NA	+	+	+	?	+
<b>C</b> ground of being	++	+	? / -	+	++	+	+	+
<b>D</b> personal being	-	+	? / ?	?	+	?	++	-
<b>E</b> God-world symbiosis	-	+	- / +	+	++	+	+	?
<b>F</b> chance-law dualism	-	-	- / NA	+	++	++	+	++
<b>G</b> irreducible pluralism	--	-	- / NA	+	?	++	-	?

The question to be answered – or perhaps merely illustrated, given the space available – is which of these seven views of ultimacy give better explanations of the ontology of nature I have identified, in light of the eight criteria elaborated in the previous section.

Grids are invidious things but I fear the exposition will become completely unwieldy and confusing without a reference chart. Thus, listing criteria in the top row and views of ultimacy in the left column, I indicate when a criterion confers a strong advantage (++) , an advantage (+) , a disadvantage (-) , or a strong disadvantage (--) on a view of ultimacy. A square containing “?” indicates that the ultimacy view is more or less neutral to the corresponding criterion, or else that judgment is too complex. A square containing “NA” indicates that the criterion is formally not applicable to the ultimacy theory in question. Of course, each and every one of these judgments is contestable. The complexity of the judgments involved explains why so many theologians refuse this kind of comparative exercise and instead modestly work out of a single tradition, trying to do the best they can with the elements of consonance and dissonance brought by contemporary scientific understanding.

The five criteria on the right side of the table are most closely connected to the “laws canalizing chance” ontology, whereas the three criteria on the left reflect generic but fundamental issues in metaphysics. This introduces a degree of one-sidedness into the analysis. Indeed, there are several missing criteria that might dramatically change the overall results of the inference-to-best-explanation argument I am constructing here. For example, if the (not present) criterion of conformity to biblical theism were stressed, then D (personal being) would have a decisive advantage. If consistency with the Christian doctrinal tradition were stressed, then some combination of C (ground of being or being-itself) and D (personal being) would profit, whereas Buddhism favors A (ungrounded nature) and philosophical Daoism prefers G (harmony of irreducibly plural structures and processes).

This nicely illustrates how the complexity of comparative judgments about theories of ultimacy requires transparency of the criteria involved in the judgments. Such transparency promotes meaningful discussion across different views of ultimacy and is a great advance over the covert operation of such criteria in the premises of traditional natural theology arguments. An equally important conclusion is that plotting out the journey from law and chance in nature to theories of ultimacy does not by itself settle the question of the nature of ultimate reality. It merely indicates how the ruling ontology favors some views of ultimacy by means of the comparative criteria while not favoring others. Other criteria may also be relevant to a final decision, or perhaps final decisions are eschewed in the name of celebratory acceptance of the theological vagueness of reality.

Expounding the fifty-six judgments I have expressed in the diagram is not feasible. It is important to make a few comments, however, in order to illustrate the kinds of argumentation that lie behind the plus and minus signs.

First, consider the “chance-law dualism” view (F). A creative symbiosis of chaotic and ordering principles, this view has western roots in the pre-Socratic philosopher-physicists of Milesia and eastern roots in the Chinese classics. This view treats as ultimate principles the key ideas of the “laws canalizing chance” ontology, picturing entangled, morally neutral, co-primal forces interacting creatively to make

the value-laden world we inhabit. It is the simplest and most direct extension of the ontology of nature to an ultimacy theory. No wonder, then, that the five criteria most strongly connected to the ontology of nature (criteria four through eight) confer such powerful blessings upon this view. The disadvantages marked in the diagram are also the reasons why this view is not more common in religious and philosophical circles. In particular, the lack of a fundamental unity (criterion 1) makes the significantly rational aspects of reality hard to fathom and obscures the metaphysical locus of objective value (criterion 2) in entities that emerge through the symbiotic process. Yet someone rating these two criteria as relatively unimportant, while prizing criteria four through eight, might well consider their search concluded. For such a thinker, the “chance-law dualism” view is the metaphysical account of ultimacy best tuned to the realities of law and chance in nature. Jacques Monod’s *Chance and Necessity* suggests that he is such a thinker.

