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God and Natural Order

Physics, Philosophy, and Theology

Shaun C. Henson



God and Natural Order

In *God and Natural Order: Physics, Philosophy, and Theology*, Shaun Henson brings a theological approach to bear on contemporary scientific and philosophical debates on the ordered or disordered nature of the universe. Henson engages arguments for a unified theory of the laws of nature, a concept with monotheistic metaphysical and theological leanings, alongside the pluralistic viewpoints set out by Nancy Cartwright and other philosophers of science, who contend that the nature of physical reality is intrinsically complex and irreducible to a single unifying theory. Drawing on the work of theologian Wolfhart Pannenberg and his conception of the Trinitarian Christian God, the author argues that a theological line of enquiry can provide a useful framework for examining controversies in physics and the philosophy of science. *God and Natural Order* will raise provocative questions for theologians, Pannenberg scholars, and researchers working at the intersection of science and religion.

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God and Natural Order

Physics, Philosophy, and Theology

Shaun C. Henson

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For Adina and Erica

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Abbreviations

<i>DW</i>	Cartwright, <i>The Dappled World</i>
<i>HLPL</i>	Cartwright, <i>How the Laws of Physics Lie</i>
<i>BQT</i>	Pannenberg, <i>Basic Questions in Theology</i> (3 volumes)
<i>JGM</i>	Pannenberg, <i>Jesus—God and Man</i>
<i>MIG</i>	Pannenberg, <i>Metaphysics and the Idea of God</i>
<i>RAH</i>	Pannenberg, <i>Revelation as History</i>
<i>ST</i>	Pannenberg, <i>Systematic Theology</i> (3 volumes)
<i>TPS</i>	Pannenberg, <i>Theology and the Philosophy of Science</i>
<i>TTN</i>	Pannenberg, <i>Toward a Theology of Nature</i>

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Introduction

The idea of a single omnipotent Creator has often functioned in the history of science to ratify the notion of a “unified nature,” and vice versa. Concepts of God, usually Christian, have for centuries found alliance with scientific evidences for a natural order tidied by an apparent unity of physical laws. At times theological views seem to have driven unifying scientific projects, in natural philosophy and then physics. Recent philosophers of science, however, have challenged a belief that nature may be reduced to a grand mathematical formula like the “theory of everything” sought by physics. A problem for Christian thought is that some among these “metaphysical pluralists” consider the same God not a “Unifier,” but a guarantor of the diversity they proclaim. God by their reckoning may be a lover of plurality, or a kind of divine metaphysical “Pluralist.” Which is the Christian God, then—Unifier or Pluralist?

This book highlights underlying metaphysical elements of this scientific debate by constructing a dialogue between physics, philosophy of science, and theology. At issue here is how a full Christian Trinitarian theology of God, making explicit concepts implicit in the debate, might hypothetically alter the discussion. Specifically, to what extent might theologian Wolfhart Pannenberg’s concepts of God and creation, which are already considerable of the science and philosophy at work in the dialogue, be understood to comment usefully on aspects of the problem? Pannenberg’s intriguing creation thought contains unique material and methodological factors suggestive of a limited synthesis for features of the contest. His Trinitarian God is an “All-determining Reality” describable as both a Unifier and Pluralist, having created a world marked by unities and pluralities reminiscent of the Creator’s own distinctive character.

THE METHOD AND STRUCTURE OF THE BOOK

Pannenberg’s work offers method and structure to the book in several ways. At the heart of his method are bold ideas formally introduced and examined below in Chapters 3, 4, and 5, after a presentation of the original scientific

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problem in Chapters 1 and 2. The relevant ideas driving Pannenberg's methodology include a high regard for a "bottom-up" ("from below") approach to doing theology like a science. This means that one often begins with public knowledge as experienced in the world, like the unity-plurality debate at hand, rather than with a theological doctrine or problem (an approach "from above"). One then takes the issue or problem and seeks to show the degree to which Christian theology might, hypothetically, make sense of or resolve it, in effect combining the approaches. Closely related is Pannenberg's high regard for a dialectical approach (thesis, antithesis, synthesis) to such problems, most often associated with the philosopher Hegel (1770–1831). However outmoded philosophy may now consider dialectical method to be, it offers much here toward examining the disagreements of the following chapters, and provides a good test for Pannenberg's favored ideas, like dialectic.

Pannenberg's general understanding of theology is what commentator Ted Peters calls a "field-encompassing field."¹ Theology in this Pannenbergian guise is capable of addressing and informing areas of the sciences or other disciplines where conflicts and questions persist, presumably due to a lack of consideration on the part of enquirers of the God who is "All-determining" of the reality under investigation.

Giving force to each of these concepts is Pannenberg's further daring notion of treating all theological propositions precisely as hypotheses. That idea, however seemingly unorthodox, allows Pannenberg great creative freedom for demonstrating traditional theology to cohere with scientific thought. It also underlies this project of placing his work into conversation with unifying physics and diversifying philosophy on the debated character of nature, testing the degree to which his work might offer any semblance of synthesis at least for metaphysical, philosophical, and theological aspects of the debate. The objective, then, is to demonstrate Pannenberg's hypothetical ideas, and in turn apply and test them over several chapters as aspects of a further hypothetical proposal. In effect, this book gives a Pannenbergian treatment to several of Pannenberg's own key ideas, in the context of an interdisciplinary project in science and religion, based on a current problem in the philosophy of science.

THE PROJECT IN CONTEXT

All attempts at proceeding from hypothetical explanations based on observations to sound and useful predictions and conclusions are delicate endeavors. Leaving theology and Pannenberg completely aside, this has proven true since the beginnings of sciences like biology and physics through to their modern rise and present status. The necessary development of a uniform process aiding the reliability of scientific investigation, colloquially known as the scientific method, has helped to ensure that any knowledge acquired

through experimentation actually advances human understanding of truth and reality, and is therefore useful.

A 1668 event involving the Italian naturalist Francesco Redi (1626–1697) is often used to illustrate both the need for the method and the potential for problems in its absence.² Redi had set out to test the notion of *abiogenesis*, widespread in his time, which said that life could appear spontaneously from nonliving materials. He hypothesized that certain living things could only come from other living things. Placing decaying meat into two series of containers, Redi left one set open, while carefully sealing the other. Only the meat in the open set became maggot infested. Redi had suspected from observations what most people would be certain of today—that *musca domestica*, the common housefly, was the true explanation. His test seemed to demonstrate the truth of that theory.

Critics saw a potential loophole, insisting it was Redi's sealing of the second series of containers that somehow kept spontaneous generation from happening. So he retested his hypothesis, this time with an open series of containers, and another series covered with cheesecloth. Through the second series air could circulate, but flies were unable to gather. His careful method of retesting the hypothesis proved successful again, with no maggots appearing in the second series of containers. Redi had achieved the same results with a more stringent method. He did not immediately eliminate the idea of spontaneous generation from the public mind, nor even totally from his own, by the careful testing. But he did help to provide a step along the way toward establishing what we now know as the scientific method.

Sciences like biology and physics differ in various ways, including their adaptation of the so-called scientific method according to the given science and the problems it approaches. Still, there are ordinarily now several common steps involved. These include *observations* of phenomena; the formation of *hypotheses* or descriptions of possible explanations for the phenomena observed (which in physics, for instance, usually take the form of mathematical relations or causal factors, rather than houseflies and their offspring); making *predictions* based on hypotheses; and *testing* the hypotheses toward increasingly truthful *conclusions* and *predictions*. Important considerations along the way include *repetition*, meaning that circumstances granting tentative conclusions must be repeatable, as Redi demonstrated; *control*, including sampling multiple possibilities; and *falsifiability*, implying the subjecting of hypotheses to potential disproof.

Time and experience have shown that by this method and these factors, one can test suspected explanations of observed phenomena, thus reliably increasing understanding of reality as encountered in the physical world. Redi and others like him showed how even appearances of observed phenomena can be deceiving, and must be tested over and again to reveal the truth. Increasingly, explanation and understanding intersect. Throughout the course of the process one approaches at least a critical depiction, necessarily constantly under revision, of that which is true and real.

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Whether or not one can actually put forth a truly hypothetical theology, as Pannenberg proposes, subjecting it to some form of testing like that given to scientific knowledge, depends in large part on the limits afforded to pivotal matters. The same matters affect the viability of this study using Pannenberg's proposals, mirroring his methods for the purposes of testing them. Conspicuous concerns are what "science" and "religion" are said to be as forms of knowledge, how one defines "hypothesis," and what one means by "testing."

Increasingly common interactions between scientific and theological knowledge and methods in recent decades have provided a progressively acceptable arena for addressing such issues. These exchanges allow for gauging the interdisciplinary viability of both scientific and theological concepts. This study is a project in philosophical theology and Pannenberg scholarship, and it certainly can be profitably understood to fall into a tradition latterly known as interdisciplinary work in the field of "science and religion."

A PROJECT IN SCIENCE AND RELIGION

While the example of Redi is not directly to do with the interaction of the sciences with religion, the two fields of enquiry were often vigorously interacting in the background, as sciences like biology and physics developed. The life and writings of Redi's openly religious English contemporary John Ray (1627–1705) illustrate this from the same field.³ Often at the center of exchanges between early modern science and religion were questions of authority, an issue directly relevant to the scientific method. Put into question form, how is one able to determine the actual status of claims, even if appearances seem to suggest that a given claim is true?

One can begin with the notion of divine authority, which in the Middle Ages was mediated through Biblical reference by a Church at the height of its powers onto all areas of life and learning. This was considered the surest way of knowing. In early modern history such ecclesiastical authority began to conflict with developing scientific methods for acquiring knowledge. The Scientific Revolution, in which Redi, Ray, and others were players, gave birth to Enlightenment thinking characterized by a generalized questioning of that authority. The public itself is now broadly aware of this, at least with respect to high-profile cases. The scientific and religious interactions in renowned tales like Galileo's trial, during the same century as Redi's experiments, or of Darwin's embattled theories concerning evolution later in the nineteenth century, are common fare today. But the exact machinations of these conflicts are usually far more complicated than is suspected. They had as much to do with science versus science, politics, and even personality conflicts as with science versus religion. Even so, several high-profile confrontations left an impression that the rise of the sciences decisively cast

forever the seemingly less certain knowledge of religion into well-founded doubt, the latter having been based on ostensibly untestable concepts like revelation from God, and the unquestioned authority of a Church securing its power throughout society, rather than on the careful testing and retesting of hypotheses.

Nevertheless, in the centuries since Redi and others, the light of religion has never dimmed entirely, despite ongoing questioning and rapidly increasing scientific understanding across multiple investigative fields. One does easily find hesitation about the reliability of religious knowledge,⁴ most stridently today from atheistic scientific figures like the Oxford evolutionary biologist Richard Dawkins. Dawkins is probably the most famous figure of the early twenty-first century arguing that we must leave belief in God in its many forms behind—along with all other unscientific and unprofitable, if not dangerous, superstitions—or else risk entering a deluded new kind of Dark Age.⁵

Yet other evidences have pointed to Dawkins' view being of necessity a caricature, itself an ideological relic of days now gone. It is not news that one finds arguments and evidences likewise easily locatable that, whatever its cultural shelf life, Western society seems neither to have entered a decidedly post-Christian (although post-Christendom, surely) nor a post-scientific culture. Instead, we appear to have entered a phase of postmodernity in which the lines of demarcation between science and theology, among other boundaries, have become categorically blurred.⁶ Factors like the advent of quantum mechanics, the implications of which seem counterintuitive if not bizarre such that even Einstein found them difficult to countenance, have led to an awareness of ultimately strange characteristics of physical reality.⁷ There has grown an additional awareness that factors other than a mythically unfettered advancement of truth by a pure and objective exercise of scientific methodology have aided scientific progress. These have included various complex social, political, and otherwise peripheral factors not directly related to the acquisition of empirical scientific knowledge, but part of the human condition in which we function.⁸ Each sense of awareness, against the backdrop of reputable scientists noting some time ago that “not only is the universe stranger than we imagine, but stranger than we can imagine,”⁹ has further distorted perceptions of the boundaries between that which one might have once been able to say was the difference between, for example, physics and metaphysics. The most important scholarly outgrowth of these changes has been the gradual expansion of the body of literature known most often today as “science and religion” (or “theology and science”), into which this project may be understood to fall from the perspective of philosophical theology.

In the 1960s, pioneers of the emerging field like physicist Ian Barbour began producing books like *Issues in Science and Religion*.¹⁰ In the decades following, others joined in, most notably at first additional scientists like Arthur Peacocke¹¹ and John Polkinghorne,¹² each having both scientific and

theological interests. Scientists like Barbour, Peacocke, Polkinghorne, and increasingly a host of scientist-theologians like Alister McGrath,¹³ have all helped to illustrate how we have come full circle since the Enlightenment. We see once again well-trained, reasonable scientists demonstrating publicly how science and religion may be understood to complement one another, rather than inevitably to conflict.

The sheer variety of science and religion literature produced to date by scientists, theologians, historians, and philosophers has become too vast to account for here, and is increasing. The phenomenon has evidenced historian John Hedley Brooke's argument that there can be no single definitive account of how the multiple sciences and diverse theologies in existence may be said always to interact, even on a single matter.¹⁴ This is so whether of eternal conflict, neutral separation, friendly interaction, or some creative combination in between.¹⁵ There are now textbooks for students at university studying science and religion,¹⁶ and chairs have been established at the most prestigious of universities, with John Brooke having become the first incumbent of the Andreas Idreos Professorship in Science and Religion at Oxford in 1999.¹⁷

While most science and religion literature seems to have been written by scholars having some discernible religious commitment, or a metaphysical commitment approaching religion,¹⁸ even atheists have recognized the opportunity to market their views, rather than fighting the trend. Harvard scientist E. O. Wilson, about whom a national newspaper has written, "his atheism was complete before he went to university,"¹⁹ has weighed in with *Creation: A Meeting of Science and Religion*.²⁰ Most science and religion literature, including Wilson's offering, reflects the broadly Christian context in which the sciences themselves have grown, whatever an author's personal convictions. Rarely are Christian views asserted dogmatically, but the discussions virtually always surround a theism informed by a Judeo-Christian backdrop. This present project seeks to take that indistinct Christian God concept often appearing in science and religion literature, and look at possible implications for both science and theology when a full traditional Trinitarian concept is brought to bear in the way that Pannenberg has sought to do. This makes the study also understandable as a project in Pannenberg scholarship.

A PROJECT IN PANNENBERG SCHOLARSHIP

Theologians and philosophers with scientific interests and understanding like Pannenberg, representing expertise principally from the religious sector, have also contributed to science and religion literature. Prominent among these are figures like Thomas Torrance,²¹ Nancey Murphy,²² and Keith Ward.²³ Wolfhart Pannenberg has arguably been the most prominent name among nonscientist contributors, having worked on related issues since the

start of his career in the 1960s. Among the concerns driving his writings and methodology from his first book, *Revelation as History*,²⁴ have been issues immediately relevant to the viability of theology in a world indelibly marked by the sciences and scientific method.

Broadly, Pannenberg has argued that theology must not allow itself to be relegated to a religious ghetto in terms of its relationship to wider knowledge and other disciplines. One of his most important contributions to that ongoing project has been *Theology and the Philosophy of Science*.²⁵ Many of the ideas offered in *TPS* have continued to influence all of his writings, and science and religion more widely, ever since. There Pannenberg labored for the currency of “theological science” among all other human and natural scientific investigation. Related volumes, like the collection of essays entitled *Toward a Theology of Nature*,²⁶ have followed. Pannenberg’s most mature work overall has been the three-volume *Systematic Theology*.²⁷ In the second installment of *ST*, Pannenberg’s seasoned creation theology featuring intriguing unities and pluralities appears. That volume figures prominently below.

As with prodigious science and religion literature, commentary and assessment regarding Pannenberg’s works have abounded, such that just prior to 1990, one appraiser noted how aspects of his theology had been “the focal point of some 200 articles in scholarly journals, and his name is mentioned in nearly every book on theology published in recent years.”²⁸ The assessments have continued, especially since all three volumes of *ST* became available also for the English-speaking world by the early 1990s. The increase of science and religion literature itself, seeing Pannenberg’s thought as especially relevant, has added to the number. While that expanding literature is beyond accounting for entirely here, several trends and exceptions have appeared, into the gaps of which this book fits.

Firstly, this book continues as at least a “chapter” among the overall evaluations of Pannenberg’s theology that began to appear in the 1970s, since Pannenberg’s creation theology in *ST*, and most of his other works and methods are considered in what follows. These assessments include works by E. Frank Tupper (1973)²⁹ and Alan Galloway (also 1973).³⁰ Compilations of similar critiques of various aspects of Pannenberg’s thought followed soon afterward, like the collection of essays edited by Carl Braaten and Philip Clayton (1988).³¹ Timothy Bradshaw (1988)³² published in that same year a helpful comparative study on the major themes of Pannenberg’s Trinitarian concept of God, including similarities and differences between the theologies of Pannenberg and Karl Barth. This study likewise adds at least nuances to evaluation of Pannenberg’s Trinitarian doctrines of God, and especially creation. Stanley Grenz (1990)³³ added a preview look at the first volume of Pannenberg’s systematics just after Clayton’s and Bradshaw’s works appeared. Included below is a continuation of discussions concerning Pannenberg’s ideas on central issues like truth, which were taken up by Grenz.

Critical assessments of the importance of Pannenberg’s work for science and religion, more aptly in line with this study, have also appeared.

These include Pannenberg either as the single main theological focus, or as an important contributor to science and religion dialogue. Works by Nancey Murphy (1990),³⁴ Ted Peters (between 1989 and 2005),³⁵ and an edited compilation by Carol Albright and Joel Haugen (1997),³⁶ are several examples. F. LeRon Shults (1999)³⁷ presented a related fresh reading of Pannenberg's works with special respect to his methodology in the light of postfoundationalism, a movement concerned to mediate between modern and postmodern emphases. Special attention is given to Pannenberg's methodology in Chapter 5 below in light of science and religion, evaluating not only Pannenberg's method, but also Shults' assessment of it. Shults' book included one of the first overviews of the material contained across each volume of *ST*. Following Shults, Jacqui Stewart (2000)³⁸ added what some judged to be an especially stringent assessment of Pannenberg's thought in the light of the human sciences.³⁹

Christiaan Mostert (2002)⁴⁰ has written more directly of Pannenberg's Trinitarian theology of creation, which is the principal focus below. But still Mostert did so only cursorily, in the context of discussing Pannenberg's eschatology. Iain Taylor (2007),⁴¹ in a volume based on his doctoral work at King's College, London, gave one of the first book-length treatments to Pannenberg's mature Trinitarian doctrine as it appears throughout his *ST*. Taylor does include a chapter singly focused on the Trinitarian doctrine of God appearing in Pannenberg's creation thought of *ST*, II. *God and Natural Order*, if judged primarily with regard to its Pannenberg content, fits most originally as escalating focus on the creation material considered by Taylor. In that guise, this book is the first full-length treatment in English devoted entirely to assessing Pannenberg's mature Trinitarian creation thought—within the context of a science and religion-themed project.

THE CHARACTER AND SHAPE OF THE PROJECT

When Pannenberg writes of theological statements as hypotheses, he means to imply the potential fallibility of all assertions about reality, including both scientific and theological ones. He also seeks to strengthen theological assertions. The notion of hypothetical knowledge in the sciences is, after all, a way toward the strengthening of scientific assertions about reality over time through the testing of them; it is not about weakening them. Pannenberg writes, similarly inclined,

Therefore, if theological statements . . . adopt a critical attitude to claims of a self-communication of divine reality in religious awareness, they must be third-order hypotheses: hypotheses about hypotheses about hypotheses. In more precise terms, theology statements are hypotheses about the truth and/or untruth of constructions of religions awareness: that is, they are about the *relation* of the implications about meaning

contained in experience of reality in its most varied forms, which are also of relevance to religion. . . . In this role theological statements are concerned both with the inadequacy of traditional and new religious assertions of meaning and with ascertaining the degree of their illuminative power. They must also decide what changes may be required in traditional assertions of meaning for the most successful integration of the present experience of meaning and try to define their relation to other religious traditions. Models in theological theory, in which positive statements are made about God and divine actions, must take account of all these aspects.⁴²

When set in the context of Pannenberg's entire discussion of hypotheses in *TPS*, implied are the ideas that theology investigates the same one reality investigated by the sciences, and that theological knowledge must be revisable in the light of new understandings of truth from any field, as well as with respect to their illuminative power for reality overall.

This book, in an attempt to be Pannenbergian in testing Pannenberg's thought, adopts each notion. The stance taken is to assume, hypothetically, that Pannenberg's Trinitarian creation is about the same world investigated by unifying physicists and pluralizing philosophers. Also assumed with Pannenberg is that information shared either way, from science to religion or vice versa, might be mutually illuminating. It should possibly also be revised accordingly, insofar as either set of assertions might be provable as true. Of course, theological knowledge is such that, being ultimately "unprovable" in the limited sense that scientific knowledge is "provable," it is unlikely ever to alter scientific knowledge. Nevertheless, one of the interesting aspects of the following chapters is how Pannenberg's Trinitarian thought can appear to offer possible philosophical answers for features of a quandary seemingly unresolvable otherwise. Contrarily, weaknesses illuminative of the present status of both Pannenberg's work and of science and religion studies come to light also, partly to do with this matter of the unprovability of religious assertions. Still, the power of coherence to be found in religious hypotheses like those offered by Pannenberg's scientifically informed creation thought can only ever possibly be seen with such dialogue as may be found herein, however hypothetically understood. Even Pannenberg presumes that his theological hypotheses are not entirely testable until the end of all history, at a time understandable in secular terms as the ultimate whole of all human experience for which humanity waits. In Christian thought, at this *eschaton* (from the Greek *eschatos*, "the last") all that is hidden will be revealed by God.

Pannenberg does devote space to the relative untestability of religious assertions in *TPS*.⁴³ He decides upon arguing several points by which such an assertion might be judged *not substantiated*, since it can never really be judged as *substantiated* at present. These include primarily obvious potential mistakes, like not taking account of existing interpretations, not connecting

with reality as a whole as now understood, not integrating with the appropriate area investigated (e.g., if one were not to relate Pannenberg's talk of laws of nature with present talk in physics or philosophy of science on laws), or not meeting the interpretative force of other existing hypotheses.⁴⁴ This book carefully seeks to avoid such mistakes, at least evading *unsubstantiation* in hypothesizing Pannenberg's work as hypothetically synthetic.

In the six chapters that follow much of the material undertaken is complex, yet the method is simple. Chapters 1 and 2 comprise the initial debate between a unifying physics driven initially by Christian monotheism and a diversifying philosophy of science driven partly also by distinctly Christian ideas, but interpreted differently. This results in a dialectical problem of thesis, "God as Unifier" (Chapter 1), and antithesis, "God as Pluralist" (Chapter 2). Chapter 3 then proposes, hypothetically, how certain material and methodological factors in Pannenberg's mature Trinitarian creation theology appear to offer syntheses for some issues debated between the physicists and philosophers. Thus, one has an intriguing apparent synthesis for aspects of Chapters 1 and 2.

The critical stance assumed from that point onward is that which all hypothetical investigations must take, which even Francesco Redi assumed regarding *abiogenesis* centuries ago. The methodology bears in mind the terms of an ancient Greek idea of truth, denoted by the word *aletheia* ("truth"). *Aletheia* conveys the nuance that there is likely an *actual* truth behind the *appearance* of things. A proper assessment of what really *is* must make an effort to get at that potentially hidden truth, somewhat like the blowing away by the wind of layers of cloud covering a beautiful mountain peak, or peeling away the outer layers of a fruit in common culinary experience.

So the apparent synthesis is then respectfully dissected, peeling away any such layers covering the truth. In Chapter 4 that focus is on material limits, occurring when critically comparing the terms and ideas appearing in the written materials of the physicists, philosophers, and Pannenberg. In Chapter 5 yet another layer is peeled away, inquiring, again respectfully, concerning the limits of Pannenberg's overall methodology, examining why his work might ever suggest theological commentary on a problem in secular physics or philosophy. The method is straightforward in that Pannenberg's material presentations and methodological factors are the aspects of his thought fostering the apparent synthesis.

Chapter 6 offers conclusions about the limits of Pannenberg's material and methodology, and concerning the interdisciplinary status of "science and religion" dialogue generally. The main contention throughout the book is that Pannenberg's unique Trinitarian creation could be seen to offer syntheses for certain metaphysical, philosophical, and theological aspects of the dialectic between unifying physicists with their Unifier God and diversifying philosophers with their Metaphysical Pluralist God—yet it is hardly to be considered even *ceteris paribus*. Acceptance of the synthesis would require a

secular approval of conditionals; namely of several creative, intriguing, but in the end controversial aspects of Pannenberg's Trinitarian creation. Even so, that Pannenberg's creation thought can be shown to fit the secular scientific problem to the degree that it can is noteworthy for theology broadly, and science and religion dialogue particularly. The entire process begins by demonstrating just how thoroughly replete with theological ideas the histories of physics and philosophy are at times, making space for revisitations by the likes of Pannenberg. We turn first to the historical basis in monotheism that gave rise, in part, not only to the very idea of laws of nature, but also to a drive toward unifying them.

NOTES

1. Ted Peters, "Pannenberg on Theology and Natural Science," in Wolhart Pannenberg, *Toward a Theology of Nature: Essays on Science and Faith*, ed. Ted Peters (Louisville, KY: Westminster John Knox Press, 1993), 7. Hereafter appearing as *TTN*.
2. This narrative is widely circulated in discussions on the development of scientific method. Redi's works include scientific documents concerning vipers (*Osservazioni intorno alle vipere*, or "Observations about vipers"), insects (*Esperienze intorno alla generazione degl' insetti*, or "Experiments about insect reproduction") and medicine, including cases, clinical reports, and statistics (*Consulti medici*, or "Medical discussions").
3. John Ray, *The Wisdom of God Manifested in the Works of Creation* (1691). Ray noted, "by the Works of the Creation in the Title, I mean the Works created by God at first, and by Him conserv'd to this Day in the same State and Condition in which they were at first made."
4. E.g., John Horgan, "Clash in Cambridge: Science and Religion Seem as Antagonistic as Ever," *Scientific American* 293.3 (September 2005): 24–28.
5. Richard Dawkins, *The God Delusion* (London: Transworld, 2006). The early twenty-first century has witnessed increasing terrorism claiming religious motivations. Dawkins has used this fact to further underscore a decades-long campaign for atheism. Daniel C. Dennett, *Breaking the Spell: Religion as a Natural Phenomenon* (London: Allen Lane, 2006), offers a less caustic thesis.
6. Nancey Murphy, *Anglo-American Postmodernity: Philosophical Perspectives on Science, Religion, and Ethics* (Oxford: Westview Press, 1997), 1–3, 8–9, 26, 30, 46, and 209–210.
7. Quantum mechanics, the branch of physics dealing with the study of the smallest known aspects of physical reality, has revealed famously strange characteristics like the blurring of the classical distinction between waves and particles, the superposition of a single entity in more than one place at once, and the effects of human observation upon measurement. All are contrary to experience on an everyday human scale. See James Cushing and Ernan McMullin, eds., *Philosophical Consequences of Quantum Theory* (Notre Dame, IN: University of Notre Dame Press, 1989).
8. Thomas Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970).
9. Versions of this quote have been variously attributed to Christian astrophysicist Sir Arthur Eddington (1882–1944) and to atheist biologist J.B.S. Haldane (1892–1964).

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10. Ian Barbour, *Issues in Science and Religion* (London: SCM Press, 1966), and other titles including *Myths Models and Paradigms: A Comparative Study in Science and Religion* (San Francisco: Harper and Row, 1974), *Religion and Science: Historical and Contemporary Issues* (London: SCM Press, 1998), and *When Science Meets Religion: Enemies, Strangers, or Partners?* (San Francisco: HarperCollins, 2000).
11. Arthur Peacocke's offerings include *Creation and the World of Science* (Oxford: Oxford University Press, 1979), *Theology for a Scientific Age* (London: SCM Press, 1993), and *Paths from Science toward God* (Oxford: Oneworld, 2001).
12. John Polkinghorne's volumes include *Science and Creation* (London: SPCK, 1988), *Science and Christian Belief* (London: SPCK, 1994), *Scientists as Theologians* (London: SPCK, 1996), and *Science and the Trinity* (New Haven, CT: Yale University Press, 2004).
13. Alister McGrath's books include *The Foundations of Dialogue in Science and Religion* (Oxford: Blackwell, 1998), *Science and Religion: An Introduction* (Oxford: Blackwell, 1999), *A Scientific Theology: Nature, Reality, Theory*, 3 vols. (Edinburgh: T&T Clark, 2001–2003), and *Surprised by Meaning: Science, Faith, and How We Make Sense of Things* (Louisville, KY: Westminster John Knox Press, 2011).
14. John Hedley Brooke's works include *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991), with Geoffrey Cantor, *Reconstructing Nature: The Engagement of Science and Religion* (Edinburgh: T&T Clark, 1998), and ed. with Ronald L. Numbers, *Science and Religion around the World* (Oxford: Oxford University Press, 2011).
15. Mikael Stenmark, *How to Relate Science and Religion: A Multidimensional Model* (Cambridge: Eerdmans, 2004), is a recent attempt to show how science and religion might be understood to relate.
16. W. Mark Richardson and Wesley J. Wildman, eds., *Religion and Science: History, Method, Dialogue* (London: Routledge, 1996), and Christopher Southgate, ed., *God, Humanity, and the Cosmos: A Textbook in Science and Religion*, 3rd ed. (Edinburgh: T&T Clark, 2011).
17. John Hedley Brooke served as Oxford's first Andreas Idreos Professor of Science and Religion from 1999–2006.
18. E.g., Paul Davies, physicist and author of *God and the New Physics* (Harmondsworth: Penguin, 1990) and *The Mind of God* (Harmondsworth: Penguin, 1993).
19. Ed Douglas, "Darwin's Natural Heir: The Guardian Profile; Edward O. Wilson," *Guardian*, 17 February 2001.
20. E. O. Wilson, *Creation: A Meeting of Science and Religion* (New York: W.W. Norton, 2006). Wilson's book takes the form of a genial extended letter written to a Southern Baptist minister, in which he entreats cooperation for the sake of ecological health.
21. Thomas Torrance's books include *Theological Science* (Oxford: Oxford University Press, 1969), *Space, Time, and Resurrection* (Edinburgh: Hansel, 1976), and *Reality and Scientific Theology* (Edinburgh: Scottish Academic Press, 1985).
22. Nancey Murphy's offerings include *Theology in the Age of Scientific Reasoning* (Ithaca, NY: Cornell University Press, 1990), and with George F. R. Ellis, *On the Moral Nature of the Universe: Theology, Cosmology, and Ethics* (Minneapolis, MN: Fortress Press, 1996).
23. Keith Ward's works include *Divine Action* (London: Collins, 1990), *Religion and Creation* (Oxford: Oxford University Press, 1996), *God, Chance, and Necessity* (Oxford: Oneworld, 1996), *Pascal's Fire* (Oxford: Oneworld, 2006), and *More Than Matter? What Humans Really Are* (Oxford: Lion Hudson, 2010).

24. Wolfhart Pannenberg, ed., *Revelation as History*, trans. David Granskou (New York: Macmillan, 1968; London: Sheed and Ward, 1969). Hereafter appearing as *RAH*. Originally published in German as *Offenbarung als Geschichte* (Göttingen: Vandenhoeck und Ruprecht, 1961).
25. Wolfhart Pannenberg, *Theology and the Philosophy of Science*, trans. Francis McDonagh (Darton, Longman & Todd, 1976). Hereafter appearing as *TPS*. Originally published in German as *Wissenschaftstheorie und Theologie* (Frankfurt am Main: Suhrkamp Verlag, 1973).
26. Pannenberg, *TTN*. See note 1.
27. Wolfhart Pannenberg, *Systematic Theology*, 3 vols., trans. Geoffrey Bromiley (Edinburgh: T&T Clark, 1994 [1991]). Hereafter appearing as *ST*, with volume number. Originally published in German as *Systematische Theologie*, I–III (Göttingen: Vandenhoeck und Ruprecht, 1988–1993).
28. Stanley J. Grenz, “The Appraisal of Pannenberg: A Survey of the Literature,” in *The Theology of Wolfhart Pannenberg: Twelve American Critiques, with an Autobiographical Essay and Response*, ed. Carl E. Braaten and Philip Clayton (Minneapolis, MN: Augsburg, 1988), 19–52.
29. E. Frank Tupper, *The Theology of Wolfhart Pannenberg* (Philadelphia, PA: Westminster Press, 1973).
30. Allan D. Galloway, *Wolfhart Pannenberg*, ed. H. D. Lewis (London: Allen & Unwin, 1973).
31. Carl E. Braaten and Philip Clayton, eds., *The Theology of Wolfhart Pannenberg: Twelve American Critiques, with an Autobiographical Essay and Response* (Minneapolis, MN: Augsburg, 1988).
32. Timothy Bradshaw, *Trinity and Ontology: A Comparative Study of the Theologies of Karl Barth and Wolfhart Pannenberg*, Rutherford Studies in Contemporary Theology (Edinburgh: Rutherford House, 1988).
33. Stanley Grenz, *Reason for Hope: The Systematic Theology of Wolfhart Pannenberg* (Oxford: Oxford University Press, 1990).
34. Murphy, *Theology in the Age of Scientific Reasoning*.
35. Ted Peters, ed., *Cosmos as Creation: Theology and Science in Consonance* (Nashville, TN: Abingdon Press, 1989); *God as Trinity* (Philadelphia, PA: Westminster Press, 1993); *Science and Theology: The New Consonance*, ed. Ted Peters (Boulder, CO: Westview Press, 1998); and articles including “Theology and Science: Where Are We?,” in *Zygon: Journal of Religion and Science* 31.2 (June 1996): 323–343, and “Natural Theology versus Theology of Nature,” in *Theology and Science* 3.1 (March 2005): 1–2.
36. Carol Albright and Joel Haugen, eds., *Beginning with the End: God, Science, and Wolfhart Pannenberg* (Peru, IL: Open Court Publishing Company, 1997).
37. F. LeRon Shults, *The Postfoundationalist Task of Theology: Wolfhart Pannenberg and the New Theological Rationality* (Grand Rapids, MI: Eerdmans, 1999).
38. Jacqui A. Stewart, *Reconstructing Science and Theology in Postmodernity: Pannenberg, Ethics, and the Human Sciences* (Aldershot, UK: Ashgate, 2000).
39. F. LeRon Shults, “Theology, Science, and Relationality: Interdisciplinary Reciprocity in the Work of Wolfhart Pannenberg,” in *Zygon* 36.4 (December 2001): 809–825.
40. Christiaan Mostert, *God and the Future: Wolfhart Pannenberg’s Eschatological Doctrine of God* (London: T&T Clark, 2002).
41. Iain Taylor, *Pannenberg on the Triune God* (Edinburgh: T&T Clark, 2007).
42. *TPS*, 333–334.
43. *TPS*, 334–345.
44. *TPS*, 344–345.

1 God as Unifier

Scientific Unification and Its Theological Alliances

It is not difficult to establish, from either religious or scientific vantage points, that human beings have an intrinsic need for the intelligibility both of their own lives and of the world around them. Such intelligibility, when found, tends to display inextricable connections with various concepts of unity. The impulse to unify is a means to achieving this desired intelligibility, finding easy ground in drives to reduce and comprehend, which are further common human impulses. These have all given physics seeds for its rise and current power in Western civilization. One could go further, declaring that all human religious and scientific endeavors emanate from these elemental intellectual and emotional drives.¹ Theologies and the sciences work in the human mind to unify and make intelligible our existence.

Among the sciences, physics is particularly like religion in seeking an ultimate explanation for all that we see and experience. This reductionist attitude in physics comes from a conviction that all of nature's principles or laws are as they are because of deeper, underlying principles or laws.² The view arises from the observation that as these principles or laws continue to be uncovered, they begin to merge, uniformly pointing toward yet deeper, shared aspects of the forces and structures of nature.

This trend continues until quantum mechanics, special relativity, and Newtonian mechanics merge to form the two pillars of modern physics—quantum field theory and general relativity.³ Locating the guiding principle combining these final two would be a step toward a quantum theory of gravitational interactions—yet to be definitively uncovered—like string theory.⁴ The very deepest of these explanatory principles or laws is envisioned to be metaphorically like the monotheistic God found in Judaism, Christianity, or Islam—no less than an explanation of everything. As this “final” explanation hints toward philosophical implications, it has in recent decades come to be known as a “theory of everything.”⁵ The attainment of this singular theory or equation enabling a comprehensive understanding of the origin, workings, and destiny of our universe has been noted as the greatest unsolved problem in physics today.⁶

Einstein spent his final thirty years on the project, and a growing number of physicists have dedicated their energies and lives to the puzzle. The search began, however, long before Einstein, or anyone now continuing the investigations.

THE ONE AND THE MANY: EARLY PHILOSOPHICAL FOUNDATIONS FOR NATURAL UNITY

The search for a simple, elegant, and unified theory of nature has appeared in many guises for two millennia, far predating modern physics. A belief in the unity of nature finds clear expression in philosophy before Plato (ca. 429–347 bce) and the natural philosophies of Aristotle (384–322 bce) and Democritus (ca. 460–ca. 370 bce).⁷ Attempts at considering natural unity formally are recognizable in academic discussions beginning with the first Greek thinkers inspired by notions of monism. They supposed that while sensory experiences may suggest a nature seemingly boundless in variety, some underlying unity must exist if the world is to be comprehended. Hidden beneath appearances must lie some fundamental principle or substance uniting everything, from which all else emerges.⁸

In harmony with this assumption, Greek philosophers sought to explain and unify the variety of phenomena evident in nature on the basis of simple and even single principles. This search, by those who may be viewed as the first unifiers of the eventual science of physics, highlighted one of the most enduring philosophical issues in human history: the question of “the One or the Many.” Pre-Socratic thinkers Heraclitus of Ephesus (ca. 550–480 bce) and Parmenides of Elea (ca. 544–460 bce) typified by their quarrels the eventual disparate approaches of many thinkers and issues at stake. In early Greek philosophy alone, systems were proposed offering plentiful choices. The One might be constituted by a pluralism with mobility (Heraclitus),⁹ pluralism with divisibility (Leucippus, Democritus),¹⁰ unity with no diversity (Parmenides and the Eleatics),¹¹ and diversity with no unity (Cratylus, a disciple of Heraclitus, who argued that reality is so diverse as to be beyond intelligible comprehension).¹²

The Pythagoreans, by the fifth century bce, reasoned that numbers were a key to any proposed unity. Followers of Pythagoras of Samos, the group developed early basic arithmetic and geometry, analyzed music mathematically, and viewed the universe and its constituent parts as being numerically composed.¹³ Beginning with the idea of the One, they sketched a comprehensive account of the world. “And indeed all the things that are known have number; for it is not possible for anything to be thought of or known without this,” Philolaus argued.¹⁴ Each number was seen as nothing more than unity multiplied.¹⁵ The Pythagorean emphasis on mathematics revealed itself in the works of Plato and others. Formal scientific confirmations ensued from early physicist-astronomers like Kepler and Galileo.

GOD AS THE ONE UNIFYING THE MANY: THEOLOGICAL FOUNDATIONS

Given the basis of physics’ current search in elementary human impulses and early formal philosophy, it is of no surprise that at various points in history intimate relations have existed between monotheistic religious concepts,

mostly Christian, and scientific searches for unity. And it is no great leap to compare the relevance of the latest theoretical physics on questions concerning the nature of ultimate reality with metaphysical or theological concepts about the same reality.¹⁶ To deny the metaphysical and theological underpinnings of much in Western scientific development, not least of physics since the seventeenth century, would be to engage in acute historical error. Much disputed, nevertheless, is the proper interpretation of these connections, however factual.¹⁷ Yet with the gradual secularization of the sciences, including physics, it is remarkable that the character of a scientific search for a theory of everything has remained delicately contiguous with questions concerning God and the nature of creation.¹⁸ In physics these considerations have usually centered on long-standing connections between concepts of a unified nature and traditional Christian or Jewish monotheism.

UNIFICATION AND THE HISTORY OF DIVINE LAWS OF NATURE

Acknowledging the metaphysical and theological bases that have given rise to concepts vital for physics' current search for unity still offers limited insights into the science of physics overall. For instance, the concept of law, like the concept of unity so dependent on it, has definite roots partly in religious thought, specifically in natural theology when "laws of nature" were imagined as human versions of God-given edicts. Rom Harré in *Laws of Nature* notes this religious-scientific belief among the likes of Kepler, Galileo, Descartes, Boyle, and Newton, emphasizing their confidence that through these laws God's governance of nature was enacted.¹⁹ Jane E. Ruby, in "The Origins of Scientific 'Law,'" argues against such *prima facie* claims, conceding the theological origins of law, but contending that the idea in modern use had several starting points, only one of which was to do with divine legislation. The modern idea of law, she argues, emerged "through different processes at different times in several distinct fields."²⁰

While today "law of nature" is a thoroughly secular concept, two hundred and fifty years or so ago, Berkeley defined laws in his *Treatise Concerning the Principles of Human Knowledge* as follows:

Now the set of rules or established methods, wherein the Mind we depend on [in this case meaning the spiritual being who causes our ideas] excites in us the ideas of sense, are called the *laws of nature*; and these we learn by experience, which teaches us that such and such ideas are attended with such and such other ideas, in the ordinary course of things . . . this consistent uniform working . . . so evidently displays the goodness and wisdom of the Governing Spirit whose Will constitutes the laws of nature. . . .²¹

Two features of laws of nature as conceived by these early natural religionists have survived the centuries, though they are admittedly now also

devoid of religious meaning: universality and necessity. The very term “law of nature” elicits notions of universality intimating unity, as in laws being universally true of nature.

THEOLOGIZING WITH SCIENTISTS: ON THE GOD OF A UNIFIED NATURE

What kind of God might a “Unifier of Nature” be, and what further implications concerning that God might be derived from the view? One can explore this by examining the concept in the works of several thinkers foundational to physics’ search for a unified natural order. From the sixteenth century onward, pivotal figures like Johannes Kepler (1571–1630), Galileo Galilei (1564–1642), René Descartes (1596–1650), Isaac Newton (1642–1727), Michael Faraday (1791–1867), James Clerk Maxwell (1831–1879), Albert Einstein (1879–1955), and recent others like Stephen Hawking (1942–) and Steven Weinberg (1933–) have all contemplated a unified natural order, or worked explicitly on theories of everything.²²

While some physicists today focus exclusively on a unified theory, it has been argued that all past great advances in physics have been steps toward this goal.²³ Isaac Newton’s seventeenth-century unification of celestial and terrestrial mechanics, James Clerk Maxwell’s nineteenth-century unification of optics with the theories of electricity and magnetism, and Einstein’s merging of space-time geometry and gravitation from 1905 to 1916 are prime examples. The unification of chemistry and atomic physics via quantum mechanics in the 1920s opened a flurry of continued work toward a desired ultimate unification.²⁴ Physics gained further momentum for this project through the work of many, like Weinberg, Hawking, Straus, Kaluza, Klein, Weyl, Eddington, Schrödinger, de Broglie, Dirac, and Born.

The interweaving of monotheistic theological concepts with the unification of physics has been so pervasive that to write a truly inclusive history of the relationship could take several volumes. What one can do is give sufficient evidence for, and some clarification of, these connections, while neither attempting nor purporting to offer a complete history.

Physics is like many scientific disciplines in having found early mutual support with metaphysics, and most often with Christian theology.²⁵ This co-ratification has extended occasionally to include monotheistic concepts from other traditions or religions, and theological offshoots and ideologies derived from major monotheistic faiths. The Deism of England and France of the late seventeenth and early eighteenth centuries was derived from mainstream European Christianity. It was borne of an attempt to cast aside supposedly suspect “revealed” beliefs like the Incarnation or Trinity in favor of what might be more certainly known using reason alone.²⁶ Similarly, in later history, the pantheistic leanings of Albert Einstein were based by his admission partly on Dutch Jewish rationalist Benedictus de Spinoza

(1632–1677), whose theological thought was judged by many Jewish contemporaries to have been intolerably unorthodox. Nevertheless, both deism and pantheism strongly influenced some physicists. Physics is now sometimes also linked with Islamic monotheism, and has been related to Buddhist and Indian religious perspectives in recent years.²⁷

Physicists have noted that metaphysical ideas undergirded Newton's gravitation, and later supported theories of thermodynamics, quantum mechanics, and particle physics.²⁸ Still, no such connections have been more intimate in Western history than the relations drawn between monotheistic notions of the Judeo-Christian "One true and living God" and the unity and order of nature.²⁹ One is clearly led to believe in some accounts of Kepler, Newton, and Einstein that they were even driven by religious convictions when searching for natural order.

JOHANNES KEPLER (1571–1630): A HARMONIOUS WORLD AS EVIDENCE OF GOD'S (TRINITARIAN) PERFECTION

In past centuries, monotheistic beliefs provided an accepted uniformity for nearly all scientific thinking and endeavors. A presupposed religious faith lent support to conceived relations between cause and effect, the latter usually considered indispensable for any rational science.³⁰ Seventeenth-century natural philosophers like the astronomer Johannes Kepler often presented their work as a search for order and unity in a world designed and governed by an intelligent Creator. The title of Kepler's first major publication, *Mysterium Cosmographicum* (1596), had intentional Christian connotations evident to its original readers. As Peter Barker and Bernard R. Goldstein have written, "The Sacred Mystery of the Cosmos" would be an apt translation.³¹ Adhering broadly to voluntarism, Kepler saw God as having been free to design nature and its laws according to God's good will and pleasure, in opposition to the idea of a nature that might have always existed. This schema implied a dependable order behind nature's observable flux. In Kepler's understanding, God had equipped human minds with mathematical capabilities for uncovering otherwise hidden natural patterns.³²

Kepler's seminal work supplied a necessary basis for successors like Galileo and Newton, although the latter are often referred to as the founders of modern science. With Kepler, a couple of important innovations came to bear on astronomy and physics. He epitomizes a transition between a mystical conception of nature's harmony and genuine scientific exploration, even though Galileo was later to deride him for just such mystical tendencies.³³ Kepler flirted with animism, and his mathematics was laden with number mysticism. Yet by 1605, his program was clearly mechanistic:

I am much occupied with the investigation of the physical causes. My aim in this is to show that the Celestial machine is to be likened not

to a divine organism but rather to clockwork. . . . Moreover I show how this physical conception is to be presented through calculation and geometry.³⁴

In this way, Kepler was a pioneer in clarifying that the quest for physical causes was to be part of the astronomer's task.

He dedicated his energies to uncovering nature's hidden harmony, which he saw as a reflection of God's perfection. This perfection was manifest in various forms, including the complement of spheres and the elliptical orbits of planets. Using an ancient Platonic notion of five perfect solids, which he thought embodied symmetry, Kepler gave an account of the relative sizes and spacing of the orbits of the planets in our solar system. These solids for Kepler indicated both the shape of the universe and the images of the divine. By exposing the geometry of creation, one was uncovering otherwise obscured patterns, and thinking God's thoughts after him, he reasoned. Kepler sought to fuse directly Pythagorean mathematical harmony with a Christian doctrine of creation.³⁵ In response to the query, "What do you judge to be the lay-out of the principal parts of the world?," Kepler wrote of the sphere as having a Trinitarian nature:

For in the sphere, which is the image of God the Creator and the Archetype of the world . . . there are three regions, symbols of the three persons of the Holy Trinity—the center, a symbol of the Father; the surface, of the Son; and the intermediate space, of the Holy Ghost.

So, too, just as many principal parts of the world have been made—the different parts in the different regions of the sphere: the sun in the center, the sphere of the fixed stars on the surface, and lastly the planetary system in the region intermediate between the sun and the fixed stars.³⁶

Spherical shapes were not rare in reflecting the divine image. Wherever Kepler gazed, and as Richard Westfall has written, "he looked everywhere,"³⁷ he believed he saw triadic configurations. These triads, the organizing shapes of a divinely ordered and unified cosmos, were, like God, at once both triads and unities.

In such ways, some have deemed Kepler to have been limited by his theological beliefs, which he refused to alter even when confronted with contradictory evidence.³⁸ He was daunted, for example, to discover planetary orbits to be elliptical, not spherical, but steadfastly refused to relinquish his belief in the holiness of spherical shapes. It was through music that he found and embraced another unique though likewise ancient way to express their symmetry.

Like the Pythagoreans, Plato, Aristotle, and others, Kepler embraced the idea that nature operates in tune with musical chords. Cicero, in *Scipio's Dream* (55 bce), had explained that we only fail to hear this wonderful

harmony because our ears are deafened by the din of the universe, much like people living near the roaring waters of the Nile or ocean eventually become oblivious to the noise of continuous waves.

Kepler reckoned by calculation that the musical pitch of a celestial body would rise proportionately to the speed of its movement; the faster the movement of the body, the higher the pitch. Thus, planets could emit certain notes according to their elliptical orbits. This presented a complex picture of varied harmonies associated with various orbital ellipses. Rather than becoming concerned, Kepler saw the complexity as leading to a richer harmonic beauty surpassing the simpler beauty of a merely geometrical explanation. The intricately beautiful harmony reigned throughout the heavens, he argued, and was the direct result of divine will.³⁹

He synthesized this musical theory with geometry, astronomy, and numerology to produce in 1619 *The Harmonies of the World*, in which he sought through combining these varied disciplines to unlock all of nature's secrets. Sections bear titles like "In What Things Pertaining to the Planetary Movements Have the Harmonic Ratios Been Expressed by the Creator, and in What Way?" and "In the Celestial Concords Which Planet Sings Soprano, Which Alto, Which Tenor, and Which Bass?" For Kepler, all that we see converged by a divine hand to "sing" with exquisite perfection, more than any human choir ever could.

Kepler, aided by mathematical and astronomical data left by Tycho de Brahe, whose post of imperial *mathematicus* he filled on 6 November 1601, published his *Astronomia Nova* detailing three planetary laws. The first stated that the planetary orbits about the sun are elliptical, not circular as Copernicus had imagined. Further, the sun was revealed to be among the focal points of the orbits; this revelation made less trouble for the observational difficulties of Copernicus' models. The second law demonstrated that planets do not orbit at uniform speed, but at a changing speed such that an imaginary line drawn between them and the sun sweeps out equal areas in equal intervals of time. His third was a statement made in a publication of *De Harmonice Mundi*, that the squares of the times requisite to make a complete solar orbit of the planets are proportional to the third power of their respective average distances from the sun.⁴⁰ Kepler was convinced that a force in the sun controlled planetary motion via an attractive force like magnetism. A counterbalancing force existed in the planets, resisting heliocentric attraction and forcing the planets into elliptical orbits. Kepler came close to positing a viable theory of gravity, which was not fully accomplished until Newton a century later.⁴¹

To twenty-first-century minds some of Kepler's ideas for unity, like musical harmony as a unifying principle, sound ludicrous. Yet Galileo, Descartes, and especially Newton were all dependent on Kepler's works for their subsequent constructs and discoveries. It is little known but true that the latest theories of planetary position and arrangement consider seriously something very much like Kepler's resonance, though not of a musical variety. It is

fascinating that Kepler intuited his theories and laws at all, since the mathematical tools now used to describe modern symmetry theory did not then exist.

Despite what could justifiably be called a degree of theologically induced blindness, Kepler's planetary laws and inferences for universal harmony have been crucial for the development of modern physics and its search for unity. Kepler's belief in God and God's orderliness guided his intuition, and this led him to eventual and essential contributions. In Kepler's mind, when exposing the geometrical designs of nature and "thinking God's thoughts after Him," one was thinking thoughts of unity.

RENÉ DESCARTES (1596–1650): GOD'S MATHEMATICS AS THE UNIFYING LANGUAGE OF CREATION

René Descartes most clearly articulated the need for a unified physics, building on the work of Galileo Galilei (1564–1642) in emphasizing mathematics, and Galileo's virtual invention of physics and dynamics.⁴² Not long after Descartes' fifteenth birthday in January 1611, Galileo's *Starry Messenger* was published in Italy. The little book left a profound mark on Descartes that lasted his lifetime.

Like Galileo in his reluctance to mix religion with scientific efforts openly, Descartes still offered more to survey on theology and the unity of physics than did Galileo. Galileo would have a section in any history of physics, but the paucity of his commentary on theology and natural unity precludes attention here. His influence on Descartes, however, does not go unnoticed, and connects with Descartes' thought on the interaction of what we would today see as separate realms.

Despite vilification by some religious thinkers, and late philosophers decrying the ills of modernity, Descartes' own religious commitments informed his philosophy and science. This is true despite his attempt to keep his faith and science separate, in contrast to Kepler, who virtually fused them.⁴³ Although attempting to doubt systematically all that he knew, he refused to subject his religious devotion to the same methodical processes, instead holding faith to be among the ideas indispensable for the very operation of the "method."