Second, consider the “worldly autonomy” criterion (4), which favors views of ultimacy that rule out the *need* for *intelligent, occasional* intervention for nature to work as described in the “laws canalizing chance” ontology. This criterion is indifferent to whether there is an ultimate ontological ground to reality and whether such a ground is unified. It does insist on nature’s autonomy of operation and on the sufficiency of the explanatory principles of law and chance. All of the ultimacy views except for “personal being” (D) pass muster with this criterion. The “personal being” view is difficult to assess because the relation between God and the world in this view is developed quite differently in its various formulations. In Deism, for instance, the world’s autonomy is divinely created and subsequently respected by God who takes a “hands off” approach to the world. This idea of created autonomy is also present in some forms of theism, even when God is intensely involved in the world for the sake of self-revelation, fellowship with created reality, and salvation of souls. There are other views of theism in which the idea of created autonomy is not present, however, and in such cases God is needed not just for revelation and salvation but even for the natural process to unfold, either at a few crucial moments or more or less regularly. The “worldly autonomy” criterion is hostile toward this latter form of “personal being” ultimacy theory, where God must act specially to make the world unfold as it has. The question mark in the grid reflects these multiple possibilities.

Fourth, the “goodness/theodicy” criterion (3) is difficult to apply. The ultimate “goodness” part of this criterion is particularly difficult. It seems that an “omnipotent God” picture of ultimacy provides resources for affirming ultimate goodness, vested in the divine nature and power, but also invites a terrible question about the goodness of that divine nature (theodicy). Without an omnipotent or creator God, however, there are neither special resources nor particular impediments to affirming the ultimate goodness of all of reality. Stressing their lack of resources, and the arbitrariness of any affirmation of ultimate goodness, I enter minus signs for five views. I enter question marks in the other two due to the ambivalence of the available resources. The “theodicy” part of this criterion is equally complex. The first two (A, B) and last two (F, G) views are not normally theistic views so the theodicy part of this criterion is not relevant to them. When God is omnipotent, as in the “ground of being” (C) view, the theodicy problem is painfully and famously difficult. When

God is not omnipotent but merely another being, albeit a special being, as in the “God-world symbiosis” (E) view or process metaphysics, the theodicy problem is famously simple and God’s goodness easy to affirm. The other potentially theistic ultimacy theory, the “personal being” (D) view, comes in several forms, as we have noted, and shares the theodicy difficulties and advantages of the other two views depending on the question of omnipotence.

Finally, let us compare the “ground of being” (C) and “God-world symbiosis” (E) views, which rate the best overall in terms of all eight criteria. The “ground of being” view is just the sort of onto-theological invention that German philosopher Martin Heidegger and French philosopher Jacques Derrida have vigorously criticized as futile and dangerous. It predominated in the era of Christian doctrinal formation and profoundly conditions the official formulations of the Trinitarian and Christological doctrines. Its shared Platonic and Aristotelian roots give it a thoroughly western cast but there are prominent parallels in South Asian and East Asian philosophical traditions. Plato had a huge impact on Western religious through Middle Platonism, represented especially by the Alexandrian Jewish philosopher Philo, and through Neo-Platonism, represented especially by late antique philosopher Plotinus and the theologian Augustine. The late medieval rediscovery of Aristotle in the West, thanks to the flourishing intellectual life of Islamic cultures, also had a profound effect on Jewish, Christian, and Muslim thinkers, and nowhere more than in the writings of Christian theologian Thomas Aquinas. In the twentieth century, the most creative representative of this view was probably German-American philosopher-theologian Paul Tillich. In its many variations, this vast tradition asserts that ultimacy is “Being Itself.” This is not merely an empty abstraction from everything that exists – the one thing everything actual has in common is being itself – but a flowing power, a structure of possibilities, a harmony of value, and a luminescent intelligibility in all being. It specializes in answering the problem of the one and the many, and articulating the fundamental intelligibility of mathematics, nature, and the universe as a whole. As noted above, however, it has little uncontrived leverage against the threatening charges of divine evil and neglect, and thus fares poorly relative to the theodicy part of the “goodness/theodicy” criterion (3).