Descartes insisted on obedience to the Church, deferring on direct faith questions. While his true motivations for such deference may be open to question, *Meditations on First Philosophy* was proposed as a philosophical demonstration that God exists, and that the soul is immaterial and immortal in nature. He dedicated the work to "the most wise and illustrious the dean and doctors of the sacred faculty of theology in Paris" (the Sorbonne).⁴⁴

Descartes believed that in his work he was discovering the "laws that God has put into nature." Dreaming of "blending the various mathematical sciences into a common science of proportions," he had faith in the possibility of a unification of all sciences by virtue of their underlying mathematics. To

some even in his day, the sciences and the nature they investigated seemed so apparently disparate as to discourage attempts at unity. Undisturbed, Descartes believed the sciences to be one, even as thought itself was one: "For the sciences as a whole are nothing other than human wisdom, which always remains one and the same, however different the subjects to which it is applied. . . ." ⁴⁵

Natural unity was mathematical for Descartes, emanating from two sources: the design imposed on nature by the Creator, and the work of the human mind. When arguing that science is one because of the oneness of thought, he was making a statement of mind over matter or object, stemming from the subject itself. As historians of science would later note, it is no accident that the original title of *Discourse on the Method* was *Project of a Universal Science Destined to Raise Our Nature to Its Highest Degree of Perfection*.⁴⁶

This process would be aided in Descartes' methodology by his preference for seeing science as ideally the work of an individual, rather than a community. In an early consideration while locked in the stove-heated room in which he gave birth to the *Discourse*, he made mental connections between unity, perfection, and individual creativity: "There is very often less perfection in works composed of several portions, and carried out by the hands of various masters, than in those on which one individual alone has worked."⁴⁷ Extending this to God and religion, he continued, "Thus it is quite certain that the constitution of the true Religion whose ordinances are of God alone is incomparably better ordered than any other."⁴⁸

There are several senses in which Descartes' idea might be understood, leading to the one most helpful here. The first is clearly true of his method: that one is actually to empty oneself of all outside thoughts by systematic doubt, until reaching conclusions that cannot be doubted, beginning with "I think" or "I doubt." Another sense is by implication, as evidenced throughout Descartes' various writings. Like other philosophers, Descartes longed for the solitude indispensable for carrying out his thought and work. He began the *Discourse* by remaining "the whole day shut up alone in a stove-heated room, where I had complete leisure to occupy myself with my own thoughts."⁴⁹ And he ended similarly, noting that he would always hold himself to be indebted most to those "by whose favor I may enjoy my leisure without hindrance, than I shall be to any who may offer me the most honorable position in all the world."⁵⁰

A third sense, really a consequence of the second in most cases, is that works are produced that offer ostensibly objective information recognizable by most others. God, for Descartes, had endowed all reflective human beings with "clear and distinct" ideas enabling such "easily recognizable" reflections.⁵¹ God was worshipped and known through reason, not just faith, and by this was all the more worthy of our reverence as we come in time to understand God's nature, and role in natural order.⁵² It was this God whose mathematical principles guaranteed the correctness of a

natural philosophy based on numbers. God had four distinct functions in Descartes' thought, without which his system would, by his own admission, crumble. God could not fail to exist, was the necessary being that created and sustains contingent beings, was the cause of motion and its conservation, and established a link between matter and the human mind. Any clear and distinct ideas were trustworthy because God was the guarantor of their application.⁵³

Isaac Newton, despite his many criticisms of Descartes' cosmology, may be the individual coming closest to reaching the several ideals displayed in Descartes' longings. Newton follows the path toward a unified nature pioneered by Kepler, Galileo, Descartes, and others, culminating in a revolution of synthesis. In Newton we find scientific exploration characterized by a systematic program of unification.⁵⁴ Newton's own unusually solitary nature and labors did produce profound conceptual syntheses. In them we have, in a modern scientific sense, the conceptual birth of a "universe."

ISAAC NEWTON (1642–1727): GOD AS GUARANTOR OF NATURE'S UNIFYING LAWS

With Isaac Newton, the current dream of a final theory of natural order by unification had its clearest modern beginnings. He played a more central role in the overall development of physics than anyone mentioned here so far, and is among a handful of thinkers alongside Copernicus, Galileo, Darwin, Einstein, and Freud whom some say "made philosophers necessary" by determining their concerns—like natural unity.⁵⁵ Newton's laws of motion and universal gravitation explained and unified much, ranging from falling apples and rising and falling tides to the orbital patterns of planets and moons. He may have sensed for the first time the possibility of a truly comprehensive explanation of nature.⁵⁶ This sense found expression in the preface to the first edition of *Principia Mathematica*, where he wrote:

If only we could derive the other phenomena of nature from mechanical principles by the same kind of reasoning! For many things lead me to have a suspicion that all phenomena may depend on certain forces by which the particles of bodies, by causes not yet known, either are impelled toward one another and cohere in regular figures, or are repelled from one another and recede. Since these forces are unknown, philosophers have hitherto made trial of nature in vain. But I hope that the principles set down here will shed some light on either this mode of philosophizing or some truer one.⁵⁷

In Newton's works before and after *Principia*, we find a vital and successful continuance of Kepler's calculations of planetary motion and its governing laws. The seventeenth-century's novel concept of laws of nature, laden with

theological concerns, found refinement and nuance in Newton's works. He admired and improved on Descartes' ideas also, providing necessary calculations for validating those worthy of substantiation and discarding others. While all of these factors make Newton important, it was the overall scope and direction of his investigations that made him vital for any potential unified physics.

Newton's work is noteworthy for profound syntheses of disparate streams of thought, physics aside.⁵⁸ His interests were broad, and were in his mind all interconnectable. Included were mathematics, optics, physical dynamics, history, astronomy, alchemy, chemistry, music theory, and theology, among others.⁵⁹ For Newton, God was not just the guarantor of the rationality and intelligibility of nature and its universal laws, but inseparable from a unified nature.⁶⁰ He declared that the regulation of our solar system presupposes that infinite space is "the Sensorium of a Being [*Annon Spatium Universum, Sensorium est Entis*] incorporeal, living, and intelligent, who sees the things themselves intimately, and thoroughly perceives them, and comprehends them wholly by their immediate presence to himself. . . ."⁶¹

Often undervalued or ignored is the direct interplay of metaphysical and religious commitments on Newton's scientific investigations. Deep-seated beliefs that gradually became more apparent guided both his personal and professional life. These were evident in his far-reaching syntheses, informing especially his ideas regarding the uniformity of nature and the universality of its laws, which held scientific sway for some time.

Opportunity also played a vital part. He fulfilled Descartes' ideal investigator type in being like many famous inventive minds—chafing under strict supervision, and best when left to his own ideas and investigations. During his first three years at Cambridge he did not distinguish himself in the eyes of tutors in any way whatsoever.⁶² Yet his unorthodox program of "Descartean" self-study led to significant findings from 1664–1666 relevant for his developing concept of natural unity. In 1665, plague caused Cambridge to close for two years, during which time Newton worked as his own sole tutor. A falling apple, perhaps apocryphal, may have given Newton some insights into gravity during this period, but matters were hardly so effortless. Many experiments, brooding contemplations, and calculations became sources for Newton's greatest scientific writing some twenty years later in the *Principia*, which he penned entirely in Latin within eighteen months during 1685 and 1686. During the forced vacation of his *anni mirabiles*, hints of universal laws crept into his work. He later recounted:

In the beginning of the year 1665 I found the Method of approximating series & the Rule for reducing any dignity of any Binomial into such a series. The same year in May I found the method of Tangents of Gregory and Slusius, & in November had the direct method of fluxions & the next year in January had the Theory of Colours & in May following I had entrance into y^e inverse method of fluxions. And the same year I

began to think of gravity extending to y^e orb of the Moon & (having found out how to estimate the force with w^{ch} [a] globe revolving within a sphere presses the surface of the sphere) from Kepler's rule of the periodical times of the Planets being in sesquialterate proportion of their distances from the centre of their Orbs, I deduced that the forces w^{ch} keep the Planets in their Orbs must [be] reciprocally as the squares of their distances from the centres about w^{ch} they revolve: & thereby compared the force requisite to keep the Moon in her Orb with the force of gravity at the surface of the earth, & found them answer pretty nearly. All this was in the two plague years of 1665–1666. For in those days I was in the prime of my age for invention & minded Mathematicks & Philosophy more than at any time since.⁶³

Newton returned to Cambridge in 1667, from which time a fusion of scientific and religious ideas becomes clearer in his works. With the assistance of an unnamed patron, he was shortly elected a minor Fellow at Trinity College on 2 October 1667. One might take the mandatory agreed conditions for that fellowship to indicate the strength of Newton's religious commitments. He had to promise "that I will embrace the true religion of Christ with all my soul . . . and also that I will either set Theology as the object of my studies and will take holy orders when the time prescribed by those statutes arrives, or I will resign from the college."⁶⁴ One could equally assign a simple sense of forced insincerity to such statements, were it not for what followed. Newton obtained the Lucasian Chair in Mathematics in 1669 when Isaac Barrow retired and recommended Newton to fill it.⁶⁵ Then straightaway in the early 1670s Newton turned his energies, in fact, to concentrated theological study, focusing mostly on the Trinity and God's relations to the natural order.

A strong Arian monist, he believed Athanasius and his followers to have perpetrated a great fraud upon Christianity with their Trinitarian doctrine, which Newton never accepted. He theorized that false scriptures supporting a Trinitarian view had been inserted into the original texts by Athanasius' followers in the fourth and fifth centuries. It is plausible that Newton's Arian sympathies are important to understanding his unifying impulses, which had widespread effect on his whole worldview inclusive of scientific study and religious beliefs. While Descartes is often read as having claimed the whole universe to have been shaped by impersonal laws, and the material world to be independent of God, Newton obviously believed neither point. He saw that position as a recipe for atheism, and would not recant his view of a designed nature with God as its guarantor. God was the author and sustainer of an intelligible and dependable unity in operation through discernible laws, all indicative of God's existence.⁶⁶

Although Newton's beliefs were later closely connected with Deism, the evidence is overwhelming that his personal views were not deist at all. His God was more intimately involved in creation than any such accounts

allowed. From at least the late 1660s, one of his chief goals was to demonstrate matter as being directly dependent on God.⁶⁷ Gravitation was not inherent in matter, Newton reasoned. In a stringent rejection of what he saw as Descartes' moves toward atheism, he wrote of gravity's properties in the late 1660s essay "*De Gravitatione et aequipondio fluidorum et solidorum in fluidis scientiam*."⁶⁸ Gravity operated because an agent, the Creator, acted constantly according to certain laws; through this action material bodies were attracted to one another. This idea found its way into the General Scholium to the second edition of the *Principia*, where Newton identified gravity as:

a certain very subtle spirit pervading gross bodies and lying hidden in them; by its force and actions, the particles of bodies attract one another at very small distances and cohere when they become contiguous; and electrical [i.e., electrified] bodies act at greater distances, repelling as well as attracting neighboring corpuscles; and light is emitted, reflected, refracted, inflected, and heats bodies. . . .⁶⁹

Newton saw the actions of this "most subtle spirit" as functioning in harmony with the reasons God had placed the planets in their respective orbital positions.

One can disagree unambiguously with at least one conceivable implication of Richard Westfall's "The Rise of Science and the Decline of Orthodox Christianity," where he argues that Newton's God lost the characterization of the Christian Redeemer God. That is, the evident truth is that Newton would have recoiled from any notion of secularizing the sciences.⁷⁰ Judging from his published writings, personal correspondences, and private papers, Newton meant precisely to imply the Christian Redeemer God when he wrote of God acting on and through nature. While the implication is more ambiguous in documents like the General Scholium and the *Principia* to which it was attached, Newton's letters, for instance, are intimately revealing of scientific interplay with what was for Newton intentionally the God of the Christian religion. Of gravity, planetary position, and God's designs for the unity of the whole system, he wrote to his colleague Richard Bentley of the Creator having placed Jupiter and Saturn where they are with great care given their "quantity of matter," so as to affect one another "sensibly" and not cause "considerable disturbance in the whole system."⁷¹ John Hedley Brooke has noted that Bentley, in turn, viewed gravity as "a new and invincible argument for the being of God."⁷²

It is more easily argued that both Westfall and Brooke are correct in saying that Newton's God was at least partly a metaphysical projection of nature, as well as of Newton himself.⁷³ Still, Newton's view of a unified creation through God was so great that he devoted considerable time to the study of theology and alchemy, often even to the exclusion of mechanics. He composed no less than fifteen rules for the interpretation of Scripture, which

unsurprisingly paralleled his rules for interpreting nature. For most of his life, a notable exception being his last few years, he poured great energy into study and writings on Scripture, as well as the views of the Church fathers, sacred ritual, and Church history.⁷⁴ Newton held to Bacon's classic view that God had revealed Himself in two books, the Book of His Word and the Book of Nature, and saw precisely a co-ratifying relationship, and ensuing evidences, between God and a unity of laws governing nature.

Betty Jo Teeter Dobbs has confirmed in *The Janus Faces of Genius* that Newton's intertwining of religious belief with mathematics, physics, and cosmology was to him part of a necessary corrective to Descartes' overly mechanized system.⁷⁵ Newton's divergent studies were intimately related, each being a method for obtaining at least partial truths. From these, when considered together, one might then obtain a unified truth. Newton saw himself with his various labors as restoring a true natural philosophy and religion.⁷⁶ His ultimate motivation through it all was knowledge not merely of nature and its hidden workings, but of God.⁷⁷

The work for which he is best known, *Principia Mathematica*, offered the most comprehensive "system of the world" since Plato and Aristotle two thousand years prior. Newton gave with the *Principia* his greatest offering: reducing to mathematical laws the complex relations between heavenly bodies, and in so doing uniting the earth with the heavens under the same laws of operation. All of nature was in this system unified by certain laws, which were actively subject to the God who had placed them to govern matter. Rarely noted is that Newton's greatest sustained attention to theology occurred in the fifteen years prior to the *Principia*'s publication, and that he viewed that work to be as much about God as nature, contributing both to theology and natural philosophy.⁷⁸

The concept of natural unity by universal law was inextricably connected in Newton's mind to the One God whose omnipresence constituted space.⁷⁹ From nature one could derive the very attributes of God. Newton gave exhaustively precise public definitions of the Deity, published even within his most exemplary scientific work. The General Scholium to the 1713 edition of *Principia* defined God as "eternal, infinite, absolutely perfect." God was "Lord over all, He exercises dominion over His Creation and His servants." We may conclude from this that God is a "living, intelligent and powerful" being, in effect omnipotent, omnipresent, and omniscient. God is "all eye, all ear, all brain, all arm, all power to perceive, to understand, and to act."⁸⁰ Newton's description of God required over 800 words.

Placing this work in its historical context makes the nature of the assertions in *Principia* ever clearer. While today his "Mathematical Principles of Natural Philosophy" may seem the epitome of cold rationality, to publish in the year 1687 a work telling of attractive forces pushing or pulling objects together at a distance (gravity) was not orthodox mechanical philosophy. Such a notion instead quite "smacked of the occult," as Dobbs argues.⁸¹

Until Newton's dismissal of the idea (which was never quite final), a hypothetical ether composed of fine, imperceptible particles was the only acceptable explanation for otherwise "apparent" attractions. Magnetic, electrical, and gravitational forces were all explainable by the ether, and without it any idea of effect at a distance was no less than fantasy or magic. Dobbs, disagreeing sharply with I. Bernard Cohen's view in *Contemporary Newtonian Research* (1982), insists that alchemical-religious inclinations were a source of fundamental importance in Newton's revolutionary departure from orthodox mechanism. He did not lay aside his alchemical views and thus "rise above" them, as Cohen suggests, rather he found in them a necessary explanatory power.⁸²

One makes another great, yet not uncommon, historical-contextual error if one underestimates or discounts Newton's use of the ancient wisdom of alchemy, just as one must not discount the influence of his theology when formulating the *Principia's* syntheses. Newton's prime alchemical concern was to find evidence of an active vegetative principle sought by the great alchemists and natural philosophers whose works he so diligently studied.⁸³ This vegetative principle was a secret, animating, universal spirit by which God continuously crafted the universe according to providential design. The principle kept the universe from ever being the mechanized system envisioned by Descartes. Beyond his alchemy, one must recognize that common to Newton's age was the assumption that truth was unified in God. All true knowledge was in some sense of God, with the unity of truth guaranteed by God's own unity. The unified attributes of God were recorded in scripture, but were also reflected in a unified, and simultaneously diverse, nature.

For Newton then, natural philosophy, like any route to truth, had direct theological import. The unity of truth was certain even if approached variously; likewise, unity of nature was guaranteed by the majestic unity of the God who had fashioned and still sustained it all. Only with Einstein more than two centuries later were significant alterations to Newton's scientific models categorically introduced. And Einstein, as Newton's truest scientific successor, would much later hold not entirely contradictory theological views. This is not widely known, and is sometimes denied in complete error. Recent scholarship has emphasized that Einstein made stronger connections between a unified view of nature and of "God" than has been previously understood.

ALBERT EINSTEIN (1879–1955): "A RAPTUROUS AMAZEMENT AT THE HARMONY OF NATURAL LAW . . ." OR, "GOD DOES NOT PLAY AT DICE WITH THE LAWS OF NATURE"

Albert Einstein is most significant for his theories of special (1905) and general (1915) relativity, and for the indirect contributions to quantum theory for which he won the Nobel Prize in Physics for 1921. Less known is that

he spent his final thirty years obsessively seeking a theory to explain singly the entire universe—an early unified field theory. During Einstein's lifetime the problems of such a unified theory were only partially understood, then in terms of relating relativity to quantum theory, the latter of which he regarded as incomplete.

Einstein's attempts at unification were doomed by a paucity of necessary information, even if they were ahead of their time rather than consummate failures. His search was relegated to a strictly causal formula, which would effectively unify electromagnetism and gravity, with quantum theory being among the theory's first approximations.⁸⁴ Relativity and quantum theory may still be understood today as the two pillars of all modern physics, with relativity governing the macrocosm and quantum theory the microcosm. Each is a premium description of its respective domain, and together they have moved physicists toward an ever more complete comprehension of our universe.

Relativity, both general and special, accounts for departures from Newton's mechanics occurring with high-speed relative motion. The special theory (1905) posits that all laws of physics are universally the same for any observer regardless of the observer's position or movement as frames of reference, particularly referring to motion relative to the speed of light, which is constant. The general theory (1915), an extension of that idea, is designed especially to include gravity and acceleration.⁸⁵ The conjoined theories revolutionized our idea of gravity, describing it in terms of the curvature of space-time. Quantum theory originated and developed from the ideas set forth in Planck's quantum principle combined with Werner Heisenberg's uncertainty principle, demonstrating that quantum particle activity is difficult to predict.⁸⁶

Einstein was vexed that the two theories were—and still are—at odds, seemingly speaking different languages. He realized, with those who continue work on unification today, that without such a theory much of science and all of physics remains fragmented, parts of it irreconcilable. The simple and obvious solution to this quandary would be the formulation of a single theory uniting the two realms, explaining the nature of the entire universe and its mechanics in one comprehensive equation or theory. Following his work in relativity, it was this vision that drove Einstein for thirty years, until his death. The problem is understood today in better detail as the unification not simply of relativity and quantum theory, but of the four known fundamental forces of nature, including the strong and weak nuclear forces. Einstein was not mistaken in his pursuit, the results of which (a quantum theory of gravity whose classical limit is general relativity) must still be found in order to formulate a “final” theory. But in Einstein's lifetime the weak and strong nuclear forces were neither well defined nor well understood, and were not appreciated by him as part of the problem.

During his final decade, spending his energies almost exclusively on the matter, he published eight papers on a unified field theory, which he first

called a “unitary field theory.” He understood the possible solution as a third stage of relativity, following on the special and general. His reported his views simply in the booklet *Field Theories, Old and New*:⁸⁷

The new unitary field theory is based on the following mathematical discovery: There are continua with a Riemannian metric and distant parallelism which nevertheless are not Euclidean. It is easy to show, for instance, in the case of three-dimensional space, how such a continuum differs from a Euclidean. . . . First of all, in such a continuum there are lines whose elements are parallel to one another. We shall call those “straight lines.” It also has a definite meaning to speak of two parallel straight lines as in the Euclidean case. Now choose two such parallels E1L1 and E2L2 and mark on each a point P1, P2. . . . On E1L1 choose in addition a point Q1. If we now draw through Q1 a straight line Q1—R parallel to the straight line P1, P2, then in Euclidean geometry this will cut the straight line E2L2; in the geometry now used the line Q1—R and the line E2L2 do not in general cut one another. To this extent the geometry now used is not only a specialization of the Riemannian but also a generalization of the Euclidian geometry. My opinion is that our space-time continuum has a structure of the kind here outlined.

The mathematical problem whose solution, in my view, leads to the correct field laws is to be formulated thus: Which are the simplest and most natural conditions to which a continuum of this kind can be subjected? The answer to this question which I have attempted to give in a new paper yields unitary field laws for gravitation and electro-magnetism.⁸⁸

This problem was so important to Einstein that he worked on it until the very last day of his life, 17 April 1955, while painfully dying from an abdominal aneurysm in a Princeton, New Jersey, hospital. He requested his eyeglasses, writing materials, and some recent notes on unified field theory, and continued work on the problem. “I agree that the chance of success is small,” he said, “but the attempt must be made . . . it is my duty.”⁸⁹ He died at 1:15 a.m. the next day.⁹⁰

Einstein, like Newton, had an evident impulse to unify. He defined “science” itself eloquently in terms of its unifying effect, as “the [centuries-] old endeavor to bring together by means of systematic thought the perceptible phenomena of this world into as thoroughgoing an association as possible.”⁹¹ “Science,” he wrote elsewhere, “forces us to create new ideas, new theories. Their aim is to break down the wall of contradiction which frequently blocks the way of scientific progress.”⁹² And all scientific endeavors, he proclaimed, have at their base a necessary belief in the complete unity and harmony of our world: “Without the belief that it is possible to grasp the reality with our theoretical constructions, without the belief in the inner harmony of our world, there could be no science.”⁹³ Such obvious

incongruities as those found in relativity and quantum theory, therefore, he could not abide. In the last century, it was Einstein who most explicitly sought for a unified theory, and he continues to serve as an inspiration for all who continue the search.⁹⁴

Along with the shared impulse to unify, some have argued for another similarity between Einstein and Newton. That is, to neglect the religious element in Einstein's life would be perhaps to miss completely a prime motivating factor for his "ever-firm belief in the harmony of our world." Biographer and acquaintance Abraham Pais has called Einstein "a typical Old Testament figure, with the Jehovah-type attitude that there is a law and one must find it."⁹⁵ Einstein's relationship to religion was complex, but evident and important enough that recent biographers have made it central for his science. Max Jammer's *Einstein and Religion: Physics and Theology*⁹⁶ is the most direct recent treatment in this regard.

Jammer argues forthrightly that like Newton, Einstein's belief in the unity of nature had a distinct basis in his unorthodox yet doubtlessly undergirding religious viewpoints. Einstein's religious sentiments, Jammer contends, were sometimes expressed through music during brief breaks while doing science. This gave Einstein the strength and enthusiasm to work so long and strenuously on his theories of special and general relativity, and later on a unified physics. Jammer's view is supported by accounts from Einstein's close associates, and was confirmed also by Einstein's wife to several friends.⁹⁷

Special relativity was introduced with unifying effects in mind, and general relativity presented the key to various important syntheses. In special relativity, electromagnetism is characterized by a definite propagation velocity of light that acts invariantly for observers regardless of position or circumstances, while the general theory is based on mathematical expressions of equivalence, encompassing and extending all applications of special relativity. The theories synthesize space and time into a single space-time continuum, geometry and gravitation, with light and gravitation as both propagate at the same velocity of c , finally bringing together light, matter, and energy.⁹⁸ Niels Bohr declared of it, "Einstein succeeded in remolding and generalizing the whole edifice of classical physics and in lending to our world picture a unity surpassing all previous expectations."⁹⁹

Jammer holds that Einstein's religious sentiments, in addition to aiding in the formulation of special and general relativity, "also motivated his indefatigable tenacity in searching for a unified field theory, a task on which he embarked soon after the completion of his general theory."¹⁰⁰ His purpose in formulating a unified theory was, as he once told his student Fritz Zwicky, to "obtain a formula that will account in one breath for Newton's falling apple, the transmission of light and radio waves, the stars, and the composition of matter."¹⁰¹ He did not succeed, but never ceased to believe that the theory could be formulated.

It is plausible that belief in the theory even survived his scientific failures for religious reasons. It is clear that Einstein's *belief* in a unified nature

preceded his location of any scientific *evidence* for it: "We want the observed facts to follow logically from our concept of reality," he once said.¹⁰² Jammer believes Einstein's certainty to have been possibly rooted in his Spinozistic conviction of nature's unity: "*Deum unicum, hoc est in rerum natura non nisi unam substantiam dari*" ["God is One, hence in the nature of things only one substance is given," *Ethics*, corollary 1 to proposition 14, part 1].¹⁰³ Spinoza, the quintessential pantheist, taught that nature itself is divine and God is One. It follows that nature, which was divine in Spinoza's scheme, must exist in unity; it too is One.¹⁰⁴ Einstein was familiar with the Shma' Israel, a fundamental tenet of Judaism, from his childhood religious instruction: "Hear, O Israel, the Lord is our God, the Lord is One."¹⁰⁵ Both of these Jammer reckons to have been at least partial reasons for Einstein's longsuffering devotion to his work, and his search for "oneness" in physics. Connected to oneness for both Spinoza and Einstein was a strict determinism governing the universe; this also relates to strong religious notions. Thus we have Einstein's famous quotation in reference to the apparent indeterminacy of quantum physics: "God does not play at dice with the universe." His implication was that, as it stood, quantum mechanics must be incomplete, since it defied the necessary determinism of God's beautiful, determined creation.¹⁰⁶

The prospect that Einstein's physics may have been influenced by religious views is not novel to Jammer. The notion was considered during Einstein's lifetime by friend and foe. Cornelius Lanczos, Einstein's colleague in Berlin, and Georg Herz Shikmoni, then chairman of the Spinozaeum in Haifa, both claimed that relativity had been influenced by religion. Shikmoni maintained that there existed very close relations between $E = mc^2$, Einstein's formula for mass-energy relations, and a specific proposition in Spinoza's *Ethics*.¹⁰⁷ Lanczos, Shikmoni, and those holding similar views believed that the religious influence seemed to enhance rather than detract from Einstein's scientific theorizing.