The “God-world symbiosis” view (E) has a less prominent heritage. Its roots in the west are Pre-Socratic, as are most good ideas in subsequent Western thought, but its flowering was not until the modern period of western intellectual history. Its most celebrated articulation is in the philosophical cosmology of Whitehead, especially *Process and Reality*.<sup>18</sup> While that book does portray in great detail a picture of the world process, including God as an element of that process, it does not clearly furnish any theory of ultimate reality. Certainly it places God and the (uncreated, everlasting, dynamic) world alongside one another in a never-ending symbiotic process of mutual actualization and value-creation. But the categories that guide this construction of a philosophical cosmology of the God-world process are not rooted in anything, unless it is “Creativity Itself,” the process analogy of “Being Itself.” Whitehead has little to say about “Creativity Itself” and his profound reflections on

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18 A. N. Whitehead, *Process and Reality*, ed. D. R. Griffin and D. W. Sherburne (New York: Macmillan, 1978).

something like this issue in *The Function of Reason*<sup>19</sup> tend more toward the chance-law dualism picture of ultimacy (though his distinction is slightly different in that book). Whatever Creativity-Itself is for Whitehead, however, it certainly is not God. It follows that Whitehead's recommendations for philosophical theology and indeed for theistic religious life dramatically deemphasize the problem of "one and many," forgo the idea of divine creation from nothing (*creatio ex nihilo*), and surrender the obsession with God as the ultimate explanation for things. In this way, Whitehead and his followers believe they escape the moral ambiguity of "Being Itself" and place themselves under the seductively wholesome influence of a definitely good but definitely not omnipotent deity. Unsurprisingly, therefore, the "God-world symbiosis" view (E) fares poorly against the criterion of "one and many" (1) but supremely well against the theodicy part of the "goodness/theodicy" criterion (3). There is also a nagging question about how even-handedly process metaphysics can support the reigning ontology's insistence on the co-primality of law and chance, but I think one could go either way on this question.

Thus, while the "ground of being" (C) and "God-world symbiosis" (E) views both handle the five criteria most deeply connected to the "laws canalizing chance" ontology of nature almost as well as the "chance-law dualism" view (F), they have precisely opposite advantages and disadvantages on more generic metaphysical criteria. The "one and many" criterion (1) looks kindly upon the "ground of being" (C) view and casts a harsh eye on the "God-world symbiosis" (E) view, while the "goodness/theodicy" criterion (3) turns in opposite judgments.

## Conclusion

This chapter has been an exercise in plotting the complex path from law and chance in nature to theories of ultimacy. In so doing, it has illustrated a new kind of natural theology, one that is comparative in approach and prizes transparent criteria for the sake of correcting and guiding a dynamic process of inquiry. The aim never was to achieve a decisive victor among the many ideas of ultimacy that clamor for attention now as always. Yet tentative conclusions are possible.

What we know about principles of law and operations of chance in nature suggest the "laws canalizing chance" ontology of nature. This ontology inspires several criteria for adjudicating a debate among ultimacy theories. The five criteria

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19 A. N. Whitehead, *The Function of Reason* (Boston: Beacon Press, 1929). Published in the same year as the vast *Process and Reality*, the "Introductory Summary" to the *Function of Reason* describes the polarity, which is not at all the same as the law-chance polarity but surely bears an intriguing relationship to it: "History discloses two main tendencies in the course of events. One tendency is exemplified in the slow decay of physical nature. With stealthy inevitableness, there is degradation of energy. The sources of activity sink downward and downward. Their very matter wastes. The other tendency is exemplified by the yearly renewal of nature in the spring, and by the upward course of biological evolution. In these pages I consider Reason in its relation to these contrasted aspects of history. Reason is the self-discipline of the originative element in history. Apart from the operations of Reason, this element is anarchic."

most strongly connected to the ontology favor the “chance-law dualism” view most passionately, followed by the “ground of being” (C) and “God-world symbiosis” (E) views with roughly equal enthusiasm. The ontology is unsympathetic to views that don’t help explain how it is possible that the symbiosis of law and chance we see all around us works as well as it does, represented here by the “ungrounded nature” (A), “self-grounding nature” (B), and “irreducible pluralism” (G) views. It is unfriendly to views that have difficulty according moral symmetry and co-primality to the principles of law and chance, represented here by many (and possibly all) versions of the “personal being” (D) view of ultimacy. And it is bluntly hostile to versions of the “personal being” view of ultimacy that threaten worldly autonomy of the symbiotic chance-law entanglement.

After that basic result, the more generic metaphysical criteria play a role. These three criteria are connected to the “laws canalizing chance” ontology but are already familiar from the history of metaphysics in the world’s vast traditions of philosophy. The three criteria listed in the diagram (1, 2, 3) are somewhat biased in the direction of theism, as noted, and we would have to rely on other criteria to redress this lack of balance. As things stand, however, these criteria draw our attention to the “ground of being” (C) and “God-world symbiosis” (E) views as the most promising (generally theistic) contexts within which to develop a theory of ultimacy that harmonizes optimally with what we know about law and chance in nature.

In all, then, the journey from law and chance in nature to theological theories of ultimacy, while extraordinarily complex, is also intelligible. It is mediated by an ontology of nature that can furnish criteria for regulating a philosophical debate among competing theological theories of ultimacy. This complex pattern of inferential connections is, I contend, the only way that natural theology can work without succumbing to fallacies due to hidden or unarticulated premises.<sup>20</sup>

## Bibliography

- Boyer, C., and I. Asimov, eds. *A History of Mathematics*, Second ed. (New York: John Wiley & Sons, 1991).
- Chalmers, D. J. *Conscious Mind: In Search of a Fundamental Theory* (New York: Oxford University Press, 1996).
- Chalmers, D. J. “Facing up to the Problem of Consciousness,” *Journal of Consciousness Studies* 2/3 (1995).
- Cummings Neville, Robert, ed. *The Human Condition* (vol. 1), *Ultimate Realities* (vol. 2), and *Religious Truth* (vol. 3) (Albany, NY: SUNY, 2001).
- Deacon, T. W. *The Symbolic Species: The Co-Evolution of Language and the Brain* (New York and London: W. W. Norton & Company, 1997).
- Laplace, P. S. “Philosophical Essay on Probabilities “ (1814).
- Laplace, P. S. “Méchanique Céleste” (1799–1825).

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<sup>20</sup> For a detailed account of the logic of this comparative form natural theology, including a logical critique of traditional forms of natural theology, see W. J. Wildman, “Comparative Natural Theology,” *American Journal of Theology and Philosophy* 27/2 & 3 (May/September 2006), pp. 173–90.

- Monod, Jacques. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology* (New York: Knopf, 1971).
- Prigogine, Ilya, and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature* (New York: Bantam Books, 1984).
- Rolston III, H. "Naturalizing and Systematizing Evil," in *Is Nature Ever Evil? Religion, Science, and Value*, ed. W. B. Drees (New York: Routledge, 2002).
- Whitehead, A. N. *Process and Reality*, ed. D. R. Griffin and D. W. Sherburne (New York: Macmillan, 1978).
- Whitehead, A. N. *The Function of Reason* (Boston: Beacon Press, 1929).
- Wildman, W. J., and R. J. Russell. "Chaos: A Mathematical Introduction with Philosophical Reflections," in *Chaos and Complexity: Scientific Perspectives on Divine Action*, ed. R. J. Russell, N. Murphy, and A. R. Peacocke (Vatican City State: Vatican Observatory; Berkeley: Center for Theology and the Natural Sciences, 1995).
- Wildman, W. J. "Comparative Natural Theology," *American Journal of Theology and Philosophy* 27/2 & 3 (May/September 2006).