Enemies, too, saw religious influence in Einstein's physics, and beheld in this a detestable corruption of "pure" science. In Germany, great issue was made of Einstein's Jewishness when considering his contributions to physics. He was seen as not just a physicist but a *Jewish* physicist, his theories being therefore laden with extraneous religious baggage, examples of "Jewish physics." "Jewish physics," it was believed, sought to deprive Aryan physics, seen as "true physics," of its proper place. Like Shikmoni, Nazi ideologues attempted to demonstrate exactly how and where relativity had come under Talmudic influence. A 1937 issue of the Nazi propaganda journal *Zeitschrift für die gesamten Naturwissenschaften* relates:

The mode of thought that finds its expression in Einstein's theory is known, when applied to other ordinary things, as "Talmudic thinking." The task of the Talmud is to fulfill the precepts of the Torah, the Biblical law, by circumventing them. This is accomplished by means of suitable definitions of the concepts occurring in the law and by a purely

formalistic mode of interpreting and applying them. Think about the Talmud Jew who places a food basket under his seat in a railway car, thus turning it formally into his residence and obeying thereby formally the law that on the Sabbath one should not travel more than a mile from his residence. It is this formal fulfillment that is important for the Jew. . . . This formalistic Talmudic thinking also manifests itself in Jewish principles. Within the theory of relativity, the principle of the constancy of the velocity of light and the principle of the general relativity of the phenomena in nature represent the "Torah," which under all circumstances must be fulfilled. For this fulfillment, an elaborate mathematical apparatus is necessary; and just as previously the concept of "residence" . . . was rendered lifeless and given a more expedient [*zweckentsprechende*] definition, so in the Jewish relativity theory, the notions of space and time are deprived of all spirit and defined in an expedient, purely intellectual way.¹⁰⁸

Einstein often commented on religion and a possible relationship between religion and the sciences. He sometimes angrily denied the misconception that he was an atheist or even a pantheist. "I'm not an atheist, and I don't think I can call myself a pantheist," he said. He strove always to distinguish between his disbelief in a personal God and atheism, which are not the same things.¹⁰⁹ What he did affirm on a number of occasions was that his complex religious views were indeed closer to Spinoza's God than to any traditional anthropomorphic or anthropopathic view, Jewish or otherwise. He did not think traditional religious faith was a sign of stupidity, and certainly did not consider unbelief to be a sign of intelligence.¹¹⁰ Yet his was a God decidedly impersonal and superior to any human conception, evidenced most importantly by nature's order, fundamental simplicity, elegance, and not least unity. These together engendered what Einstein termed a "cosmic religious feeling," as evidence of a superior mind revealing itself in nature.¹¹¹ In a statement that tends to confirm Jammer's understanding of Einstein's use of music to express this cosmic religious feeling, and his view that science and religion had a necessary and interdependent relationship, he added:

How can cosmic religious feeling be communicated from one person to another, if it can give rise to no definite notion of God and no theology? In my view, it is the most important function of art and science to awaken this feeling and keep it alive in those who are receptive to it. . . . I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research.¹¹²

A great deal has been written elsewhere of Einstein's familiar "science without religion is lame, religion without science is blind" statement.¹¹³ It suffices here to say that the latest scholarship, especially by those who knew Einstein personally like Jammer (*Einstein and Religion*) and Pais (*Subtle*

Is the Lord and Einstein Lived Here), concludes that Einstein intended to say that a necessary, interdependent relationship exists between science and religion. In Einstein's mind, this relationship had some correspondence to relations between a form of "God" and a deterministic, harmonic, and unified nature.

Physics has progressed since Einstein's death, but his vision of a unified nature remains. It has been assumed by a host of others, like Stephen Hawking (1942–), Steven Weinberg (1933–), and many less known. They all recognize and respond to a fact observed by Wolfgang Pauli in 1958, that "Einstein's life ended . . . with a demand on us for synthesis."¹¹⁴ The search for a theory of everything has so captured collective imaginations and base intellectual impulses that physicists like Hawking have, since Einstein, themselves become topics for almost boundless speculation.¹¹⁵ Weinberg won the Nobel Prize in Physics for 1979 for another apparent step toward the goal of ultimate unification, combining the weak and electromagnetic forces into a single electroweak force. What Weinberg and other physicists see as advancement toward final hidden laws of nature—en route for our understanding of the "what" of all physical reality—continues with a flurry of premises like the several string theories, all now unified, as it were, into M-theory.

String theory is viewed by many physicists today, including Weinberg, as one of the great scientific theories of the past century, and one of the most promising of candidates for unifying physics. Its significance is considered to be possibly on a par with quantum mechanics and general relativity.¹¹⁶ Based on dual resonance theory, a consequent of Regge theory,¹¹⁷ this latest favored candidate for uncovering nature's final laws states that all of nature is comprised at its deepest level by massless, elastic, multidimensional, vibrating, string-like structures. The hypothesis is mathematically sound, whereas earlier hopefuls like grand unified theories and supergravity presented problems or made incorrect predictions.¹¹⁸

As physics continues into the twenty-first century, the search for a unified theory of nature based in converging laws has become, after several centuries of unambiguous development, a primary driving, and thriving, force in all of physics. Like the Heracliteans and Parmenideans before them, and despite widespread disagreement among those involved, the conviction that some unifying substance or principle must lie hidden within nature has only grown and persisted. Present searches and debates that mirror these ancient arguments of "the One or the Many," are in essence similar still today. Only the methods and terminology, altered by scientific advances, have changed.

Two substantial differences are evident. One is that, contrary to the developmental history of a unified physics and Einstein's example, the professional convention now is that talk of God and religion is outside of consideration. It is noteworthy that despite this sentiment, thinkers like Hawking¹¹⁹ and Weinberg, both of whom by now have expressed atheistic viewpoints, and lately others like Lisa Randall¹²⁰ find leaving God out of consideration

entirely sometimes undesirable, or at least quite difficult, when discussing and explaining to the public the so-called “final” theories of nature.

A further and important burden on the unifying quest of physics is a recent collection of philosophers of science who, in the manner of Heraclitus, resist what they see as inherently reductionist and imperialistic tendencies in physics, however greatly evidenced they may appear to be. To these philosophers, a persistent belief in the underlying unity of nature, and the present existence and use of that belief in our time, has become a kind of scientific fundamentalism.¹²¹ Of religious significance is that some of these philosophers reference ideas of God, soundly from the history of orthodox Christianity, to defend their positions. As with the theological alliances of the unifiers of nature, one might then ask—what kind of God is God as a “Metaphysical Pluralist”?

NOTES

1. This statement does not diminish the idea of divine revelation. While some will deny the existence of revelation, many orthodox thinkers will concede that Christianity contains revelation, but also human extrapolations, concepts, and structures.
2. Steven Weinberg, *Dreams of a Final Theory: The Scientific Search for the Ultimate Laws of Nature* (New York: Vintage, 1994), 52.
3. Steven Weinberg, “A Unified Physics by 2050?” in *Scientific American* (December 1999): 36–43. Weinberg’s popular article illustrates the narrowing of the hierarchy of principles toward deeper ones in a way that can make for a simply sketched model. Each stratum described below stands vertically, with the mentioned elements drawn from top to bottom, and each succeeding stratum to the right of the preceding one, eventually forming an arrow. Stratum 1: electricity, magnetism, and light point deeper to electromagnetism. Beta decay and neutrino interactions point to weak interactions. Protons, neutrons, and pions become strong interactions. Terrestrial gravity and celestial mechanics combine in universal gravitation. Stratum 2: electromagnetism and weak interactions combine to form electroweak interactions, which combine with strong interactions to present the “standard model.” Universal gravitation now joins with space-time geometry to become general relativity. No guiding principle yet exists for combining quantum field theory (the standard model) with general relativity. String theory is a recently favored candidate, as its mathematics appears to fit the parameters of a “final theory” better than other options.
4. String theory posits physical reality, at its most basic level, to consist of one-dimensional vibrating string-like structures (with length, but lacking width and height), further predicting at least ten space-time dimensions. There are five different such theories in operation, some with “closed” and others with “open” strings, recently all combined into one M-theory.
5. The theory does not cover “everything.” *The Oxford Concise Science Dictionary* (Oxford: Oxford University Press, 1997), 722–723, defines “theory of everything” as “a theory that provides a unified description of all known types of elementary particles, known forces in the universe, and the evolution of the universe.”

6. Stephen Hawking, *Is the End in Sight for Theoretical Physics? An Inaugural Lecture* (Cambridge: Cambridge University Press, 1980).
7. Reginald Irvan Gray, *Unified Physics* (Dahlgren, VA: Naval Surface Warfare Center, 1988), 1–1.
8. Étienne Klein and Marc Lachière-Rey, *The Quest for Unity: The Adventure of Physics* (Oxford: Oxford University Press, 1999), 3. Klein and Lachière-Rey state that all of science is driven by a quest for unity. Cf. John C. Taylor's *Hidden Unity in Nature's Laws* (Cambridge: Cambridge University Press, 2001), which provides an in-depth argument for a hidden nomological unity.
9. G. S. Kirk, J. E. Raven, and M. Schofield, "Heraclitus of Ephesus," *The Presocratic Philosophers: A Critical History with a Selection of Texts*, 2nd ed. (Cambridge: Cambridge University Press, 1983), 181–212.
10. Ibid., "The Atomists: Leucippus of Miletus and Democritus of Abdera," 402–433.
11. Ibid., "Parmenides of Elea," 239–262.
12. Ibid., 184, 185n, 186.
13. Ibid., "Pythagoras of Samos," 214–238.
14. Ibid., 326.
15. Klein and Lachière-Rey, 15.
16. Michael Redhead, *From Physics to Metaphysics* (Cambridge: Cambridge University Press, 1995), xi.
17. Rolf Gruner, "Science, Nature, and Christianity," in *Journal of Theological Studies* 26.1 (April 1975): 55–81, argues that neither the classical view of science and religion as always in conflict, nor the revisionist view that modern science would not now exist without the bedrock of Christianity, is supportable. "The most that can be admitted," in Gruner's view, "is that if there had been no such religion, there probably would have been no modern science." He, among others, sees the point as trivial.
18. See Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton, NJ: Princeton University Press, 1986). Funkenstein affirms and illustrates the underpinnings of theology and metaphysics for the sciences, focusing on pre-eighteenth century developments. Though religious influence is at the center of the enquiry, Funkenstein includes a brief discussion (362ff.) on other factors influential in the development of the sciences like skepticism, pantheism, and atheism.
19. Rom Harré, *Laws of Nature*, ed. Roy Harris (London: Duckworth, 1993), 9–10.
20. Jane E. Ruby, "The Origins of Scientific 'Law,'" in *Journal of the History of Ideas* 47.3 (1986): 341–359.
21. George Berkeley, *Treatise Concerning the Principles of Human Knowledge*, ed. Jonathan Dancy, Oxford Philosophical Texts Series (Oxford: Oxford University Press, 1998 [London, 1710]), paragraphs 30–33, 113–114.
22. Within this history there is such a thoroughgoing connection between physics and permeating ideas of unity or harmony that present physics is replete with Fourier analyses. These are systematic searches for mathematical harmony among the entities and interactions of matter and energy. Gerald B. Folland, *Fourier Analysis and Its Applications* (Belmont, CA: Brooks/Cole, 1992). Cf. Klein and Lachière-Rey, 24.
23. Weinberg, "A Unified Physics by 2050?," 36–43.
24. Ibid.
25. John D. Barrow, *Theories of Everything* (Oxford: Oxford University Press, 1991), 29, 118–21, 129, 177; Klein and Lachière-Rey, 37.
26. James Byrne, *Religion and the Enlightenment: From Descartes to Kant* (Louisville, KY: Westminster John Knox Press, 1996), 100, and especially chap. 5, "The Distant God of Deism," 99–123.

27. E.g., Fritjof Capra's *The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism* (New York: Bantam, 1975), Gary Zukav's *The Dancing Wu Li Masters: An Overview of the New Physics* (New York: William Morrow, 1979), S. Balachandra Rao, *Indian Mathematics and Astronomy: Some Landmarks* (India: Jnana Deep Publications, 1994), Raja Ram Mohan Roy, *Vedic Physics: Scientific Origin of Hinduism* (Golden Egg Publishing, 1999), Subhash Kak (author of *The Nature of Physical Reality*, 1986), *The Astronomical Code of the Rgveda* (New Delhi: Aditya Prakashan, 1994).
28. Klein and Lachière-Rey, 37.
29. E.g., Max Jammer, *Einstein and Religion: Physics and Theology* (Princeton, NJ: Princeton University Press, 1999), David Lindberg and Ronald Numbers, eds., *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986), Geoffrey Cantor, *Michael Faraday: Sandemanian and Scientist: A Study of Science and Religion in the Nineteenth Century* (Basingstoke: Macmillan, 1991), and Richard Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1980).
30. Brooke, *Science and Religion*, 19.
31. Peter Barker and Bernard R. Goldstein, "Theological Foundations of Kepler's Astronomy," *Osiris 16: Science in Theistic Contexts: Cognitive Dimensions* (Chicago: University of Chicago Press, 2001), 88–113.
32. Brooke and Cantor, *Reconstructing Nature*, 19.
33. Klein and Lachière-Rey, 18.
34. Kepler, as quoted in Robert S. Westman, "Magical Reform and Astronomical Reform: The Yates Thesis Reconsidered," in *Hermeticism and the Scientific Revolution: Papers Read at a Clark Library Seminar, March 9, 1974*, Robert S. Westman and J. E. McGuire, eds. (Los Angeles: William Andrews Clark Memorial Library, University of California, 1977), 41, and in Brooke, *Science and Religion*, 120.
35. Brooke, *Science and Religion*, 26.
36. Kepler, *Epitome of Copernican Astronomy*, Book IV, Part I (New York: Prometheus, 1995).
37. Richard Westfall, "The Rise of Science and the Decline of Orthodox Christianity: A Study in Kepler, Descartes, and Newton" in Lindberg and Numbers, eds., *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986), 222–223.
38. Mark William Worthing, *God, Creation, and Contemporary Physics* (Minneapolis, MN: Augsburg, 1996), 14.
39. Barker and Goldstein, 112–113; Klein and Lachière-Rey, 19.
40. Worthing, 14.
41. Ibid.
42. Galileo considered his *Dialogue Concerning the Two New Sciences* (Leyden: Elzevirs, 1638) "superior to everything else of mine hitherto published."
43. Westfall, "The Rise of Science and the Decline of Orthodox Christianity," 224–228.
44. René Descartes, *Discourse on Method and Meditations on First Philosophy*, ed. David Weissman (New Haven, CT: Yale University Press, 1996), 49.
45. Descartes, *Rules for the Direction of the Mind*, Rule One, in Trans. John Cottingham, Robert Stoothoff, and Dugald Murdoch, *The Philosophical Writings of Descartes*, vol. 1 (Cambridge: Cambridge University Press, 1985), 9.
46. Étienne Klein and Marc Lachière-Rey, 38.
47. Descartes, *Discourse on Method and Meditations on First Philosophy*, ed. David Weissman (New Haven, CT: Yale University Press, 1996), 9.
48. Ibid.

49. Ibid.
50. Ibid., 48.
51. Stephen Toulmin, "Descartes in His Time," in David Weissman, ed., 139.
52. David Weissman, "Metaphysics," in David Weissman, ed., 153.
53. Ibid., 157.
54. Klein and Lachière-Rey, 38–39.
55. H. S. Thayer, ed., *Newton's Philosophy of Nature: Selections from His Writings* (New York: Hafner, 1953), xiii.
56. Weinberg, *Dreams of a Final Theory*, 11–12.
57. Isaac Newton, preface to *Philosophiae Naturalis Principia Mathematica* (1687), trans. I. Bernard Cohen and Anne Whitman (London: University of California Press, 1999), 382–383.
58. Worthing, 18.
59. *Let Newton Be!*, J. Fauvel et al. (Oxford: Oxford University Press, 1988), 128.
60. Funkenstein, 192–193.
61. Newton, *Optice*, 314–315, in Richard Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1980), 647.
62. Westfall, *Never at Rest*, 100.
63. Newton, Add MS 3968.41, f. 85 in the Cambridge University Library collection.
64. Trinity Statutes, *Fourth Report from the Select Committee on Education* (London, 1818), 373.
65. Westfall, *Never at Rest*, 102–103.
66. Westfall, "The Rise of Science and the Decline of Orthodox Christianity," 233.
67. Westfall, *Never at Rest*, 303.
68. Newton, Add MS 4003 in the Cambridge University Library collection.
69. Newton, "General Scholium," to *Philosophiae Naturalis Principia Mathematica* (1687), in Cohen and Whitman, 943–944.
70. Westfall, "The Rise of Science and the Decline of Orthodox Christianity," 232–233.
71. Reprinted in H. S. Thayer, ed., *Newton's Philosophy of Nature: Selections from His Writings* (New York: Hafner, 1953), 49.
72. John Hedley Brooke, "The God of Isaac Newton," in J. Fauvel et al., 169–183.
73. Ibid. Cf. Westfall, "The Rise of Science and the Decline of Orthodox Christianity," 233–235.
74. Betty Jo Teeter Dobbs, *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), 170.
75. Ibid., chap. 4, "Modes of Divine Activity in the World: Before the *Principia*," 89–121.
76. Ibid., i.
77. Ibid., 7, 122.
78. Westfall, *Never at Rest*, 540, and John Roche's essay, "Newton's *Principia*" in *Let Newton Be!* (Oxford: Oxford University Press, 1988), 43–61.
79. Brooke, "The God of Isaac Newton," in *Let Newton Be!*, J. Fauvel, et al. (Oxford: Oxford University Press, 1988), 169–183.
80. Newton, General Scholium, in *Principia* (1713 ed.). Cf. Brooke's use in "The God of Isaac Newton," 169–170.
81. Dobbs, 3–4.
82. Ibid.
83. Ibid., 5.
84. Barry Parker, *Einstein's Dream: The Search for a Unified Theory of the Universe* (New York: Plenum Press, 1986), 271.
85. Succinct definitions appear in Taylor, *Hidden Unity in Nature's Laws*, 212. Accessible explanations are in Nigel Calder, *Einstein's Universe* (New York: Wings Books, 1979).

86. Roger Penrose details these theories with critical analysis in *The Road to Reality: A Complete Guide to the Laws of the Universe* (London: Jonathan Cape, 2004).
87. Albert Einstein, *Field Theories, Old and New* (New York: The Estate of Albert Einstein and Readex Microprint Corporation, 1929). Euclid (350–300 bce), Greek mathematician and “father” of geometry, posited a simple (“Euclidean”) view of space and time in terms of planes, which prevailed prior to Einstein’s general relativity. Riemann (1826–1866), a German mathematician, posited Riemannian metric space, succeeding the simple Euclidean view in general relativity. Einstein defines the Riemannian view in nonmathematical terms as “a metric continuum which is Euclidean in infinitely small regions, but not in finite regions.”
88. Ibid.
89. Einstein quoted in Parker, *Einstein’s Dream*, 68.
90. Abraham Pais, *Subtle Is the Lord: The Science and the Life of Albert Einstein* (Oxford: Oxford University Press, 1982), 477, and Parker, *Einstein’s Dream*, 68–70.
91. Albert Einstein, *Out of My Later Years* (New York: Philosophical Library, 1950), 62.
92. Albert Einstein and Leopold Infeld, *The Evolution of Physics: The Growth of Ideas from Early Concepts to Relativity and Quanta* (New York: Simon and Schuster, 1938), 280.
93. Einstein and Infeld, *Evolution of Physics*, 312–313.
94. Weinberg, *Dreams of a Final Theory*, 17.
95. Ibid.
96. Max Jammer, *Einstein and Religion: Physics and Theology* (Princeton, NJ: Princeton University Press, 1999).
97. Recorded in the autobiography of actor Charles Chaplin, *My Autobiography* (London: The Bodley Head, 1964), 346–347.
98. Klein and Lachièze-Rey, 49–54.
99. Niels Bohr, *Atomic Physics and Human Knowledge* (New York: Wiley, 1958), 70.
100. Jammer, *Einstein and Religion*, 57.
101. Ibid.
102. Einstein and Infeld, *Evolution of Physics*, 312–313.
103. Jammer, *Einstein and Religion*, 57.
104. Ibid.
105. Deuteronomy 6.4, English Standard Version.
106. Jammer, *Einstein and Religion*, 58.
107. Cornelius Lanczos, *Judaism and Science* (Leeds: Leeds University Press, 1970).
108. Bruno Thüring, “Physik und Astronomie in Jüdischen Händen,” in *Zeitschrift für die gesamten Naturwissenschaften* 3 (May–June 1937): 55–70.
109. Jammer, *Einstein and Religion*, 48–51.
110. Ibid., 96. A reference to correspondence between Max Born and Albert Einstein as found in *The Born-Einstein Letters* (London: Macmillan, 1971), 203.
111. Albert Einstein, *Ideas and Opinions* (London: Souvenir Press, 1973), 38. Originally from “Religion and Science,” written by Einstein for the *New York Times*, 9 November 1930, 1–4. A German copy appeared in *Berliner Tageblatt*, 11 November 1930.
112. Ibid., 38–39.
113. Jammer takes up the quote in several places in *Einstein and Religion*, first on page 11. He claims that the familiar aphorism best describes Einstein’s entire philosophy of religion.
114. Wolfgang Pauli, *Neue Züricher Zeitung*, 12 January 1958. Reprinted in Pauli, *Collected Scientific Papers*, vol. 2 (New York: Interscience, 1964), 1362.

115. E.g., Michael White and John Gribbin, *Stephen Hawking: A Life in Science*, 2nd ed. (London: Penguin, 1998). Hawking's writings have helped to popularize the now widespread term "theory of everything." See Hawking, *A Brief History of Time* (London: Transworld, 1988), 171–187.
116. Barry Parker, *Search for a Super Theory: From Atoms to Superstrings* (London: Plenum Press, 1987), 248.
117. *Ibid.*, 248–249. An invention of Gabriel Veneziano, dual resonance theory was essentially a formula enabling scientists to predict more accurately the interaction of particles. It spun off from Regge theory, one of several theories from the late 1950s that showed when a certain plot was made, particles, notably hadrons, appeared to queue along straight paths. These Regge trajectories were assumed to contain particles all of the same type. Regge theory was superseded by Murray Gell-Mann's group theorizing, but still managed to give birth to more viable ideas like dual resonance.
118. *Ibid.*, 247ff.
119. Stephen Hawking and Leonard Mlodinow, *The Grand Design: New Answers to the Ultimate Questions of Life* (London: Bantam Press, 2010), refers to God, but explains why no God is necessary for the universe to exist as we currently understand it.
120. Lisa Randall, *Knocking on Heaven's Door: How Physics and Scientific Thinking Illuminate the Universe and the Modern World* (London: The Bodley Head, 2011).
121. "Scientific fundamentalism" is a term used by philosopher of science Nancy Cartwright in her book *The Dappled World: A Study of the Boundaries of Science* (Cambridge: Cambridge University Press, 1999). This text hereafter appears as *DW*.

2 God as Pluralist

Philosophical Challenges to Scientific Unification

Historically significant debates between Heraclitus, Parmenides, and their respective philosophical devotees illustrate well that where some see unity, others see and desire to promote plurality, if not disunity. Despite the driving forces and apparent evidences throughout the long history of physics' search for a unified nature, recent years have allotted a fresh cadre of "pluralists" in the mold of Heraclitus. These have arisen partly in response to a perceived imperialism on the part of physics' unifying quest, and particularly concerning the nature of Nature. These pluralists, primarily philosophers of science, have their own set of convincing evidences, and some of them have equally compelling ideas of God.

Among the more persuasive is a school of thinkers based around Stanford University, California, aptly called "The Stanford School" of philosophical thought.¹ Their collective works, and those of similar thinkers scattered in various locales, offer serious challenges to unifiers of various orientations and sciences, like those introduced in the previous chapter. As with the unifiers of physical nature, their works present a by-product of serious questions for theologians regarding any proposed God, and this God's relation to creation. In this case, the questions are especially fitting for any who would likewise imagine a unified nature as the logical yield of the "One, true God," and find subsequent comfort in the apparent intelligibility and natural order offered by a unifying physics.

Nancy Cartwright, a philosopher of science, is one of the most incisive, imaginative, and currently influential among this set of thinkers.² She has become prominent since the mid-1980s for her questioning of assumptions and methods leading to conclusions that nature is somehow essentially unified or theoretically unifiable. This is especially so for her criticisms of the unifying quest of physics, and what she views as faulty procedures, imperialistic tendencies, questionable implications, and a paucity of proper evidences. Her research, writings, and lectures for more than thirty years have been characterized by what even analysts who disagree with her tend to see as a largely original and important polemic against the particular types of scientific fundamentalism found in physics' search for its so-called theory of everything.³ Cartwright's philosophy of science has been influenced by

the thought of her mentor Rom Harré, among others. She challenges the findings in physics that hold the universe to be so well ordered and its laws so universally evident and applicable that all of nature should eventually be reducible to a proposed single, elegant, explanatory theory.

In essays and books like *How the Laws of Physics Lie* (1983), *Nature's Capacities and Their Measurement* (1989), and *The Dappled World: A Study of the Boundaries of Science* (1999) Cartwright argues that the laws of nature, where they do obtain, hold only *ceteris paribus*, not *simpliciter*.⁴ *Ceteris paribus* implies that laws "hold only in circumscribed conditions or so long as no factors relevant to the effect besides those specified occur."⁵ While realist-fundamentalists argue for universal order consisting of laws simple, graceful, and few in number, eventually looking for the single comprehensive theory, Cartwright claims contrarily that any such laws must necessarily be numerous, diverse, limited in scope, and complicated. Her idea of "laws" is one of "Metaphysical Nomological Pluralism," defined as a doctrine in which nature "is governed in different domains by different systems of laws not necessarily related to each other in any systematic or uniform way; by a patchwork of laws."⁶ Borrowing for her book's title from Catholic poet Gerard Manley Hopkins, her presumption is that "as appearances suggest, we live in a *dappled* world, a world rich in different things, with different natures, behaving in different ways."⁷ Simply, for Cartwright, "the disorder of nature is apparent."⁸

Her guiding principle throughout is an unyielding claim that contrary to centuries of misappropriated emphasis, our world is made up of laws better described as "patchwork" than "pyramid." Laws as they actually are insofar as we can tell, she says,

do not take after the simple, elegant and abstract structure of a system of axioms and theorems. Rather they look like—and steadfastly stick to looking like—science as we know it: apportioned into disciplines, apparently arbitrarily grown up; governing different sets of properties at different levels of abstraction; pockets of great precision; large parcels of qualitative maxims resisting precise formulation; erratic overlaps; here and there, once in a while, corners that line up, but mostly ragged edges; and always the cover of law just loosely attached to the jumbled world of material things. For all we know, most of what occurs in nature occurs by hap, subject to no law at all. What happens is more like an outcome of negotiation between domains than the logical consequence of a system of order. The dappled world is what, for the most part, comes naturally: regimented behavior results from good engineering.⁹

To see the world otherwise is for her representative of a *realist-fundamentalist* or *scientific-fundamentalist* view, and is methodological anathema. Having focused less accurately by her own admission on loosely connected views of *realism*, she has more recently come to name *scientific fundamentalism*

as her primary philosophical foe. As she defines the fundamentalist view, it sees all facts as belonging to a single, overarching scheme that tends to be derived from highly structured experimental environments. This scheme is considered to have precedence over any deviation or alternative opposed to the findings derived from that environment.

Scientific fundamentalism, akin to a realist view, holds to a simplistic connection between the theories and mathematical formulae of physics or any other science, and the ways in which the world *actually is*. It also tends toward a denial of any metaphysical presuppositions in procedure, as in the hypothetical assumption that “surely the world must be unified, now let us set about evidencing how this is so.”¹⁰ Cartwright and others suggest that this is precisely the order of activity: a metaphysical presumption of unity as a guiding principle is posited, which then has influence on scientific findings. This she and others sharing her viewpoint call poor scientific method.¹¹ For Cartwright, the appropriate warrants for mammoth endeavors bearing such unfettered sweeping implications as a theory of everything have not been adequately demonstrated.¹² Further, her claim is that the required evidences likely will not be possible to obtain.

Cartwright takes care in pointing out that her beliefs are founded in large part on the failures of disciplines like physics clearly and entirely to uncover widespread unity in the form of a single theory, despite many competent scientists assuming the project decade upon decade. In short, the paucity of evidences and lack of practical applications for the good of humanity make the expensive, energy-depleting, and fund-absorbing search for a “final” theory arguably not worthwhile.

Cartwright builds her case by arguing for a retrieval of an updated version of Aristotelian *natures*. She follows Rom Harré in rejecting the widespread view that during the scientific revolution, talk of *natures* was replaced adequately with the advent of talk of *laws*.¹³ The move back to some version of Aristotelian *natures* is necessary because our most basic scientific knowledge is of *capacities*, not *laws*. Laws, in the sense of that which regularly happens, “occur” only when aided by what Cartwright calls *nomological machines*,¹⁴ which are conditions in fixed, specific instances giving rise to such regularities. Like Aristotle, we should be seeking “a cause and principle of change and stasis in the thing in which it primarily subsists,” and should assume that the proposed “principle of change” will be “in the thing itself and not *per accidens*.”¹⁵

This advocacy of a return to Aristotelian *natures* is made with the knowledge that our version would differ in respects from Aristotle’s conception. Most of the latest concerns, for instance, are not with individuations and substances, which are the foundational ideas behind his version. Still, the need is clear enough for Cartwright, given the applicability of *natures* and *capacities* where laws inevitably fail.¹⁶ Such language and categories work to our aid as we labor to avoid neglect of the rich patchwork that is our world, while *laws* gloss over the multiplicity and patchwork of things evident in nature. One of Cartwright’s practical concerns is that this glossing-over will

be at least a contributor to our ignorance of nature's true capacities, and could aid in ill-spent projects where funding and effort will be less helpful to humanity—thus, the neglect could even be to our ultimate harm.¹⁷ In this regard she identifies similar imperialism in medicine, where genetics seems to be a late type of the theory of everything. Her argument is that cures for cancer, for example, may not come from a global genetic approach, but may require a local look at what could become easily overlooked options given a continued genetic fascination. In this way an all-encompassing, reductionist theory like genetics could be of practical harm through an inherent ignorance of alternative approaches that may actually work better. Similarly, our efforts to understand nature and its activities at any level might be thwarted by too much focus on the general, and neglect of the particular. Related apprehensions mark the entire Stanford School movement, which is somewhat unique in its substantive criticisms of physics' unifying quest.

DIVERSIFYING PHILOSOPHERS OF SCIENCE: A MODERN CONTEXT FOR CARTWRIGHT

Sociologists have taught us that scientific discovery and progress are not the stuff of existential vacuums, but are produced from within specific, affective social environments. This is also true of theoretical work in the philosophy of science. Cartwright's first words to readers of *DW* describe the deep influences on her work of the traditions of the Stanford School of philosophers of science.¹⁸

Following sociological or social constructivist reasoning, one is compelled to ask questions about the disunity of the sciences movement in which Cartwright participates. If Cartwright is "squarely in the tradition of the Stanford School," of what traditions and influences are the philosophers associated with the School who have so influenced her? The Stanford School to whom Cartwright refers includes not only respected philosophers, but also sociologists, historians, and others, among them Ian Hacking, John Dupré, Peter Galison, Margaret Morrison, Patrick Suppes, and David J. Stump.

In *The Disunity of Science: Boundaries, Contexts, and Power*, a volume of essays edited by Galison and Stump, incisive critiques are raised by a number of thinkers from a variety of disciplines against various concepts of unity as related to the sciences and nature.¹⁹ Considerations given coverage range from the metaphysical disorder of the universe to the disunities of the sciences themselves, with multiple concepts of diversity and disunification in between.²⁰ Unifying the disunifiers, whatever their specific concerns (physics, epistemologies, social constructivism, and so on) tend to be assumptions of an inherently local, circumscribed quality to all scientific facts and knowledge. These assumptions support a concomitant reluctance to universalize the local findings of experimental and theoretical activities. The scientific and philosophical concerns explored under this guise are many. They include

multicultural issues, postmodernism, scientific relativism, realism and anti-realism, and the two most pertinent here: the character both of nature's laws and entities, and of the mathematical and metaphysical theories describing nature. With the mapping of new, localized boundaries for doing sciences like physics come fresh critiques of the unifying tendencies and practices within those sciences.

The previous chapter outlined some historical foundations for unifying tendencies and practices in physics, which have led to a reductionist belief that all of nature's principles or laws are as they are because of deeper, underlying principles or laws. That this supposed trend of convergence might eventually be traced to a law deeper and more fundamental than any other—the sought-after theory of everything—has become accepted canon with many physicists. For the sake of breadth of coverage, Chapter 1 traced proclamations of unity back to the pre-Socratics, as one can with relative ease locate vestiges of quite similar proclamations through to the twenty-first century. Peter Galison might see such a wide-ranging history as doing “a certain amount of violence to the lines of historical continuity,”²¹ preferring instead a more recent, localized history. In setting the stage for unity chronologically speaking, against which disunifiers do their present work, Galison begins his focus on the current context with modern talk of unification in German-speaking countries in the mid-nineteenth century.²² In Galison's judgment, it was there that modern talk of unification in the sciences began.

In the midst of lengthy struggles for German political unification, the idea of scientific unity became a lofty ideal. This is readily detectable in various writings and speeches of the period intertwining scientific ideals with the political.²³ Rudolf Virchow, for instance, maintained that political liberalism was a requirement and prerequisite for the progress of medicine. Disunity and particularity in the form of various tariffs and regulations were seen as burdens to a technology otherwise functioning to unify and order the world. In similar fashion, Herman Helmholtz linked political unification to that of *Wissenschaft* in his 1869 speech on “The Aim and Progress of Physical Science.” “The ultimate aim of physical science must be to reduce all phenomena to mechanics,” Helmholtz said. Galison compares the force of Helmholtz's unification to that brought to biology by Charles Darwin.²⁴

A later generation of scientists and philosophical theorizers, including figures like Moritz Schlick, Otto Neurath, Rudolf Carnap, Friedrich Waismann, Gustav Bergmann, Philipp Frank, Kurt Gödel, and for a time Ludwig Wittgenstein, entered into a highly charged atmosphere of pervasive unifications that produced the Vienna Circle. All of those just mentioned were at some point either Circle members or associates. The Circle's central concerns, it is generally now known, were to unify the sciences and correctly delineate scientific method. Their *wissenschaftliche Weltauffassung*, or “scientific attitude,” was to bring disparate scientific craft together as one. Unification by the Circle's positivist methods was based on materialist ideas, generally around the three themes of language, laws, and methods. They

held experience and observation in the highest regard, and “verification” as a highest principle. Metaphysics and religion—or ideas of God—therefore had nothing whatsoever to do with the Circle’s vision of unification; such concepts were anathema to its members.

In time, the *International Encyclopedia of Unified Science* appeared, with Neurath, Carnap, and C. W. Morris its editors.²⁵ Neurath and Carnap had similar relatively modest goals involving the location of a linguistic unity for the sciences, invoking a common terminology and iconography. They were resistant to any notion of a super, Kantian system for the various scientific disciplines, laboring instead toward a more practicable encyclopedic assemblage befitting their understanding of the true nature of the sciences.²⁶

As Galison narrates the story, it was in men like Victor Lenzen that reductionism and unity took on rigid nomological implications across the board. “In the face of apparent disunity,” Lenzen wrote,

developments in contemporary physics inspire the hope that quantum mechanics and the theory of relativity may be united in a single theory. And because of the basic function of generalized physics and the ever increasing development and adaptation of the techniques of specialized physics, the progress of physics augurs well for the unity of all empirical science.²⁷

Lenzen was denoting precisely that which Nancy Cartwright eyes warily: the creation of readily integrated laws at the end of which stands today the holy grail of one all-encompassing fountain of all that is.²⁸

NANCY CARTWRIGHT AND A METAPHYSICAL PLURALIST WORLD

Nancy Cartwright counts herself as being like members of the Vienna Circle, and like many, incidentally, in the recent disunity of science movement. She sees herself not as an abstract theorist, but as one who actively seeks to proceed by that which is demonstrable from sound scientific methods—with an attempt to deny metaphysical assumptions of unity. Cartwright depicts herself in *DW* as one looking at the claims of the sciences and their effects as a collective force in society, which is again reminiscent of the Circle. Otto Neurath, she says, is the “hero” behind her book.²⁹

Neurath, a founding member of the Vienna Circle, and a social engineer of the Bavarian Republic, became well known for the fact that his philosophy was precisely attuned to his practical concerns with changing the world. Cartwright, likewise, is concerned with what the sciences can and should be achieving for our betterment, and has adopted as her own the unique brand of empiricism advocated in the Vienna Circle’s, hence Neurath’s, *wissenschaftliche Weltauffassung* or “scientific attitude.” The chief requirement of the view is that one should see the world that we *actually* live in—messy,

mottled, and the proper focus of our desires for improvement—as the object, subject, and ultimate arbiter of all our scientific knowledge.³⁰ Abstract theorizing, or philosophy for philosophy’s sake with little or no application, had virtually no place in Neurath’s world of the early twentieth century, nor does it have a secure place in Cartwright’s today.

Although one might initially expect Cartwright to view Neurath, as the driving force in the Vienna Circle’s Unity of Science Movement, to have been a philosophical foe, the obverse is true. Neurath was both a proponent of unification and antireductionist.³¹ While working hard for unification he did not approve of “foundational reductionism,” which would have granted easy access to unity.³² He taught instead that we must give up belief in any ultimate scientific “system,” and he worked hard for others to accept this idea. The mythological “system” consists of an ideal single great theory of science into which all other theories and intelligible scientific knowledge should be located.

Neurath’s undermining doctrine in this regard becomes clear when his own view of the various sciences and their functions is contrasted with that generally taken to be the standard Vienna Circle view on the unity of the sciences. The latter is a model still enjoying wide acceptance, and is familiar to almost anyone with even tangential relations to the sciences or philosophy of science. The proposed Circle view, as most understand it, imagines the varied sciences as lying in a pyramidal structure. The laws, concepts, and guiding principles of each domain exist in a hierarchy of complexity, ranging from most complex at the top to least complex or fundamental at the bottom when depicted ontologically, and contrariwise when the pyramid is depicted with implications of epistemology or derivability in mind.³³ The least complex and most encompassing science, physics, is at the ultimate fundamental level in the proposed pyramid. The next least complex and encompassing science is chemistry, placed at the next level, and so forth.

Cartwright finds Neurath’s view of relations and ordering among the sciences, and thus of nature, preferable to the pyramidal structure. In his revision the pyramidal model is left behind in favor of a set of balloons. Each balloon represents a science, theory, or model corresponding to nature, and the balloons are all tied via strings to the same material world. They share a common language: that of space-time events. Aside from this there is no discernible structure. Like ordinary balloons the sciences have flexible boundaries, capable of expansion or contraction and of covering some of the same areas of nature. They may be tied together in small groups or exist separately. They do, though, have boundaries, and lack any universal or “covering law” theoretically applicable in every situation.³⁴

Cartwright’s Three Primary Theses

Cartwright mentions three primary theses early in *DW*. The volume is primarily a set of reworked essays from past professional journal publications, now refashioned and placed in conjunction for a focus on natural order

overall. It is of little surprise then that the same theses and themes generally fit the entirety of her essays and books to date, and appear clearly, and in repetition, in most of them. They are the theses for her entire life's work, and she augments them with a few autobiographical notations on her approach to philosophy of science.

In her words, the three recurring theses are:

1. The impressive empirical successes of our best physics theories may argue for the truth of these theories but not for their universality. Indeed the contrary is the case. The very way in which physics is used to generate precise predictions shows what its limits are. The abstract theoretical concepts of high physics describe the world only via the models that interpret these concepts more concretely. So the laws of physics apply only where its models fit, and that, apparently, includes only a very limited range of circumstances.
2. Laws, where they do apply, hold only *ceteris paribus*. By "laws" I mean descriptions of what regularly happens, whether regular associations or singular causings that occur with regularity, where we may, if we wish, allow counterfactual as well as actual regularities or add the proviso that the regularities in question must occur 'by necessity.' Laws hold as a consequence of the repeated, successful operation of what, I shall argue, is reasonably thought of as a *nomological machine*.
3. Our most wide-ranging scientific knowledge is not knowledge of laws, but knowledge of the *natures* of things, knowledge that allows us to build new nomological machines never before seen giving rise to new laws never before dreamt of.³⁵

Cartwright's first thesis is an insightful methodological critique dealing with the character of truth as pertaining to the ordering of nature in scientific thought, and the proper use of modeling in physics to get at that truth. Thesis two, quite closely connected with the first, deals further with what one might usefully call the "provisional character" of any such truth to be uncovered, as outlined via thesis one—a prodigality of truth, perhaps, but not in easy, universal terms or applications. The third and final thesis is Cartwright's intriguing turn away from talk of laws and back to a form of pre-sixteenth century talk of the *natures* and *capacities* of individual things. It is from a close inspection of that notion, in Cartwright's view, that truth might be derived with greater confidence. Cartwright is clear that, and why, talk of *laws* has routinely replaced talk of *natures*, but this has been an overwrought and mistaken emphasis, she contends. A careful focus on theses one and two illuminates the need for thesis three. A closer look at each with concrete illustrations from the sciences are the most important sections of her chapter. As theses one and two are so closely connected, we can deal with them together.

In theses one and two Cartwright labors to redefine laws and the boundaries and dictates of their operation, arguing, in effect, for a reorientation

of the terms for doing physics. This redefines the world physics sets about to investigate; it becomes less a whole and more a grouping of constituent parts. As already implied, this all occurs by an influencing of the conclusions one is allowed to draw from the results of physics at work.

What is the truth of guiding laws or principles in nature, how do we get at them, and what are their proper boundaries once located? If “impressive empirical successes” argue for the truth of our “best physics theories,” what are these successes and theories, and what does this process look like when induced by a “nomological machine”?

The classic Cartwright introduction to the questions and emphases of thesis one began in *HLPL* (1983) with a number of excellent sub-arguments and examples, and continued in *DW* (1999). Cartwright’s arguments, now as then, have progressed by looking at the most auspicious of scientific practices, and by asking hard questions about what is really going on in and behind them, and with regard to our assessments of them.³⁶

In so doing, Cartwright queries even the most well-established apparent evidences for an envisioned grand nomological unity, noting that we have no adequate means of knowing whether or not such “laws” hold true in every case, everywhere, at all times. This is because most of the information we derive about nature from physics, or any science, comes to us from the models we create, which are themselves based on *exceptional, if not carefully constructed, empirical situations*. *Nomological machines* can be virtually any construct or situation that “with repeated operation, give rise to the kind of regular behavior that we represent in our scientific laws.”³⁷ They may be human constructed, as with a laboratory experiment, or naturally occurring, as with planetary alignments. Laws, for Cartwright, are not fundamental to reality, but obtain by virtue of a natural hodgepodge of capacities.

Cartwright owes an acknowledged debt to David Hume, and at once disagrees with him on important nomological issues. Hume’s arguments highlighted the problems of inductive reasoning, or the “Problem of Induction.” The dilemma is the problem of attempting to answer Hume’s critiques that belief in the uniformity of nature has no clear defense in reason, but is a habit of the mind. Given these intersections with Hume, it is unsurprising that his name appears a number of times in *DW*.³⁸ At one point Cartwright invokes Hume’s attacks on natural religion,³⁹ comparing herself to Hume in what to her is an analogous battle with natural science.⁴⁰ But with her turn from talk of laws to talk of natures—Aristotle’s emphasis on things and their individual capacities for action—Cartwright parts company with Hume and other British empiricists from the eighteenth and twentieth centuries. These also include John Locke, George Berkeley, Alfred Jules Ayer, and Gilbert Ryle. She argues against Hume and the others that categories of the “sensible,” “observable,” or “occurrent” are not as useful as talk of “powers,” “dispositions,” “capacities,” or “natures.”⁴¹

Elsewhere, Oxford philosopher Richard Swinburne discusses causal laws versus laws of nature in similar terms.⁴² He uses the term *invisible grid* to

describe the conventional model of nature presented by most physicists, and accepted by the majority of people, which sees the world as covered by given laws of nature. This view takes the format, “[E]vent of type A is followed by physical necessity by event of type B,” and then if an event of type A happens, the laws take over and bring from it an event of type B.’ Thus one might picture space as, as it were, filled by the law of gravity; then if you drop a coin from a tower, the law takes over and brings it to the ground.”⁴³ Swinburne wrote in *The Christian God* what he will still affirm as true: if causation is by substances and causal powers, then there is “no need to hypostatize the invisible grid of laws of nature.” In effect, and in agreement with Cartwright, this hypostatization is an unwarranted step.⁴⁴ But, he further observes, this is not to deny that those holding to causation as resident in fundamental laws of nature have an obvious advantage in that the world does seem given to what Swinburne calls “predictable regularity.”⁴⁵

It is on such basic observations, however, that Cartwright diverges from what might seem obvious to most. Again, for her the disorder of nature is apparent, and is as reasonable when carefully studied as the alternative. As Swinburne himself continues, a substance model, or what we might here, in reference to Cartwright, more aptly call a “neo-Aristotelian natures” model, does not argue necessarily that a substance causing an event will necessitate that similar substances will always cause similar events in similar circumstances. As Elizabeth Anscombe has observed, there is no entirely compelling reason to believe that “any singular causal proposition implies a universal statement running ‘*always* when this, then that.’”⁴⁶ Cartwright’s redefinitions and reorientations take a philosophical scalpel, so to speak, to the entire issue of natural laws. She then applies these to specific situations for illustration and evidences. Prior to the consideration of Cartwright’s “evidences” from the sciences, there remain a couple of necessary antecedent issues.⁴⁷

In *HLPL*, Cartwright is careful to distinguish between two basic types of natural law recognized by both philosophers and physicists: the “fundamental” and the “phenomenological.” She updates the terms in *DW* to the more recent meanings of “theoretical” and “representational.”⁴⁸ A long tradition is indicated in these differentiations, with the fundamental or theoretical finding favor throughout the history of these concepts over the phenomenological or representational. Cartwright’s arguments regarding each are quite unique to her, and understanding her project and the specific examples in the arguments that follow requires a certain parlance of conceptions.

For philosophers, phenomenological laws apply to appearances, while theoretical laws are all about the reality of forces and entities behind that which we observe. Epistemologically, general philosophical viewpoints hold that we know of the phenomenological or representational directly by observation, and of the theoretical or fundamental indirectly, via inference—it is very much a distinction of observable (equal to “phenomenological” and related to “representational” in meaning) and unobservable (equates with “theoretical”).

Physicists use these terms also, but with meanings not tied so simply to the “observed” and “unobserved.” Hence a conflict of interpretations ensues. For the physicist, a contrast is drawn especially between the phenomenological and the “fundamental,” with “fundamental” being a nuance granting special powers to laws seen by philosophers like Cartwright as being more probabilistic than most physicists would allow. She argues a point from the Pergamon Press’s *Encyclopaedic Dictionary of Physics* that says, “A phenomenological theory relates observed phenomena by postulating certain equations but does not enquire too deeply into their fundamental significance.”⁴⁹ But, this definition, while mentioning “observed phenomena,” is written of “superconductivity and superfluidity.” Elsewhere, the *Phenomenology of Particles at High Energies* is inclusive of theoretical entities and processes like “hadronic interactions at high energies” and “colliding proton beams.”⁵⁰ For physicists generally, the existence of laws is not debatable, nor are they given to a variety of parsings and exceptions.

This has not really changed since the time in history when laws of nature were routinely connected with God in the minds of many natural philosophers. As an Oxford science dictionary entry says,

In science, a law is a descriptive principle of nature that holds *in all circumstances* covered by the wording of the law. *There are no loopholes in the laws of nature* and any exceptional event that did not comply with the law would require the existing law to be discarded or would have to be described as a miracle.⁵¹

In Cartwright’s dappled world loopholes are commonplace, and certainly are not miracles in the sense implied in the Oxford dictionary’s definition. Exceptions to laws, in Cartwright’s thinking, have more to do with the truth of the way things actually *are* in nature. Less likely than a miracle is a scientific misreading of the actual state of things via our faulty modeling, the manner and limitations of getting at nature itself rather than just at (faulty) models of it.

Talk of covering laws and various misappropriated emphases further complicate matters. In a Cartwrightian sense, “miracle” would really only come into play with the shattering of falsely held conceptions, as in discovering that a supposed law or model is suddenly suspended. But the initial suspicion in investigating an occurrence of this type would be on a misplaced understanding of laws, theories, and models, which do not fit nature as well as could be hoped, rather than that any supposed miracle may have actually occurred.

For the physicist, the term “phenomenological,” as compared with “theoretical” or “fundamental,” implies no clear-cut difference between “observable” and “unobservable.” “Phenomenological” is instead a term dividing fundamental explanatory laws, like the law of gravity, from laws that describe, like Maxwell’s equations. This division between the theoretical

and the phenomenological is also indicative of a realist from antirealist separation. Cartwright described herself as an antirealist in *HLPL*, not because she rejected the opposition between theory and observation but because she dismissed the theoretical as opposed to the phenomenological.⁵² She updated this stance in *DW* as one opposed to fundamentalism rather than scientific realism.

Physicists, then, purportedly use phenomenological laws and representational models to describe, and fundamental or theoretical equations to explain, the phenomenological laws and models. Cartwright contends that phenomenological laws are closer to the truth than the fundamental laws intended to explain them, though even they work only reasonably well. The fundamental laws actually “lie” as we use them, she says, because they do not describe reality, but rather models of reality; further, these models cannot be assumed to apply universally. Succinctly, in explanations of nature, realist-physicists often think they are moving from a model or theory directly to reality in nature. Einstein was known for his convinced objective-realist views and arguments, which figured prominently in his portentous debate with Niels Bohr’s “Copenhagen interpretation” of quantum theory.⁵³ Cartwright argues for what she terms a *simulacrum* account of explanation.⁵⁴ By this account the movement from theory to reality is from theory to model, then from model to phenomenological law. These phenomenological laws in the best-case scenario may be true of objects in reality. Fundamental laws, on the other hand, can be deemed true only of objects in our models, and certainly may not be assumed to apply universally as a matter of sound scientific method.⁵⁵ If assuming all of that takes one full circle to a better understanding of the principles behind Cartwright’s first and second theses, simple and specific examples should help further.

In *HLPL*, Cartwright writes of what Richard Feynman has called “the greatest generalization achieved by the human mind”:⁵⁶ the law of universal gravitation, or $F = Gmm^1/r^2$. In Feynman’s paraphrase of the equation:

The Law of Gravitation is that two bodies exert a force between each other which varies inversely as the square of the distance between them, and varies directly as the product of their masses.⁵⁷

This is an effective case in that it deals with what is likely the first law that comes to mind when considering nature’s laws, is known by almost everyone, and is assumed to be without exception. For this reason, Rom Harré is fond of creating what Cartwright would call a nomological machine during lectures on laws by dropping his wallet, a piece of chalk, or any similar object to the ground, or onto a stationary object like a table, demonstrating the reliability of gravity’s universal operation.⁵⁸ Just as Cartwright states in her first thesis, the commonality of our ability to reproduce at will the effects of gravity in a variety of circumstances would seem to argue for the truth of the theory and its law expressed as $F = Gmm^1/r^2$.

But Cartwright also demonstrates that as the law is written, this is not always the case *simpliciter*. She is happy to note that Feynman himself gives one very simple reason why not: “Electricity also exerts forces inversely as the square of the distance, this time between charges. . . .”⁵⁹ Given a different situation, electricity could be the true explanation for attraction. Therefore, while the expressed law for gravity might be the valid explanation in many or even most cases, this cannot be said always without qualification.

There are quantifiable exceptions to a straightforward “bodies exert a force between each other which varies inversely as the square of the distance between them, and varies directly as the product of their masses.” Feynman, followed by Cartwright, notes that Coulomb’s law may likewise be responsible. Stated generally, Coulomb’s law is:

The force between two charged particles, regarded as point charges Q_1 and Q_2 a distance d apart, is proportional to the product of the charges and inversely proportional to the square of the distance between them . . . the law is now usually stated in the form $F = Q_1 Q_2 / 4\pi\epsilon d$, where ϵ is the absolute permittivity of the intervening medium. $\epsilon = \epsilon_r \epsilon_0$ where ϵ_r is the relative permittivity (the dielectric constant) and ϵ_0 is the electric constant.⁶⁰

Cartwright is careful to point out that the inverse is also true: any two massive objects placed opposite one another, or otherwise in conjunction, will pose a simple counter-example to Coulomb’s law.⁶¹ So neither law modeled will always be true in every case universally.

The obvious rejoinder allowed by Cartwright—that she is only utilizing a shortened version of the laws in making these statements—actually just further demonstrates not only her first thesis, but also subsequent arguments that the laws, where they do apply, hold only *ceteris paribus*—her second thesis. Granted, the law of gravitation as it is usually described begins, “*If there are no forces other than gravitational forces at work*, then two bodies exert a force between each other which varies inversely as the square of the distance between them, and varies directly as the product of their masses.” As the law is usually written, Cartwright is happy to point out that it applies only in ideal circumstances. While the law of gravitation with modifiers may be true within a given theory, it is, however, even more transparently *ceteris paribus* with the modifiers “if” and “then” attached, clearly unable to provide explanatory power in situations where electricity could also be a factor.⁶² This is a *simpliciter* example of the laws of physics applying within definite limits, only where its models fit.

Later in *DW* Cartwright states unapologetically, “Laws can be true, but not universal.”⁶³ Again, as with Swinburne’s arguments against extending any apparently true case of a law at work to an “invisible grid,” she notes that there is really no reason to assume that even a completely true law at work in a given case is deterministic in all cases, everywhere, all the time,

without *ceteris paribus* modifiers and considerations. In preparing to argue the point that “laws can be true, but not universal” in an interesting and productive manner, she turns to finding commonalities between physics and literary theory.

For support in this regard she turns to German Enlightenment critic and dramatist Gotthold Ephraim Lessing, and his eighteenth-century work on the relations between fables and morals. The relations between scientific laws and models, Cartwright argues, are analogous to relations existing between the moral and the fable in literature, as described by Lessing. Following on Lessing’s proposed theories, she sees the fable (insert “model”) as providing a somewhat more tangible, exacting, and even intuitive content for the morals (insert “laws”), which are argued to be only symbolic judgments. A fable functions to transform an abstract idea into a concrete example; so, too, do the models in physics function to transform laws, which for Cartwright are in actuality abstract, into a proposed concretized form.⁶⁴

Lessing himself follows Christian Wolff, who distinguishes between *intuitive* (*anschauende*) cognition and the *figural*, with the figural eventuating as the *symbolic* in Lessing’s later aesthetic works. Intuitive cognition attends to one’s ideas of things, and the symbolic to the signs one substitutes for them.⁶⁵

Familiar morals employed for elucidation are:

It is dangerous to choose the wrong time for doing a thing.

(Aesop, Fable 190)

Familiarity breeds contempt.

(Aesop, Fable 206)

The weaker are always prey to the stronger.

(G. E. Lessing)

All three morals are probably true, Cartwright allows, but only with an implied *ceteris paribus* clause. In each case only a single feature and its consequences are present, with exceptions not readily accounted for. The very first, she notes, is contradicted by the familiar biblical moral, “What man is there of you whom if his son ask bread will give him a stone?”⁶⁶ In the story that accompanies that moral, a friend asks another friend at midnight for food to give a traveler; although it is the wrong time to ask such a question (midnight), the persistence of the first friend gets a successful result.

The laws of physics behave likewise, and an easy example in *DW* is again a consideration of gravity, juxtaposed with the possibility of the presence of magnetism, whether in a permanent magnet, or from the flow of electricity resulting in temporary electromagnetism. Diamagnetism, paramagnetism, ferromagnetic substances, and ferromagnetism, as well as antiferromagnetism, could all apply. If one picks up pins with any magnet in a simple

experiment, the operation of gravity would appear to be in conflict with the law of magnetic attraction. Both operations must be read with implicit *ceteris paribus* modifiers, or in the best instance as descriptions of the nature of gravitational or magnetic operation.⁶⁷

While Cartwright goes into much more detail with Lessing's work on morals and fables, it is clear that the crucial point lies in Lessing's statement that "[t]he general exists only in the particular and can only become graphic [*anschauend*] in the particular."⁶⁸ Of the two obvious claims inherent in the statement, one ontological, the other epistemological, Cartwright finds the ontological point to be of greatest importance. Ontologically, Lessing is saying, "the general exists only in the particular"; epistemologically, the general only becomes "visualisable," or graphic, in the particular.⁶⁹ Ontologically, this translates into physics saying that a stated law, like Newton's $F = ma$, is an abstract truth "relative to claims about positions, motions, masses and extensions." It only becomes concrete in models, which themselves only apply with understood *ceteris paribus* conditions.

"Force," in addition to other "abstract" terms in physics, is simply not a concrete item or descriptor like "red" or another color predicate would be. Rather, it is an abstract concept like "working," as in, "I am working on a book chapter." Or, even in "writing" a black colored word in doing so, as in, "I am writing a word in a sentence in a book chapter, which appears on the screen as black, and will later be printed with black ink." Abstract descriptions like "writing" must necessarily ride "piggy-back," Cartwright would say, on more concrete descriptions and situations.⁷⁰

With "force," traditional mechanical concepts like "position," "extension," "motion," and "mass" provide a concrete base. In Cartwright's accounting, "force" is abstract relative to these traditional mechanical concepts or terms. It can only exist, then, in specific mechanical models in particular circumstances. Cartwright is arguing that laws of physics are general and abstract claims, like Lessing's morals, which are made concrete only with a specific use of fables. Newton's law, or any others, can be true only as they are made to apply to a specific system or situation with success, and there is no reason to extend the successful application to all that exists, as in deciding that Newton's law is universal and in fundamental governance of all that can be known of nature.⁷¹

Scientists may be shown consistently to produce nomological machines to make true a supposedly universal law of nature. Cartwright notes that in so doing, they do not even simply take a law, or at least a constant, shown to be true in a laboratory experiment, and attempt to find or apply it outside in the larger world. A simple flashlight battery provides an example. A flashlight battery can be seen, she argues, as rather like taking an entire laboratory and its particular conditions outside, rather than the abstract constant itself, to see if it works. In the easy case of the battery, which by its apt definition is a "battery" sequence of electric cells conjoined, scientists construct a tiny environment still completely under their control, in a sense. The current only

occurs with proper arrangement. Scientists can join and wrap the charged compounds and cells in question behind thick coats of protective metals and plastics, preventing any disturbance of the desired state of affairs and its operation—and behold, a battery. Throwing the same components blindly into a paper bag will not ordinarily produce the same results.⁷²

These sorts of examples cause Cartwright to conclude that nature's laws are true “only of what we make.” Social constructivists might argue, with Cartwright, that the laws of physics tend to work demonstrably only in the world that we “make,” not that we simply “find.” Planetary systems provide one obvious rejoinder, but nevertheless, the argument is difficult to refute with many models. Laws tend to be demonstrable primarily within the human constructs and constraints of modern laboratory environs.⁷³

Margaret Morrison, a long-time Cartwright colleague, is known for arguments concerning how models mediate between theory and nature. Models do not straightforwardly constitute theories, she works to demonstrate, but serve in this mediating capacity.⁷⁴ Morrison's book *Unifying Scientific Theories: Physical Concepts and Mathematical Structures* offers sharp critiques revealing mathematical manipulation of sorts involved in causing a variety of mathematical models to say what unifying physicists and mathematicians want them to say—namely, that nature is unified or unifiable.⁷⁵ Cartwright uses Morrison to argue a more specific further point, on how abstract terms are concretized in the pursuance of physics, and how this process further constrains possible applications. Picking up an antecedent discussion of phenomenological and representational models, Cartwright has updated her arguments from *HLPL*, where she wanted to stress gaps between fundamental theories and theory-motivated and phenomenologically accurate models. The subtle change is to argue that theories in physics do not represent what actually occurs; only models fill that role. Further, these representational models must not be already part of a theory. To produce or get models that truly represent what happens in the world, we have to go beyond theory—and this is a great “creative achievement,” says Cartwright.⁷⁶

Cartwright argues for the aforementioned retrieval of an updated version of Aristotelian *natures* when working to demonstrate her third thesis. With Rom Harré, she rejects the widespread view that during the scientific revolution, talk of *natures* was replaced adequately with the advent of talk of *laws*.⁷⁷ Aristotelian explanations, like “natures,” dominated the Scholastic academy prior to the scientific revolution. The banishment of these explanatory schemes has been widely considered one of the most noteworthy accomplishments of the revolution. The certainty of mathematics was favored with the rise of the modern sciences, which is understandable as contrasted with obscure definitions like that of motion: “the act of being in potentiality insofar as it is in potentiality.” Of this definition, Pierre Gassendi wrote in *Exercises against the Aristotelians*, “Great God! Is there any stomach strong enough to digest that?”⁷⁸ Joseph Glanvill, who earned a place in the Royal Society in 1664 with *Scepsis Scientifica*, contrasted Aristotelian

schemes in that book with mathematics. Mathematics, Glanvill explained, is “built on clear settled signification of names, which admit no ambiguity.” Aristotle’s peripatetic philosophy, by sharp contrast, “is litigious,” with accounts of nature that are “ambiguous,” “circular,” “empty,” and lacking in mathematics’ “settled, constant signification.”⁷⁹

As Cartwright explains, “Aristotle was derided as a cuttlefish, a squid: the ink he discharged cast everything into obscurity.”⁸⁰ The empiricists of the new revolution considered any knowledge approaching the “natures” of things to be beyond human grasp. For many, this level of understanding was reserved for the divine, lying beyond the parameters of human inquiry. Aristotle’s explanations were not really explanations, then, but occult viewpoints that went little further than being obscure definitions with minimal explanatory power.⁸¹ Yet a move back to some version of Aristotelian *natures* is now necessary, Cartwright argues, despite the prevailing viewpoint assuming Aristotelian explanations to be outmoded. This is because in truth our most basic scientific knowledge is of *capacities*, not *laws*. Rather than replacing *natures* with *laws of nature*,⁸² we have replaced occult powers with visible ones, but these have to be conjured in the often unnatural circumstances of the nomological machines that we construct. Laws we recall occur only when aided by *nomological machines*,⁸³ which again are conditions in fixed, specific instances giving rise to such regularities. But like Aristotle, Cartwright explains, it would be of most profit to us to be seeking “a cause and principle of change and stasis in the thing in which it primarily subsists.” We should assume that the proposed “principle of change” will be “in the thing itself and not *per accidens*.”⁸⁴

This advocacy of a return to Aristotelian natures is made with the knowledge that Cartwright’s version would differ in respects from Aristotle’s conception. Most of the latest concerns, for instance, are not with individuations and substances, which are the foundational ideas behind his version. Still, the need is clear enough for Cartwright, given the sharp applicability of *natures* and *capacities* where laws inevitably fail.⁸⁵ Such language and categories help as we labor to avoid neglect of the rich patchwork that is our world, while laws gloss over the multiplicity and patchwork of things evident in nature.⁸⁶ Our efforts to understand nature and its activities at any level might be thwarted with too much focus on the general, and neglect of the particular.

In reaching for further examples, Newton’s $F = ma$ is once again employed in discussing laws versus ascriptions of “natures.” If laws can be true but not necessarily universal, as argued above, then one is faced with choosing between two evident options. The laws could be *ceteris paribus* laws, as explained. But in some cases dealing with Newtonian mechanics, Cartwright argues, this explanation provides an ill fit. If a force is exerted on an object, that force is relevant to the motion of the object itself, whatever other interfering forces may or may not be present at work, but which are not renderable as “forces” *per se*. So a “composition of causes” or a *ceteris*

paribus situation where a force at work may either be gravity, $F = Gmm^1/r^2$, or just as easily an electrical charge, will not work here. A better fit for a situation where a total force “will contribute a component to the acceleration determined by this formula” is the ancient language of “natures”:⁸⁷

It is in the nature of a force to produce an acceleration of the requisite size. That means that *ceteris paribus*, it will produce that acceleration. But even when other causes are at work, it will ‘try’ to do so. . . . To ascribe a behavior to the nature of a feature is to claim that that behavior is exportable beyond the strict confines of the *ceteris paribus* conditions, although usually only as a ‘tendency’ or a ‘trying’. . . . The point here is that we must not confuse a wide-ranging nature with the universal applicability of the related law. To admit that forces tend to cause prescribed acceleration (and indeed do so in felicitous conditions) is a long way from admitting that $F = ma$, read as a claim of regular association, is universally true.⁸⁸

Isaac Newton was one of the most obvious and prominent figures advocating this step from deductive reasoning to universal law. In the context of his research in optics, his *experimentum crucis*, described in a letter to the Royal Society of 1671, proves useful to Cartwright as an historical example, with special attention paid to J. W. Goethe’s criticisms of Newton’s experiment in relation to his theory of light and colors.⁸⁹

In this first letter to the Royal Society, Newton introduced his theory that white light is made up of different rays of differing refrangibility. Color, he proposed, is a property of the ray dependent on its refrangible characteristics. Cartwright points out that Thomas Kuhn considered the experiment and its documentation “a classic in its simplicity.”⁹⁰ Newton’s experimentation with prisms is generally considered a classic set of examples of scientific reasoning. His unwavering belief was that his experiments *proved* his theory.⁹¹ Cartwright traces his confidence to his understanding that light acted as it did, and would do so in any case, due to something intrinsic in the light itself, or, due to its nature. This she reads as being akin to that which she is propounding in the idea of a return to Aristotelian natures, a turn toward a more accurate and profitable scientific methodology.

Newton did not consider it necessary to verify his results many times over, hence doing his experiments only once, and refusing contrary evidences presented by others who had tried, and failed, to repeat his experiment with the same results. He was onto something about the nature of light itself. Prominent among those refuting Newton’s results were Anthony Lucas, and later Goethe.⁹² Both men argued the need for a series of experiments to verify results. To Lucas, Newton replied, “[I]t is not number of experiments, but weight to be regarded; and where one will do, why need many?”⁹³

Goethe’s view was totally opposite Newton’s: “As worthwhile as each individual experiment may be, it receives its real value only when united

or combined with other experiments. . . . I would venture to say that we cannot prove anything by one experiment or even several experiments together.”⁹⁴ Goethe’s methods involved performing long series of scientific experiments together. This reflected not only his attendance to the verifiability of individual experiments, but also to his belief that all phenomena are interconnected, and it should therefore bear on the scientific researcher to follow through a series of experiments to that which “lies next to it or derives directly from it.”⁹⁵

Goethe claimed that Newton had failed to look at a sufficient range of phenomena in a variety of circumstances in relation to light, to have drawn such an unwarranted decisive conclusion from a single experiment. Newton’s inferences were invalid, as he neglected to account for variation in circumstances and their effects on experimental outcome.⁹⁶ Newton looked at the light refracted through his prism, elongated and broken into colored bands, which are refracted again through a second prism. There was no variation visible in the light ray falling through the second prism, and the colors were perfectly preserved. “And so,” he concluded, “the true cause of the length of the image was detected to be no other than that light consists of rays differently refrangible.”⁹⁷ Goethe’s view was based on what was actually an erroneous belief that nature always operated via the interaction of opposites—in the case of light, the relation of light to dark. Newton’s view assumed that the tendency to produce, or if desirable, to reproduce, colors is in the nature of light itself. There were no “natures” in Goethe’s worldview, but Cartwright maintains that there absolutely should be in ours.⁹⁸

Overall, a return to “natures,” argues Cartwright, is far more congenial to a pluralistic worldview, which itself is more realistic, follows from better scientific methodology, and leads to right conclusions. This would result, she argues, in a more realistic reflection of how the world actually *is*, as opposed to how certain scientists or even she herself might otherwise *wish it to be*.⁹⁹

THE GOD OF A DAPPLED NATURE

Cartwright’s theories and arguments, sketched and explained above to represent metaphysical pluralism, are not difficult to relate to theology. The usual theological perspectives say that the existence of nature, human and otherwise, calls for a doctrine of creation, fitting phenomena to hand within a theological worldview. Cartwright posits a view of the physical world, and indeed the metaphysics behind it. Like the unifiers demonstrated in Chapter 1 of this volume, she makes allusion on occasion to Christian concepts of God, and mentions their Christian authors. She favors examples that help in making her case. Her theological references imply that God may have chosen to be a *Metaphysical Pluralist*. Cartwright prefers a version of God who has decided to create nature in great plurality, and is a lover of such, rather than a Unifier potentially forsaking natural richness and diversity.

In so doing, she recovers a theological concept highlighting the particular above the general, written of especially by medieval thinkers like John Duns Scotus and Thomas Aquinas. Gerard Manley Hopkins's poem "Pied Beauty" makes the patchwork world evidence of God's design, and a cause for worship:

Glory be to God for dappled things—
 For skies of couple-color as a brindled cow;
 For rose-moles all in stipple upon trout that swim;
 Fresh-firecoal chestnut-falls; finches' wings;
 Landscape plotted and pieced—fold, fallow, and plough;
 And all trades, their gear and tackle and trim.
 All things counter, original, spare, strange;
 Whatever is fickle, freckled (who knows how?)
 With swift, slow; sweet, sour; adazzle, dim;
 He fathers-forth whose beauty is past change:
 Praise him.¹⁰⁰

Cartwright's use of Hopkins's poem is significant among the several theological allusions in her essays. She notes, but does not detail, that Hopkins' "Pied Beauty" was far more to him than another nature poem. Hopkins' unique praise of God for nature's often unnoticed diversity ("pied beauty") is embedded within a theological vision important not just to Hopkins. He took his concerns for natural diversity and individuation from thinkers like Thomas Aquinas, and especially John Duns Scotus, whom he admired greatly.¹⁰¹ The basic belief is one important to many Catholic and Protestant philosophers and theologians, though not often expressed lately: that through a wonderful multiplicity in the created order, the unique oneness and nature of God is revealed. Francis Bacon's contemporary, Cardinal Bellarmino, in *The Mind's Ascent to God through the Ladder of Created Things*, wrote of "the mere multitude of created things . . . itself wonderful, and a proof of the multiform perfection of the one God."¹⁰²

Norman Mackenzie recounts in *A Reader's Guide to Gerard Manley Hopkins* how societal norms of the Victorian Age would have lent themselves, in the extreme, to such musings. Dickens wrote of the drab sameness of things, as in "streets all very like one another . . . inhabited by people equally like one another, who all went in and out at the same hours, with the same sound upon the same pavements, to do the same work."¹⁰³ John Stuart Mill likewise found himself provoked by sameness, and wrote of a need even for eccentricities in such a context: "by dint of not following their own nature they have no nature to follow: their human capacities are withered and starved." He blamed partly what he saw as a stifling Calvinism for this.¹⁰⁴ But in a world abounding with mass production and the machinery of Industrial Revolution where many items could be mass produced, even the uniqueness of a trout, the skies, a cow, or a leaf took on incredible depth

for an observer like Hopkins.¹⁰⁵ For him, these then became “trout with rose moles all in stipple,” “skies brindled with couple colored clouds” like cows in a field, and landscapes “plotted and pieced.”

Hopkins coined his own set of words to describe uniqueness of being or lack thereof, with terms like “inscape,” “scaping,” and “instress” appearing in his works. He invented “inscape” and used it from 1868 onwards either as a verb or noun. The term appeared explicitly in his prose, letters, journals, and various spiritual writings, and was implied in his poetry. The Oxford English Dictionary included “inscape” from 1976 onwards, defining it as “the individual or essential quality of a thing; the uniqueness of an observed object, scene, event,” etc.¹⁰⁶ This definition fits Hopkins’ use of the term well, as by it he noted or defended any indication of uniqueness in a thing, including his own poetry. When accused once of writing poetry “on the side of oddness,” he replied that good composers were to be recognized by distinctive melodies, and painters by characteristic designs. In this way he, too, sought to achieve in his work a unique “design, pattern or what I am in the habit of calling ‘inscape.’”¹⁰⁷

Nancy Cartwright, bearing such thoughts and her own particular philosophical emphases in mind, proposes a God very different from the God of a unified nature. She recounts that when teaching on the mechanical philosophy of the seventeenth century, she makes a practice of proposing a God who is, indeed, very concerned about physics and its laws. But this God, a metaphysical pluralist deity, delights in the particularities of various things, defying reductionism. The Metaphysical Pluralist God will not detract from the richness and diverse beauty of God’s own creation.¹⁰⁸

How might one with serious theological concerns respond to the conflicting claims and evidences proposed by viewing Chapter 2 in the light of Chapter 1? In one sense, the problem is no more intractable than any other apparent theological quandary. The same Christian God might be explained as either a Unifier or Pluralist depending on which well-trodden tradition one prefers and chooses for focus.

Yet the problem is worthy of further exploration than that, regardless of theological or philosophical commitments, especially if one desires that theological ideas should comport well with scientific and philosophical knowledge and dilemmas. Of course, theological ideas should so comport if theology is to matter at all in a world beyond the committed worshiper. In the case of this book, for instance, there exists a scheme of God and creation indicating promise for avoiding a choice between whether God, in the Christian tradition, must necessarily be *either* a “Unifier” or a “Metaphysical Pluralist.” The next chapter brings concepts from theologian Wolfhart Pannenberg into the dialogue. His mature Trinitarian vision of creation includes the emphases of a Metaphysical Pluralist God, and those underscored in the previous chapter where a God as Unifier was presented. Might Pannenberg’s vision of God and creation represent some synthesis of the two alternatives, and if so how and to what extent?

NOTES

1. See John Dupré, *Human Nature and the Limits of Science* (Oxford: Clarendon Press, 2001). Dupré says that Cartwright's *DW* includes the first reference in print to the Stanford School. They are not the only significant contemporary pluralists, but provide the principal subjects for this chapter.
2. Cartwright is professor of philosophy in the Department of Philosophy, University of Durham, and at the University of California–San Diego (UCSD).
3. Peter Gibbins of Oxford University wrote a review of Cartwright's *How the Laws of Physics Lie* in *The British Journal for the Philosophy of Science*, 35.4 (1984): 390–401, stating that she had “produced a brilliant book which I think will alter the course of contemporary philosophy of physics,” predicting that it would “define the field for the next few years.” Cf. Alan Chalmers, “So the Laws of Physics Needn't Lie,” *Australasian Journal of Philosophy* 71.2 (1993): 196–205; Greg Ray, “Probabilistic Causality Reexamined,” *Erkenntnis* 36.2 (1992): 219–244; and Manfred Stockler, “On the Unity of Physics in a Dappled World: Comment on Nancy Cartwright,” in *Philosophia Naturalis* 35.1 (1998): 35–39. Cartwright's *DW* updates and expands her arguments from *How the Laws of Physics Lie* (Oxford: Clarendon Press, 1983). Hereafter appearing as *HLPL*.
4. *DW*, 4, 10, 25, 28, 33, 57, 125, 151–152, 188, *passim*. *Ceteris paribus* means “other things (or all things) being equal,” or, “as long as certain conditions apply,” and *simpliciter* signifies “simply” or “straightforwardly.”
5. *DW*, 28.
6. *Ibid.*, 31.
7. *Ibid.*, 1. Emphasis mine.
8. *Ibid.*
9. *Ibid.*
10. *Ibid.*, 12, 69–70, 148–149, 151. In Cartwright's view, an *a priori* assumption of unity is often in operation where only hard evidence should be allowed for the formation of theories, models, and laws.
11. While even scientists may in theory share this view, an appropriate philosophical question is whether scientific knowledge *actually* progresses without at least some metaphysical assumptions—like anticipating a certain result in an experimental situation for which there exists little or no evidence initially, as in expecting unity, disunity, or any state of affairs.
12. Relevant further reflections on metaphysical *a priori* assumptions among scientists can be found in Stephen J. Wykstra, “Should Worldviews Shape Science? Toward an Integrationist Account of Scientific Theorizing,” in *Facets of Faith and Science, Vol. 2: The Role of Beliefs in Mathematics and the Natural Sciences; An Augustinian Perspective*, ed. Jitse M. van der Meer (New York: University Press of America, 1996), 123–171. Wykstra makes a case that “[g]ood theories, I have emphasized, do not spring full-blown . . . they are developed through a process of arduous pursuit. Much of science hinges on willingness to pursue that which is not yet seen, and to fit what is seen into the apprehendings of what [astrophysicist Beatrice] Tinsley calls ‘emotions’” (160). Wykstra declares a nonsegregationist view “poorly based,” although he likewise concedes that for a viable integrationist view to work “would require more than this paper delivers” (162).
13. *DW*, 49 and 73.
14. *Ibid.*, 4, 25, 57–59, 104–105, 121–124, 152, 173, 187, *passim*.
15. *DW*, 81, references Aristotle, *Physica*, Book II, in *Aristotle's Physics, Books I, II*, trans. and intro. W. Charlton (Oxford: Clarendon Press, 1983), 23–44.
16. *Ibid.*, 81–82.
17. *Ibid.*, 16–18.

18. DW, ix.
19. Peter Galison and David J. Stump, eds., *The Disunity of Science: Boundaries, Contexts, and Power* (Stanford, CA: Stanford University Press, 1996).
20. Ibid.; John Dupré, "Metaphysical Disorder and Scientific Disunity," 101–117; and Ian Hacking, "The Disunities of the Sciences," 37–74.
21. Peter Galison, "Introduction: the Context of Disunity," in Galison and Stump, eds., 1–33.
22. Ibid., 3.
23. Ibid.
24. Ibid., 3–4.
25. O. Neurath, R. Carnap, and C. W. Morris, eds., *International Encyclopedia of Unified Science* (Chicago: University of Chicago Press, 1938).
26. Galison, "Introduction," 5.
27. See V. Lenzen, "Procedures of Empirical Science," in *International Encyclopedia of Unified Science*, 1.6 (Chicago: University of Chicago Press, 1938), 58.
28. Richard Creath contextualizes matters further in "The Unity of Science: Carnap, Neurath, and Beyond," in Galison and Stump, eds., 158–169.
29. DW, 5. See also N. Cartwright, J. Cat, L. Fleck, and T. E. Uebel, *Otto Neurath: Philosophy between Science and Politics* (Cambridge: Cambridge University Press, 1996).
30. Ibid., 6.
31. See Jordi Cat, Nancy Cartwright, and Hasok Chang, "Otto Neurath: Politics and the Unity of Science," in *The Disunity of Science*, ed. Galison and Stump, 347–369, especially "Neurath's Antireductionism," 348–352.
32. Ibid., 354.
33. Ibid., 7. Cartwright's depiction emphasizes epistemological considerations.
34. DW, 6–7. Covering law accounts assume one right explanation for every phenomenon, an assumption Cartwright denies and replaces with her simulacrum account. Cartwright, *HLPL*, 11, 15ff., 44, 45, 48ff., 52, 69, 155, 162, and DW, 138–139, 145, 151.
35. Cartwright, DW, 4.
36. Ibid., 10.
37. Ibid., 50.
38. Ibid., 6, 10, 11, 11n, 49, 70, 73, 78, 82, 86, 92–93, 115, 118, 138, and 141.
39. Cf. G.A.J. Rogers, "Newton and the Guaranteeing God," in *Newton and Religion: Context, Nature, and Influence*, ed. J. E. Force and R. H. Popkin (Dordrecht, NL: Kluwer Academic Publishers, 1999), 221–235. Rogers discusses Hume's famous problems with induction, and how a pre-Humean theological framework of the empiricist natural philosophers, like Newton, made such an insoluble problem irrelevant. Cartwright's issue is not with religion, but with metaphysical assumptions of a materialistic sort, like a belief in unity, but with no implication of a God guaranteeing this state.
40. Ibid., 10–11.
41. Ibid., 78.
42. Richard Swinburne, *The Christian God* (Oxford: Clarendon Press, 1994), 62–65.
43. Ibid., 63.
44. In an interview Swinburne confirmed his agreement with Cartwright on both the regularity and hypostatization of laws.
45. Swinburne defines "predictable regularity" as "regularity in the behavior of the world such that an investigator observing patterns of regular succession in some segment of it can infer with a high probability how things will be in other segments, and such predictions are very often fulfilled."

46. See Elizabeth Anscombe, "Causality and Determination," in *Causation and Conditionals*, ed. E. Sosa (Oxford University Press, 1975), 81. Emphasis mine. Also David M. Armstrong, *What Is a Law of Nature?* (Cambridge: Cambridge University Press, 1983), 95, and Swinburne's references and discussions of these resources in *The Christian God*, 63. Of further help is Peter Urbach, "What Is a Law of Nature? A Humean Answer," in *British Journal for the Philosophy of Science* 39 (1988): 193–210.
47. Cartwright finds such antecedent issues entirely necessary in almost every essay. Explaining her work here necessitates the same.
48. *HLPL*, 1ff., 8, 11, 16, 19, 85, 88ff., 93ff., 100 ff., 106, 160, 161; *DW*, 34, 137, 180, 181n, 186, 192, 198.
49. *HLPL*, 1, citing *The Encyclopaedic Dictionary of Physics* (Oxford: Pergamon Press, 1964), 108.
50. *Ibid.*, citing P. L. Crawford and R. Jennings, *Phenomenology of Particles at High Energies* (London: Academic Press, 1974).
51. "Laws, Theories, and Hypotheses," in *Oxford Concise Science Dictionary* (Oxford: Oxford University Press, 1997), 408. Emphasis mine.
52. *HLPL*, 2–3, 44–73.
53. See Einstein, "Autobiographical Notes," in *Albert Einstein: Philosopher-Scientist*, P. A. Schilpp, ed. (Evanston, IL: Library of Living Philosophers, 1949), 81–87, for his own detailed brief account.
54. "Simulacrum" indicates something possessing merely the form or appearance of a thing, not its actual substance and properties.
55. *HLPL*, 2–3, 44–73.
56. Richard Feynman, *The Character of Physical Law* (Cambridge: Cambridge University Press, 1975), 14. Cf. Cartwright's use, *HLPL*, in discussing the example of gravity, 57. In this passage Cartwright is discussing a matter ever so slightly different than laws and their universality (in this case laws and compositions of causes, thus whether or not laws such as $F = Gmm^1/r^2$ tell a straightforward "truth").
57. *Ibid.*
58. As I have witnessed Harré do in a seminar on "Three Realms of Being" at Oxford University.
59. *HLPL*, 57.
60. *The Oxford Concise Science Dictionary*, 177. "Permittivity," represented by ϵ , "is the ratio of the electric displacement in a medium to the intensity of the electric field producing it"; *ibid.*, 540.
61. *HLPL*, 57.
62. *Ibid.*, 58.
63. *DW*, 37.
64. *Ibid.*, 36–37.
65. *Ibid.*, 38. Cartwright refers to Gotthold Ephraim Lessing, *Abhandlungen über die Fabel* (Stuttgart: Philipp Reclam, 1967 [1759]), sec. I, 100.
66. *Ibid.*, 37. Cartwright quotes Matthew 7.9, King James Version.
67. *Ibid.* I have expanded Cartwright's brief sentences for breadth and clarity.
68. *Ibid.*, 38.
69. The ontological point is Lessing's; the epistemological point is my paraphrase.
70. *DW*, 45. This is my example following Cartwright's explanation.
71. *Ibid.*, 47. Newton was prepared to extend his law on the basis of his theism.
72. *Ibid.*, 57.
73. *Ibid.*, 46.
74. See Margaret Morrison, "Modeling Nature: Between Physics and the Physical World," in *Philosophia Naturalis* 34 (1998): 65–85, and *Models as Mediators*, ed. M. Morrison and M. Morgan (Cambridge: Cambridge University Press,

- 1997). Cf. Cartwright's chap. 8, "How Bridge Principles Set the Domain of Quantum Theory," in *DW*, 179–210.
75. Margaret Morrison, *Unifying Scientific Theories: Physical Concepts and Mathematical Structures* (Cambridge: Cambridge University Press, 2000).
76. *DW*, 180–181.
77. *DW*, 49 and 73.
78. *Ibid.*, 78, citing Pierre Gassendi, *Exercises against the Aristotelians*, in *The Selected Works of Pierre Gassendi*, ed. C. B. Brush (New York: Johnson Reprint Corporation, 1972).
79. *Ibid.*, citing Joseph Glanvill, *Scepsis Scientifica* (Brighton: Harvester Press, 1970 [1665]), chap. 20.
80. *Ibid.*, 78. Cartwright explains her third thesis in *DW*, chap. 4, "Aristotelian Natures and the Modern Experimental Method," 77–103.
81. *Ibid.*, 79.
82. *Ibid.*, 80. In Cartwright's earlier work, *Nature's Capacities and Their Measurement* (Oxford: Oxford University Press, 1989), she argues for the place of capacities in an empiricist philosophy. Her thesis throughout is that we must measure capacities, which can be done, or the empirical methods of modern science will not make sense. In *Nature's Capacities* she does not write of "natures" *per se*, but makes "causes" her principal focus.
83. *Ibid.*, 4, 25, 57–59, 104–105, 121–124, 152, 173, 187.
84. Aristotle, *Physics*, trans. and intro. W. Charlton, 23–44.
85. *DW*, 81–82.
86. *Ibid.*, 16–18.
87. *Ibid.*, 28.
88. *Ibid.*, 29.
89. *Ibid.*, 95.
90. *Ibid.* Cartwright quotes Thomas Kuhn, "Newton's Optical Papers," in *Isaac Newton's Papers and Letters*, ed. I. B. Cohen (Cambridge, MA: Harvard University Press, 1958).
91. *Ibid.*, 96. Cartwright cites Newton's second letter to the Royal Society, 1676.
92. *Ibid.* While Cartwright shows how both Lucas and Goethe contradicted Newton, Lucas was Newton's contemporary and Goethe lived later.
93. *Ibid.*
94. *Ibid.*
95. *Ibid.*
96. *Ibid.*
97. Cartwright cites Newton's first letter to the Royal Society (1671).
98. *DW*, 103.
99. *Ibid.*, 37.
100. Gerard Manley Hopkins, "Pied Beauty," in *The Poems of Gerard Manley Hopkins*, 4th ed., ed. W. H. Gardner and N. H. MacKenzie (London and New York: Oxford University Press, 1970), 69–70. The poem is brief yet rich with important philosophical and theological concepts.
101. See Norman Mackenzie, *A Reader's Guide to Gerard Manley Hopkins* (London: Thames and Hudson, 1981), 84–87.
102. *Ibid.*, 85.
103. *Ibid.*
104. John Stuart Mill, *On Liberty*, 3rd ed., chap. 3: "Of Individuality" (London: Longman, Green, Longman, Roberts, and Green, 1864).
105. Mackenzie, 86.
106. *Ibid.*, 232.
107. *Ibid.*
108. *DW*, 33.

3 **Wolfhart Pannenberg's Trinitarian Creation**

In this chapter we begin to examine the preceding dialectic in the light of conceivable contact points with Wolfhart Pannenberg's unique Trinitarian creation theology. Doing so at this stage, following the initial dialectic, is suggested by both material and methodological aspects of Pannenberg's three-volume systematic work. Various related writings, and consistent features in Pannenberg's wider corpus, also contribute. The relevant contact points are indicative of a limited yet intriguing possible synthesis, from metaphysical, philosophical, and theological viewpoints, of about which the physicist unifiers and the philosophical pluralists are at odds. Therefore, two main objectives will be the key considerations for the remainder of the book. The first is to proceed, hypothetically, toward demonstrating and testing the limits of Pannenberg's Trinitarian creation as a synthesis for aspects of the unity/plurality dialectic. The second is to explain and critique the pertinent aspects of Pannenberg's Trinitarian creation thought on its own merits, while fulfilling the initial aim. A relevant subtext involves evaluating Pannenberg's creation in terms of recent work in the field of science and religion.

The following exposition shows how Pannenberg's creation theology features a Trinitarian God who is the "All-determining Reality." This God's creation, as Pannenberg envisions it, adds vital nuances both to a proper understanding of God as creator and to created reality itself. This is especially by way of a potentially mediating Trinitarian concept of God as not straightforwardly either "Unifier" or "Pluralist," and a connected characterization of creation as not simply either "unified" or "plural." The most relevant methodological contact point involves what appears to be Pannenberg's main presupposition for a dialogue between theology and the natural sciences, or indeed any interdisciplinary discussion engaging Christian theology. This is an overall conception of theology named by Pannenberg commentator Ted Peters as a "field-encompassing field."¹ Theology as a "field-encompassing field" would incorporate both the scientific and philosophical domains covering the information found in Chapters 1 and 2 above. In this guise, theology is applicable to any and all aspects of reality and any discipline or field of

enquiry. The Christian concept of God, and a related view of creation, is seen as being capable of filling areas of knowledge left vacant in nontheological disciplines. Pannenberg argues that the missing areas exist because nontheological disciplines fail sufficiently to consider God, the primary factor in all reality, in their explanations and understanding. Hence, he undertakes to show a closer coherence between nontheological thought and the claims of theology, toward the plausibility of the theological claims.

Investigating these material and methodological routes in turn also allows for an in-depth look at several Pannenberg concepts that have received less attention by scholars thus far, in the context of testing them against the recent, real scientific and philosophical state of affairs already presented.²

THE CONTEXT FOR PANNENBERG'S CREATION THEOLOGY

The main concern so far has been the presentation of a contemporary scientific and philosophical problematic on its own merits. Since Pannenberg proposes that God as an explanation should be able to clarify areas of knowledge missing from other disciplines, and since he attempts in his theology to show how this might be demonstrated, a presentation of the dialectic as it stands on its own, without Pannenberg, is relevant. In this way, one can see that the problem is a real and consequential one for the disciplines involved, and not just a problem tailored for, or invented by, Pannenberg's theology. The idea that his thought might somehow resolve "areas that are missing" would therefore have greater meaning.

The dialectic has presented the viewpoints and activities of physicists who bear grand visions of a unified world, clashing with philosophers inclined, instead, toward a contrasting beauty in the form of widespread natural plurality. Attempts have been made to show that the ensuing effects of this conflict are both theoretical and practical. These range from influencing discussions on the abstractions and uses of nomological mathematical equations to having real effects on research funding appropriations. This scientific engagement with philosophy is both current and possessing its own vitality. Still, it can be seen to reflect but a recent facet of an enduring dialectic between those we may effectively call "unifiers" and "pluralists." Epitomized in Heraclitus and Parmenides and their followers, contests in which unifiers see "One" and prefer "unifying" matters pertaining to the natural world, while those otherwise inclined see "Many" and delight in "pluralizing" the same, have lasted for many centuries to the present.³

A more tractable, second major significance of that dialectic involves highlighting certain metaphysical and theological features already present within it. One salutary reading of the disagreements can lie in focusing on the metaphysical and religious aspects of them. An alternating embrace of, and resistance to, a rich variety of monotheistic religious concepts and

imageries has constituted these and similar disagreements since the rise of the modern sciences in their predominately Christian, European context.

Chapter 1 in this volume showed some monotheistic theological views attendant to a fundamental unity as influencing modern religious and scientific interactions regarding the status of laws of nature. Chapter 2 raised the question of whether a scientific outlook concerned with a fundamental plurality might also be connected to a long and significant religious history. The continued rise of postmodern concerns in philosophy, theology, and philosophies of the sciences in recent decades has made plurality a view in current, vigorous resurgence. A denouncing of universality and a related celebration of particularity, each of which are inherent in postmodern thought, aid this sense of newfound fertility for diversifying tendencies.⁴

There are examples of both unifying and diversifying inclinations to be found in other major monotheistic or religious interactions with the physical sciences.⁵ Some may even arise from derivative, nontraditional, or unconventional religious views. Nevertheless, both theological perspectives can be found distinctly in Christian theology in the West.

Both residual and overt metaphysical and religious undergirdings remain present on either side of the dialectic between physicists and philosophers. This is true even if they are ignored or seen as merely illustrative. Physicists now working to unify laws of nature are the latter-day representatives of researchers whose motivations were sometimes intensely religious. Nancy Cartwright's choice not to avoid all metaphysical or religious allusions entirely indicates at least their abiding rhetorical and illustrative potential for current metaphysical pluralists.

The spectacle of contemporary unifiers and pluralists both appealing to Christian traditions for suggesting divergent views of God and divine creative activities makes for a highly interesting, and apparently contradictory, theological problem. It is one noteworthy for relating any concept of God to a doctrine of creation. This is especially so if scientific and philosophical data are to be considered as potentially relevant to theology. For the sake of focus, we limit investigation now principally to Christian thought, and primarily to a single significant Christian thinker, Wolfhart Pannenberg, who can be brought into dialogue with the relevant issues in an illuminating way.

WOLFHART PANNENBERG

Wolfhart Pannenberg (1928–) has become an especially prominent Protestant theologian in recent decades, often noted for his activities, and their utility, in relating Christian theology to other disciplines. This is particularly true of his interactions with the natural and human sciences and philosophies of the sciences. Pannenberg's rise to prominence began in 1961 with the appearance of the edited volume *Revelation as History* (*Offenbarung als Geschichte*).⁶ In that compendium of essays by graduate student contributors from several

theological disciplines, Pannenberg and his circle of colleagues⁷ argued for a new understanding of revelation. Each essay was based on the notion that God reveals God indirectly in history as distinct from directly through His Word, as Karl Barth had been arguing. Clearly implied was a central charge that Barth and others from a previous generation had inflated the concept of revelation. With this inflation, theology had taken on the appearance of being an entirely subjective discipline. This subjectivity was a concept that Pannenberg and his colleagues wanted to guard theology against by rejecting it outright. Pannenberg argued, contrary to Barth and his sympathizers, "In distinction from special manifestations of the deity, the historical revelation is open to anyone who has eyes to see. It has universal character."⁸ Driving concerns that theology must not be wholly supernaturalist or irrational, but open to public discussion in tandem with other disciplines, have continued to mark Pannenberg's work to the present day.

While the assertions of the so-called Pannenberg Circle seem simple enough now, they were at the time of their appearance surprisingly novel. The Circle's proposals offered major alternatives not only to Barth's dogmatic arguments, but also to a portentous school already challenging Barth's—the critical New Testament interpretations of Rudolf Bultmann.⁹ The new third approach, which despite his own protests became primarily associated with Pannenberg,¹⁰ had such impact that by 1967 one commentator proclaimed, "A new school has been launched." Predictions included that the intriguing ideas were "only a foretaste of significant things to come."¹¹

GOD AS "ALL-DETERMINING REALITY," WITH THEOLOGY AS "FIELD-ENCOMPASSING FIELD"

Pannenberg's developing theological system since *RAH* has been the subject of numerous monographs, edited volumes, doctoral theses, and conferences.¹² Early concerns that theology must be open to rational interdisciplinary public discourse have since been augmented with additional proposals. One daring related Pannenbergian claim is that knowledge in any discipline is deficient when arrived at while rejecting the universal truths of God's presence and activity in the world, especially as presented in Christianity. Denying any view that says scientific knowledge has made theology redundant, Pannenberg argues that a necessary task of Christian theology, given what he says is its privileged position, is to indicate to other disciplines that systems of truth must include God to be complete.¹³ Pannenberg sees as unsatisfactory a "two language" theory of scientific and theological interactions, in which the sciences investigate natural phenomena using objective data and theology contents itself principally with the subjective or ethical. God in Pannenberg's view is *die Alles bestimmende Wirklichkeit*—the All-determining Reality. This is the very definition of God for Pannenberg.¹⁴ He wrote of theology in *TPS*,

Its real task is to examine the validity of the thesis of faith as a hypothesis. In doing this it cannot, as the science of God, have a field of investigation which can be separated or isolated from others. Though it considers everything it studies in particular relation to the reality of God, it is not a specialized positive science. The investigation of God as the all-determining reality involves all reality.¹⁵

He adds in a subsequent section,

On the assumption, then, that the word “God” is to be understood as referring to an all-determining reality, substantiation of talk about God requires that everything which exists should be shown to be a trace of the divine reality. This requirement applies, however, not to each individual thing on its own but to each in its continuity with all others. Theology as the science of God would then mean the study of the totality of the real from the point of view of the reality which ultimately determines it both as a whole and in its parts.¹⁶

Theology in this scheme becomes, in Pannenberg’s view, what Ted Peters has called “a field-encompassing field.”¹⁷ By not including knowledge of God, nontheological disciplines are in some way incomplete. They will feature what recent Pannenberg commentator Jacqui A. Stewart has termed “areas that are missing.”¹⁸

Pannenberg’s “indirect revelation via history,” his works purposefully relating theology to the natural and human sciences, and now his increasingly influential systematic theology have each received in-depth focus, and continue to generate debate. His insistence on interdisciplinary dialogue based on these ideas of God and theology, in which both are argued to be relevant for the widest possible contexts, has made his work significant in recent “science and religion” circles.

GOD AS THE EXPLANATION OF NATURAL UNITY AND PLURALITY

Certain unique characteristics of Pannenberg’s theological and philosophical works make him arguably the most important theologian since Aquinas to present a well-developed reading of the problem of unity and plurality in the natural world, particularly with regard to creatures. His take on these matters is based on underlying philosophical ideas most recently expressed in terms of an original understanding and explication of the Trinitarian Christian God, and God’s creative, formative, and continually interactive relationship to the constituent unities and pluralities of creation.¹⁹ Themes like “whole” and “part,” underlying Pannenberg’s insistence in *ST*, II, on unities and pluralities in creation, have been assessed.²⁰ But assessments of the ways that

these familiar themes show up in the creation of *ST*, II, *per se* have been sparse. This evaluative dearth is due presumably to the fact that these ideas have not appeared anywhere simultaneously in mature form until *ST*.

In the three-volume *ST*, God as "All-determining Reality" takes on a specifically Trinitarian identity, with related creative effects. Many in the developing field of "science and religion" have appraised Pannenberg's ideas, among the most prevalent being science and religion as investigating the same one reality,²¹ contingency,²² and his controversial writings on "spirit and field."²³ While these all bear some significance here, Pannenberg's creation by the nature and acts of a Trinitarian God, indicating features like a conspicuous implicit and explicit theme of unity and plurality among creatures, seems, surprisingly, not to have received an adequate evaluation. There is work to be done both in assessing and connecting it with more abstract concepts like "whole" and "part" in Pannenberg's writings.

Pannenberg's ideas of God as the "All-determining Reality" with theology as a "field-encompassing field," and the unity and plurality of the world as "trace(s) of the divine reality," can be shown to connect to the previous two chapters at numerous points. These ideas will be pivotal for the remainder of the book, and the aims of the following discussion are several. An initial aim is that this focus might shed light especially on the theological problems indicated in the tensions of the preceding chapters. This is accomplished by drawing a comparison between the three parties' arguments, now to include Pannenberg's. Another aim is to offer an evaluation of Pannenberg on major aspects of his work *per se*. It is beyond the scope of this book to comment on the whole of Pannenberg's system in detail, much of which has been done elsewhere already. What is relevant is commentary on Pannenberg's concept of creation as characterized by both unity and plurality, and its potential for a theological *via media* between radical unifying and pluralizing schemes. By pursuing this order, Pannenberg's Trinitarian creation can also be introduced in the light of its singular qualities among other modern creation doctrines. The subtext of evaluating Pannenberg's offering in terms of a project in "science and religion" continues alongside these assessments.

PANNENBERG'S TRINITARIAN CREATION

The mature results of Pannenberg's ideas relating Trinitarian thought with characteristics like unity and plurality in the natural world are found in the three volumes of his *ST*. The heart of his creation thought appears especially in Volume II, Chapter 7, on "The Creation of the World."²⁴ Pannenberg's distinctive Trinitarian approach to a doctrine of creation associates the Christian God intimately with assorted sets of created categories, entities, and processes. These Pannenberg identifies as existing in unified and plural types and schematics. His overall writings relevant for this Trinitarian creation, in *ST* and beyond, can be shown to include both concrete sets of

definitions and applications, and more abstract sets of ideas supporting and informing them.

The more concrete applications appear in the Trinitarian creation scheme of *ST*, II. Especially there one sees what would be clear relations to, and differences from, the views of our unifiers and pluralists appearing and being applied. These include Pannenberg's definitions of God and divine activity, which can be compared to the theological concepts of the unifiers, and especially to Cartwright's views among pluralists. Pannenberg's manner and methods of delineating "unity" by laws of nature are relevant, allowing places for the same in-depth interactions. The importance of diversity or "plurality" in his thought indicates that he would have both interesting agreements, and disagreements, with Cartwright and the pluralists. Further, his stress on unity and plurality appearing in God and the world can be shown to accommodate and transcend positions of extreme unity or plurality.

Broader and more abstract views on which these concrete applications are based lie both in Pannenberg's Trinitarian theology proper in *ST*, and in a "part" and "whole" hermeneutics and discussions of dialectic, mostly found in other works and volumes. Pannenberg's claims regarding the abstractions include that all human inquiry must follow some application of a whole/part epistemology to have significant meaning. At points he simply means that "wholes" and "parts" require each other for the existence of their categories. In other cases his intentions are more obscure, based in various other philosophical and theological ideas. Pannenberg's doctrine of creation from *ST*, II, serves as the central guide for the following exposition, which shows its relevance for the unifier/pluralist dialectic.

The God, Unity, and Plurality of Creation in *ST*, II

Pannenberg noted in print as early as 1981²⁵ his goal of advancing Trinitarian theology by attempting to produce a systematic theology that "will be more thoroughly trinitarian than any example I know of."²⁶ But of this intention, Philip Hefner was correct when he noted, "One reason Pannenberg's effort is so audacious and so difficult and, for some readers problematic, is that he insists that the creation must be related to the interior life of God."²⁷

Hefner was right first in that Pannenberg's understanding of creation overall, with large sections dedicated to issues like a "Plurality and Unity in Creation," is based on his conception of the interior life of a Trinitarian God and this God's creative and continuing effects on the world. Hefner was also correct that Pannenberg's relating of God and the world especially around what many will consider questionable and untestable hypotheses²⁸ is audacious, difficult, and problematic. Given his earlier statement, it comes as no surprise that Pannenberg's creation should be so very Trinitarian. But as Hefner's remark indirectly indicates, potential problems are often introduced with academic originality, even if just until they are adequately explained. Evaluating the audacity, difficulty, and what is for many the

related problematic character of the overall scheme is no simple task even for a veteran theologian like Hefner, who refused to attempt it within the confines of that brief journal article. Hefner wrote, "His [Pannenberg's] own constructive proposal is quite complex, and I will not attempt to rehearse it here."²⁹ Any attempt at doing so, despite its involved and difficult character, requires a turn to the full expression of the "quite complex"³⁰ concepts found beginning in *ST*, II, on "The Creation of the World."

There are several simple categories in *ST*, II, from which Pannenberg's complex conceptual scheme can be helpfully viewed. Although not appearing in the exact order in which we will investigate them here, Pannenberg refers to these under headings like "Creation as the Act of God," "The Trinitarian Origin of the Act of Creation," "Plurality and Unity in Creation," "The Spirit of God and the Dynamic of Natural Occurrence," and "Cooperation of Son and Spirit in the Work of Creation."³¹

The following division of this chapter incorporates Pannenberg's thoughts under two rubrics, "The Trinitarian Origin of Creation and Intratrinitarian Relations" (appearing as section A), and a longer section on "The Trinitarian Character of Creation" (section B). Two subcategories under that second section we delineate as "The Son and Logos in Creation" and "The Creativity of the Spirit in Creation." Combining several distinct matters under a couple of sections works to cover the most relevant points by holding them in like contexts. It also makes evident a number of interesting convergences and divergences with both the "God as Unifier" and "God as Pluralist" perspectives.

A. THE TRINITARIAN ORIGIN OF CREATION AND INTRATRINITARIAN RELATIONS

Pannenberg's exposition of a Trinitarian doctrine of God, including discussions of intratrinitarian relations between Father, Son, and Spirit, appears primarily in *ST*, I. He initially takes up the issues to which Hefner has referred in the context of discussing "God's Outward Action" in *ST*, II. Pannenberg's theology itself indicates best what the Trinitarian origin of creation, intratrinitarian relations, and this "outward" divine action all look like in the full creation theology of *ST*, II. Much of this ground is covered under "The Trinitarian Character of Creation" in the next section. First, it will help to look at several background matters from *ST*, I and II, including "relation," "divine essence," and "divine action." Each will help in comparing Pannenberg's work with that of the scientific unifiers and philosophical pluralists on various God concepts and their conceivable effects on creation.

Relation and Divine Essence

When beginning to explain his views on the Trinitarian origin and outworking of creation in *ST*, II, Pannenberg states:

The action of the one God in relation to the world is not wholly different from the action in his trinitarian life. In his action in relation to the world the trinitarian life turns outward, moves out of itself, and becomes the determinative basis of relations between the Creator and the creatures.³²

Pannenberg is referencing here his argument that God's existence and action are not the only determinative factors to be considered for understanding creation. This, again, is God as *die Alles bestimmende Wirklichkeit* (the All-determining Reality). But these "all-determining" God-world relations are not constituted by simple causality. A basic monotheistic causal concept is surpassed in Pannenberg's thought by a detailed explanation of creation in which God's Trinitarian nature is vital for understanding the whole of created reality. Together with God the uncreated Trinity, everything that exists is one and the same reality. The implications of this Trinitarian relationship with creation do not stop at more traditional understandings of the Father as creator, Son as reconciler, and Spirit as eschatological consummator. These traditionally vital Trinitarian activities are not neglected, but are only part of God's interactions with the world and its creatures.

"Divine action" as a concept is extended to God's intratrinitarian relations. This action moves out into the world from these relations, having certain distinguishable effects. For example, God has deliberately authored both the world's unity and the many parts comprising it, and this is intimately connected to the way in which God's identity and activities as Trinitarian can be explained.³³ While the first half of that statement is straightforward enough, there is for Pannenberg a much deeper sense in which such a statement is to be taken. He intends that direct relations are implied between the nature and activities of a Trinitarian creator and the character of our world. As the creation of a free and loving Trinitarian God, certain outgrowths of this become evident in the world's properties. These properties appear for more subtle reasons than that the world is an emanation of God's Trinitarian character, in addition to not having resulted from a theistic causality. In more abstract terms, Pannenberg has written elsewhere,

The infinity of the unifying unity (and so also its difference from that which as finite is *eo ipso* a part of the world as unified unity) can only be maintained if it is not only the source of the unity of the parts but also the source of the parts themselves. Only in this manner would God be conceived as the creative source of the world. In addition, the relationship of God to the world can only be conceived as its creative source under the further condition that the structure of the totality of the world as the whole of its parts is again grounded in God. This structure must be based upon a difference within God, one which typifies the relationship of part and whole but which is not identical with it, for otherwise the life within God would only be a mirror image of the unity of the whole of the world in its parts.³⁴

Pannenberg indicates in *ST*, I, what Hefner and other Pannenberg readers understand to be a true innovation in his Trinitarian theology. He is said to revise the traditional Christian concept of God by an introduction of "relation" into the divine essence. It seems far more accurate, however, to say that he introduces a more pronounced *emphasis* on "relation" into the divine essence or divine substance than others have done.³⁵ Discussing in detail the interrelations of the persons of the Trinity has always been an aspect of Trinitarian theology, and has received a renewed emphasis by a number of twentieth-century theologians, in what has been termed "social Trinitarianism."³⁶ Still, Pannenberg does appropriate the increasingly important category of relation into Trinitarian thought probably more than anyone previously.³⁷ An understanding of this "relation" in God provides a necessary foundation for comprehending Pannenberg's theology of creation at all, and any possibly unique characteristics or emphases in it.

To explain further any supposed Pannenbergian innovation on divine essence, it is helpful to see how divine essence or substance has been conceived prior to Pannenberg. "Divine essence" has a lengthier and more complex history than is feasible to cover here fully.³⁸ There is little that is easy about the subject, and few theological issues can seem more obscure. This is no less true of sections in Pannenberg's writings. Despite this obscurity, one may still see how Pannenberg's accounts differ from those before it. The principal change from what has gone before to Pannenberg's innovations can be characterized as a laying hold of a gradual emphasis on "relation" already in development in philosophy and theology. Pannenberg makes this endemic to understanding both God's essence and actions.

In the last half-century of philosophy, and especially in recent decades of theology, "relation" has been increasingly augmenting or replacing categories like substance. This growing categorical importance has been referred to as a "relational turn," a rigorous thematization of relationality, with special attention on implications for the doctrine of the Trinity."³⁹ Pannenberg has not been alone in emphasizing relation of late, despite the unique way in which he has done so by virtue of a heightened degree of emphasis. For example, "relation" and "relationality" figured prominently in Colin Gunton's 1992 Bampton Lectures at the University of Oxford, *The One, the Three, and the Many*.⁴⁰ Pannenberg conveys his emphasis on relation in God's essence to the idea of divine action by a Trinitarian God, and applies these moves "audaciously" (quoting Hefner) in his doctrine of creation. Further explanations of this "turn" are construed in detail by Pannenberg himself.

Writing of "God's Essence and Attributes" in *ST*, I, he begins to sum up the problem's inception. He does so initially by reference to God as identified in several Biblical narratives:

In the Bible the divine name is not a formula for the essence of deity but a pointer to experience of his working (Exod. 3:14). The question of the essence thus becomes that of the attributes that characterize God's

working. . . . Thus many qualities of God are manifested in his works. How are we to relate the plurality to the unity of the divine essence? How can the essence be one in the plurality of the attributes?⁴¹

For some time in the history of theology any certain answers to the two questions at the end of that quote were suspended. This is something Pannenberg thinks to have been good.⁴² Only with future developments in philosophy and theology did the matter become less refractory. Concerning the philosophically transcendent nature of questions about the essence of God, who cannot be seen other than in activities or their effects “manifested in his works,” one notes an obvious problem. Who can venture into God’s essence and determine how to explain connections between “essence” and “attributes”? That question seems simply “unanswerable if we view the plurality as a real plurality and ascribe it to the essence which the attributes define.”⁴³ Added to this caveat when discussing any “essence” of God, there are the ostensibly far simpler matters of distinguishing between the essence and attributes of *any thing* or *any person*—much less God.

A thought experiment in which one attempts to explain accurately the essence or attributes of a particularly ornate china teacup, or maybe an especially complex novel or painting—and being certain one is positively correct scientifically, artistically, or philosophically in doing so—can illustrate the problem. The point is that even such apparently simple matters as these are not entirely straightforward. This is true when one is considering not only the object, but also its creator, and how something of that creator may be “seen” in the work. An attribute, Pannenberg makes clear, can be that merely by which we “grasp things”; i.e., that which is external to a thing, or projected onto it by our minds, in order to comprehend it. We are limited by the finitude of our mental ability to judge in that case, as he notes. Only when something *truly* belongs to a thing may we say that the attributes are of its essence, and “not an addition of ours.”⁴⁴ Determining that is difficult, but for Pannenberg it is at least provisionally possible with regard to God.

People are easier to define as regards attributes, since “we ascribe attributes to human persons that describe their external appearance and character and distinguish them from other persons.”⁴⁵ But even then, as Pannenberg argues, “certainly the person is more than the attributes.”⁴⁶ Names were once considered to have magical properties indicating a person’s essence. But now, as proper names are mostly conventional, “the attributes tell us more about the essence of the person than the name does.”⁴⁷ Rather than differentiating people simply by their names, then, we resort to qualities. “Qualities” and “attributes” are both characteristics indicating uniqueness, in making most ordinary distinctions, whether of persons or objects. But again in theology Pannenberg shows that problems have arisen, since

[t]he theological tradition has either really distinguished the divine qualities from the unity of the divine essence and among themselves, or else

distinguished them only conceptually from the divine essence and among themselves so as to preserve the divine unity. Both solutions cause difficulties. Real distinction leads to the contradiction that the attributes are constitutive of the essence. But if they are ascribed to the essence they seem to dissolve the unity. On the other hand, if the distinction is only conceptual we seem to have only an undefined unity.⁴⁸

So whether divine qualities are really to be found in God's essence or not can lead equally to explanatory dilemmas.

Pannenberg eventually states his own position on essence and relation in God.⁴⁹ He has arrived at his stance in conversation with modern science, and takes account of the fact that the doctrine of the Trinity was first crafted using a now outmoded Aristotelian science. This journey, as he retells it, takes one through Gregory Palamas (1298–1358), Latin Scholasticism, and Karl Barth; it features Plato, Aristotle, Hume, Kant, Fichte, Feuerbach, and Schleiermacher, and arrives finally back at Aristotle, Kant, and modern science.

Palamas argued for divine qualities as “uncreated energies,” distinct from the unity of the essence and all that is created, but emanating from the essence. Pannenberg agrees with the opponents of Palamas, contending that we “either have qualities that are not independent but belong to the divine essence or we have a distinct sphere which involves positing a further divine hypostasis alongside the Father, Son, and Spirit, namely the glory or the kingdom as the quintessence of the divine energies.”⁵⁰ Pannenberg sides with Barth against Latin Scholasticism, agreeing that a focus on “divine simplicity” became an unhelpful controlling idol behind many theological formulae.⁵¹ Hume, Kant, Fichte, Feuerbach, and Schleiermacher are employed to illustrate the idea of “projecting” human or finite attributes onto God. According to Pannenberg that eventually led Feuerbach to an atheistic step of saying that something without real attributes “has no effect upon me” and therefore has “no existence.”

Plato and Aristotle are mentioned in the context of discussing Aquinas. Plato had argued for no composition in God's essence, and Aristotle for essences in terms of substances—that which is constant through any changes. For Aristotle, “relations” are not part of an essence (substance), but are accidental. Aquinas rejected the notion of composition in God, thinking of God in terms of absolute simplicity. For this cause, among others, Aquinas considered that God could only be understood as “Trinity” by virtue of faith. In Kant's phenomenology, substance and accident are considered to be under the category of relation. Founders of what has become modern physics (Descartes et al.) posited a geometrical description of nature; i.e., a line, whether from one point or another, is the same regardless of starting point. Modern science dissolves even solids into relations now, “undermining of the older concept of substance.”⁵²

All of this history, changing modern thought on essence and its position regarding relation, affects theology profoundly. “Transcendence” has

also become a revised idea, Pannenberg argues, since even “transcendence” implies a “relation.” So the revised transcendence is not one like Spinoza’s where “God’s transcendence vanishes pantheistically” into nature, nor like Hegel’s, where transcendence is an element in a process of creating and dissolving. Neither is it like transcendence in Whitehead’s metaphysics, appearing as just a “correlate of the concept of the world.”⁵³ Rather, “the divine essence can no longer be thought of as an unrelated identity outside the world.”⁵⁴

The institution of these new categories for discussion, of the introduction of relation into substance, may also pose some problems. But Pannenberg sees the changes as an opportunity to resolve other longstanding difficulties:

In trinitarian theology the principle of the unity of the immanent and economic Trinity in the doctrine of God embraces these relations. But the nature of the unity between the relations of the trinitarian God to the world and his eternal essence remains unclear. A first step toward conceptual clarification is taken with deliberations on God’s essence and existence as the trinitarian persons are seen as forms of the existence of the divine essence both in the world and before it. But how is its existence in the world related to its existence before and above it? In answering this question perhaps the idea of the divine *action* can help us to the degree that action is a mode of being of the one who acts, and it is so in the sense of a being which is outside the self as something else is brought forth by the action, and it is shown and decided who the one who acts is and what he or she can do.⁵⁵

Hence Pannenberg discusses transcendence in terms of the divine action of the persons of the Trinity on the world.

Divine Action and the Trinity

Any doctrine of creation will ordinarily discuss a God, this God’s actions in the universe including our world, and the results of this divine action, and will examine that which is created, considering also any ongoing God–world interactions. Pannenberg does all of this thoroughly in *ST*, volumes I and II.

He begins his doctrine of creation with divine action immediately in *ST*, II. Referring back specifically to his discussions of the subject in *ST*, I, he states: “The doctrine of creation traces the existence of the world to God as its origin by moving from the reality of God to the existence of a world. It does so by means of the concept of divine action.”⁵⁶

In the history of theology, whenever talk of God’s creation or interactions with the world has ensued, “divine action” has in effect been under discussion. Yet “Divine Action” as a theological topic has especially grown in prominence since the 1980s, alongside an increasing interest in interactions between theology and the sciences.⁵⁷ Much of this is prior to and

completely beside the point of Pannenberg's systematic theology. Those with both scientific and theological interests tend to find it important to work out as precisely as possible how any proposed divine action might be envisaged. Owen Thomas published *God's Activity in the World*⁵⁸ in 1983, suggesting several such approaches identifiable to him at that time. Volumes like Keith Ward's *Divine Action*⁵⁹ began to appear circa 1990. These have now been followed by several investigations, including an extensive ongoing series on the matter from the Vatican Observatory and Center for Theology and the Natural Sciences.⁶⁰ Nicholas Saunders' *Divine Action and Modern Science* examined many leading views on the matter, disputing a recently favored view that God works within quantum indeterminacy.⁶¹ With few exceptions most divine action accounts deal with the idea of a monotheistic God in broad terms. This is so even when this God is only remotely recognizable as the Judeo-Christian object of worship, perhaps due to the author's context or manner of discussion.⁶² Less frequently, divine action is considered specifically with regard to the Christian Trinitarian view, with a wish to assign particular roles to each Person of the Trinity.⁶³ A Pannenberg innovation is to do this in extreme detail. He takes up several concerns with regard to Trinitarian divine action in Volumes I and II, which show up in his doctrine of creation overall.

In *ST*, I, these interests include reasons for turning to divine action at all, as well as problems on doing so. In addition to the aid found in divine action for answering questions of how the Trinitarian persons may appear as forms of the divine essence in the world and before it, God's actions may inform one further about the God who is acting. But in considering action, how can we know if or when we might be projecting anthropomorphically onto such a God?⁶⁴

To explore this theme, Pannenberg covers historical developments that saw a change in focus on divine attributes in terms of action. This is distinct from the more traditional grounding of these attributes in creaturely effects. Use of the term "action," particularly in theology, often implies *personal* action,⁶⁵ and "the essence of the subject may be seen in the choice and achievement of the goal, so that the kind of action characterizes the one who acts."⁶⁶ But, as Pannenberg also rightly notes, "the one who acts might reveal by the action only one part of his or her essence"; i.e., a goal or effects may not reveal as much as imagined of the one acting.⁶⁷ To this one could add that an action may not reveal anything definitively of the one acting, other than that he or she has the propensity to act as indicated. And this could be action proceeding from the actor's character and "essence," or could indicate an act entirely accidental. In effect, acts can issue forth from a person without being in every case planned or willed. Even in the case of human beings, the occasional accident, or action out of character, may be impossible to discern from that which is ordinary and indicative of the one acting. The bottom line, again, is the matter of anthropomorphic projection, and when, where, and if it occurs.⁶⁸ There are no universally convincing answers

to these problems. Traditional discussions of God and God's attributes continue to grapple with action in terms of *nous*, *pneuma*, will, and even love. These and other supposed attributes might *all* be explained as human projections, of course.⁶⁹ Pannenberg raises and agrees with arguments that all of these possible objections present serious theological difficulties.

His answers follow two characteristic routes: an appeal to the end of history,⁷⁰ and a resort to the God as revealed indirectly in the course of history as Father, Son, and Spirit. "Only in the light of the end of history will these connections be fully disclosed," he writes, and a bit further adds, "*The three persons of Father, Son, and Spirit are primarily the subject of the divine action. By their cooperation the action takes form as that of the one God.*"⁷¹

We have seen that Pannenberg himself indicates best what his ideas of intratrinitarian relations, the Trinitarian origin of creation, and divine action all look like in the well-developed creation thought of *ST*, II. In this way, the topics of "The Trinitarian Origin of Creation and Intratrinitarian Relations" covered so far are but background aspects of the same themes to follow below. From this point, the themes are developed to show the "Trinitarian Origin of Creation" and "Intratrinitarian Relations" in terms of the "divine action" of the Trinitarian persons.

B. THE TRINITARIAN CHARACTER OF CREATION

Whether God is a Unifier, a Metaphysical Pluralist, or some synthesized mediation of the two would be for Pannenberg directly intertwined with God's Trinitarian character and actions. The character of this God, and the creative interactions of God's Persons—Father, Son, and Holy Spirit—have in Pannenberg's systematic creation certain effects on the character of our world. It is evident that Pannenberg's God is some combination of a God of order and unity, and also the creator and lover of plurality. Both "unity" and "plurality" are required aspects in a Pannenbergian accounting of God and creation. Bearing in mind the physicist unifiers of Chapter 1 and the pluralist philosophy of Cartwright in Chapter 2, how does this work out by comparison, and as a supposed mediation?

Displacing for the moment Nancy Cartwright and metaphysical pluralist concerns that nature might be presented as too orderly, one is encouraged from the outset in Pannenberg's account of divine action in *ST*, II, to see our world as one of determined, albeit contingent, arrangement, after all.⁷² This is so because of its origins as a free creation of the Trinitarian God. These points are established beginning with the first page of Pannenberg's Trinitarian discussion of creation. Because the world is not an emanation of God, it possesses no characteristics of God necessarily. There exists, for example, no automatic "trinitarian-ness" or "diversity-in-unity" inherent in creation. Neither does this necessarily *deny* that the world might contain such characteristics of its creator. But if so, this is not of necessity, nor by

simple causality, or emanation. The world, likewise, did not have to exist at all, as if belonging somehow to God's being, as a part of God. The world and its characteristics result from the free performance of a good God's divine action, of a Trinitarian God's "willing and doing."⁷³ Pannenberg describes the world, from this initial discussion of creation as a free act of God in *ST*, II, as still somehow characterized by the complexities of the Trinitarian God's internal "intratrinitarian" relations, as well as separate outward actions.

Order and Natural Law

In Pannenberg's account, ours is a world ordered, and orderly, by divine decree and action, although by a God more complex than the simple "One" of a straightforward monotheism. There are obvious and unsurprising similarities here between Pannenberg and physicist unifiers; it has been such apparently easy connections that have given rise for several centuries to alliances between monotheism and scientific unification.

Pannenberg's orderly God is intended as the same God gradually understood by Israel to be the author of salvation history. This God is personal; God is a divine being seen to act in establishing cosmic order, and in working to enact relations with human beings—and all of a particularly Trinitarian sort.⁷⁴ Given just these points, still not much in Pannenberg's thought would be beyond the ordinary for many explications of a creation doctrine, from any number of Christian theologians. Even the nuances of Pannenberg's creator God, like the heightened emphasis on relation in God's essence, are not completely unfamiliar, but are matters of degree. But they do still bring to mind possibilities with regard to the dialectical questions at hand. This is due exactly to Pannenberg's emphasis on the "inner divine life" so astutely mentioned by Hefner. Images of God freely fashioning creation after a design related to God's own inner divine life and voluntary interactive preferences can also quickly conjure images of Nancy Cartwright's theological allusions from *DW*.

It helps to recall at this point Cartwright's reimagining of mythical early moments in creation, where she pictures two accounts of how to write the Book of Nature to guarantee consistency. In one story God is very interested in physics, and as a rather reductionist Being lays out the laws and initial conditions, velocities, and positions of every atom in the universe. St. Peter's job of calculating each and every future occurrence, and possible macroscopic property or law to emerge, thus is made relatively easy. Cartwright does not name this God, but this is unquestionably God as Unifier. A second possibility more interesting to Cartwright supposes God to be a Metaphysical Pluralist. In this version God's focus is on laws, and having this predilection writes out carefully each law to be displayed in the universe. St. Peter's job is then far more complicated. To him now falls a momentous responsibility for the arrangement of initial conditions and properties eventuating in a state where all of the laws

are true together.⁷⁵ While the first account would make St. Peter's work lighter, Cartwright delights in entertaining the second, albeit more complex, possibility that "God may nevertheless have chosen to be a metaphysical pluralist."⁷⁶

Is Pannenberg's Trinitarian God a "Unifier" or a "Metaphysical Pluralist"? Pannenberg's answer is not straightforward, despite the attestations of an orderly God from the start of his Trinitarian creation story. His explanations of the character of the natural laws vital for ordering the world, and his later discussions concerning the functioning of Jesus as Logos and the Spirit as the creative force in the world, display substantial agreements with the physicist unifiers, but at least what could be described as a nod toward Cartwright and the metaphysical pluralists. Yet this account is not contradictory. By virtue of a creation with Trinitarian origins and outworkings, Pannenberg achieves a logically consistent account that mediates, as it were, between some of the key positions of the unifiers and pluralists.

A Trinitarian doctrine aside, one relatively unexplored aspect of the concept of natural law, in Pannenberg's opinion, is the relationship between natural law and contingency.⁷⁷ Contingency, and not just regularity, characterizes natural events. Regularity gets the majority of attention, as it can in physical reductionism. The realities of contingency and irregularity are often ignored.⁷⁸ But this choice does not make contingency any less characteristic of real events. Cartwright might have said something like this herself, despite not advocating close theologically realist connections between contingency or order as offered by Pannenberg.

Pannenberg is a realist with regard to the regularities that most people term "laws." But, he hastens to add, "like all forms of process, they have a certain, but principally limited, stability."⁷⁹ This "contingency" Pannenberg defines always as "that which is not necessary on the basis of what is past."⁸⁰

The contingent character of laws in Pannenberg's creation is precisely a theological matter. It derives from an "Israelite-Christian experience of God," which "has the stamp of a personal power, not of a mere structure of laws."⁸¹ This is Pannenberg demonstrating theology as a field-encompassing field. Robert John Russell has observed of Pannenbergian nomological contingency that the concept acts as an important bridge between the Christian doctrine of creation and a natural scientific view of laws.⁸² For theological reasons there is no "law" without "contingency." The root theological significance of contingency for Pannenberg has been described as a "dependence of the world upon God and the challenges (and promises) that come from the natural sciences."⁸³ The theological significance can be affirmed from combining a traditional idea of the world as dependent on God with a reinterpretation of natural scientific understandings in light of this belief. *Creatio ex nihilo*, a notion basic to Christian creation thought, is all about contingency. Dependence on God is the principal affirmation of the Christian creation idea. This includes both the unity of the world as a whole and the plurality of its constituent parts.⁸⁴

Technically, contingency appears in Pannenberg's thought in various ways. Russell has subsumed these under three types: "global," "local," and "nomological." Global and local refer to empirical and ontological claims about the world and its events, while nomological implies laws both natural and historical, inclusive of sub-categories. The categories embrace several distinguishable things, initially "the presupposition behind, as well as a characteristic of, any scientific law." Secondly is "the dependence of historical sequences on their term for meaning," and thirdly, "the first instantiation of new types of sequences." Fourthly, "the dependence of the present on the future as the being of God with its reversal of ontological priority" appears as a kind of contingency often referenced as Pannenberg's *proleptic* idea.⁸⁵

There are two issues, therefore, serving as vital contexts for more precise expositions of how the Son and Spirit function separately, and together, in creation. One is nomological, the other theological. These call for discussions of the uniformity of natural laws with a contingency of the world and its laws as a whole considered historically,⁸⁶ and further discussions of a Trinitarian cooperation in creation. Creation is a free act of the *Trinitarian God by virtue of each member*, Father, Son, and Spirit, in cooperation. Pannenberg describes this cooperative activity by arguing,

[o]n the Christian view creation can be thought of as God's free act because it does not derive from a necessity that flows one-sidedly from the Father, nor from a mistake of the Pneuma, but from the free agreement of the Son with the Father through the Spirit in the act of the Son's self-distinction from the Father, insofar as we have here the transition from the self-distinction of the Son from the Father within the unity of deity to self-distinction from the Father as the one God, and thus to the otherness of a creaturely existence, which is the form of the existence of the Son only in the man Jesus.⁸⁷

The nature of the world created by this cooperation of the plural persons of the Trinitarian God is characterized by both order and contingency by virtue of laws and the nature of God's actions in history.⁸⁸

Beyond *ST*, Pannenberg has included discussions of laws of nature elsewhere. These can be found most prominently in the set of essays edited together as *TTN*.⁸⁹ Pannenberg states plainly in *ST* with respect to the laws of nature ("natural laws"), "The uniform order of the world, insofar as it stands over against the plurality of events as the general forms of their conditions of origin, is that of the natural law that governs phenomena."⁹⁰

The notion of "natural law that governs phenomena" combined with a belief that these laws are aspects of God's creation and governance of the world puts Pannenberg in league with Rom Harré's account in *Laws of Nature* of Kepler, Galileo, Descartes, Boyle, and Newton.⁹¹ Each figure held that laws of nature were, in Harré's terms, "human versions of God-given

edicts.”⁹² Most expressed a connected confidence that through these laws God governed—effectively ordered—nature.⁹³

Pannenberg’s entire system of law and contingency is marked in its Trinitarian orientation by the three primary issues of creation (*Shöpfung, creatio*), conservation or preservation (*Erhaltung, conservatio*), and governance (*Regierung, gubernatio*).⁹⁴ Ted Peters has written of Pannenberg’s approach to these issues, “Although God’s acts are contingent and underivable from any higher principle, they maintain continuity with previous divine actions while opening the future to as yet unforeseeable actions.”⁹⁵ Further detail concerning this mixture of order and contingency with creativity, deriving from the intratrinitarian relations and outward actions of Father, Son, and Spirit, we turn to now.

The Nature and Activities of Son and Spirit

In Pannenberg’s creation, distinct characteristics found in the natural world like unity, plurality, order, or contingency have much to do with the nature and divine activities of Son and Spirit. Pannenberg notes that in his theology, as in that of Irenaeus, “the Son and Spirit are the two hands of God by which he created all things.”⁹⁶ Each has both separate sets of functions and cooperative actions regarding creation, all bearing discernible effects. A succinct version of this drama can be summarized in a couple of sentences, notwithstanding that such a degree of brevity is inadequate for our explanatory needs here: the self-differentiating of the Son from the Father provides the ground for the form of creation “in the distinctiveness of each creaturely form as opposed to others and to God the Creator.” Jesus as Logos, “as the quintessence of such distinctions and relations,” provides also the epitome of the world’s order and unity. The Spirit provides the dynamic character and functioning of the natural world in its orderliness and differentiations, including the evolution and fulfillment of all creaturely forms.⁹⁷

The matter of relation in God’s essence means that each separate function can at once also be understood as the activity of the other. The One God acts in each individual instance and activity. In effect, the mediating function of Jesus in creation is the work also of the Father and Spirit. The Spirit as the ground of dynamic activity in creation is, likewise, at once the activity of the Father and Son. By considering in turn the activity of the Son, the Spirit, and the cooperative activities of these together, a more complete explanation apropos to our broader aims is obtainable.⁹⁸

The Son and Logos in Creation

By the time of *ST*, the concept of Logos had become altogether central to Pannenberg’s theology, especially regarding explanations of how the Trinitarian God interacts with the world as both the “unifier” *and* the principle or author of plurality and “differentiation.”⁹⁹ But given the concept’s long, illustrious, and diverse career in philosophy and theology, one must ask

what Pannenberg means when he wields it in association with Jesus and divine action in creation. The placement of Logos in a brief context will benefit further discussion of Pannenberg's uses.

The idea of Logos had undergone significant evolution to become associated with Jesus as God's pre-existent Word and ordering principle for all of creation. This was evidently a notion present in some circles, or at least individual minds, during the time of John's Gospel (ca. 80–120 ce), as John 1.1ff. indicates. This conceptual trajectory began well before Jesus' birth, approximately with Heraclitus in ancient Greece (ca. 540–480). Many widely attribute Heraclitus with having developed and used the Logos in a pantheistic sense as a universal reason governing and pervading nature. There is some disagreement concerning this. More accurately, one can say that Heraclitus saw all of nature as existing in flux and change, but believed that he detected a universal reason, Logos, acting as a unifying principle governing these constant variations.¹⁰⁰ So Heraclitus' attestations that all things are in flux and change, as well as similar arguments by followers like Cratylus, require qualification.

The disputes between Heraclitus and Parmenides and their disciples are too complex to be reduced to any single point of contention. One might attempt some simplification by acknowledging that both thinkers, contrary to widespread opinion, accepted flux as well as stasis and unity. There was at least somewhat more interplay and agreement between the two thinkers on unity and plurality than is often considered. Still, these categories were decidedly different in each case. For instance, for Heraclitus the flux was real but constitutive of overall unity. Parmenides viewed all flux as pure illusion since he considered everything in existence to be in a state of unified stasis.

Logos developed from these early debates in the minds of the Stoics, is found widely in the Septuagint, and was again brought to the forefront of ardent religious speculation by Philo. By the time John's gospel was written, circa 80–120 ce, Jesus was identified as the Logos of creation. The *logos asarkos*, or eternal dynamic of self-distinction without flesh, was seen as having become actualized in Jesus of Nazareth, now *logos ensarkos*, or Logos become flesh.¹⁰¹ With this move the Logos became closely associated with what would later be the Christian concept of a Trinitarian God. As such, Logos for some time received significant attention among the Church fathers. We owe to Hippolytus, for instance, much of what we know of Heraclitus' writings, particularly of Heraclitus' "Cosmic Fragments," where the cosmological import of the Logos receives extensive discussion.¹⁰²

By the unique Christian meaning and context given to Logos in the Gospel of John and the fathers, Pannenberg approaches the concept for his exposition of a Trinitarian creation in *ST*. A re-narration of creation in light of the growing worship of Jesus found in John's gospel reads:

In the beginning was the Word [Logos], and the Word was with God, and the Word was God. He was in the beginning with God. All things

came into being through him, and without him not one thing came into being.¹⁰³

The passage indicates several emerging conceptual issues, made ever clearer in the verses immediately following, and as John's gospel progresses. For one, Jesus and the Logos were meant by the writer to be identified as one and the same. Jesus was understood to be co-eternal with God, in one of several seed ideas leading eventually to a full Trinitarian doctrine. Jesus was believed to have had a definitive role in creation, with involvement in every single entity or aspect of that which "came into being."

In Pannenberg's recent mature work Logos has come to play a pivotal role in systematic explanations of how the being and activities of the Son in creation affect both plurality and unity, or "distinction" and "order," in the world. The rejuvenation of Logos in Pannenberg's relatively late work, especially given his concerns for scientific interactions, some would surely read as surprising. Beyond Pannenberg and a few theologians and scientists working together to interact on the same matters, concern with the idea of Logos has by now been greatly mitigated, and at turns entirely supplanted, by a widespread awareness of scientific findings. To the science of physics has now been given the domain and expertise of the character, ordering, and functioning of material nature. While this might easily threaten Pannenberg's attempts to offer a reinvigorated Logos for his doctrine of creation, he is not alone in working to revive some version of the idea. In recent publications several thinkers, including John Polkinghorne and Arthur Peacocke, have offered Logos as a theological or philosophical correlate of viable new notions of an intelligible divine action.¹⁰⁴ "Information theory" associated with ideas of Logos or Word in God's speech and activities, along with chaos and complexity theories, are among divine action schemes replacing a prior emphasis on quantum indeterminacy, which has been undermined in recent years.¹⁰⁵

For Pannenberg, Logos represents an ancient philosophical and theological idea. But the concept, lying in direct relation to the Trinitarian doctrine, also provides a vital link to the modern scientific impetus and explorations of physics for unification in nature. Logos and natural law are not the same things, of course, and Pannenberg expresses his awareness of the differences between them as recently as *ST*. There he notes, "[T]he scientific description of reality in terms of natural law must be distinguished from the way in which the divine Logos is the unity of creation in its plurality."¹⁰⁶ Yet the chief differences are theological for Pannenberg, and are in no way inferior to scientific descriptions. Emphasizing the fidelity of Trinitarian theology, he writes,

Because the Logos who permeates the world of creation came to full manifestation in this man, all things in heaven and on earth are summed up in him (Eph. 1:10). As the creative principle of the cosmic order, then,

the Logos is not a timeless universal structure like natural law or a theoretical system of order in terms of natural law. It is the principle of the concrete, historically unfolded order of the world, the principle of the unity of its history. The working in creation of the Logos thus includes its entry into the particularity of creaturely reality, its immanence—better, its intervention—which took place supremely in the incarnation as the Logos so united itself to one individual and distinct creature that it became definitively one with it.¹⁰⁷

Given the strength of Logos in his *ST*, it is interesting that Pannenberg was at one time quite wary of the concept as it is typically used in Christian theology. Eventually he became completely convinced of its relevance, however, granting the provision of an appropriate understanding and articulation within certain boundaries. Timothy Bradshaw predicted this change in perspective when he wrote in the late 1980s, “Pannenberg is still developing his theology. . . .” In the context of noting obvious problems common to the objective idealism with which he associates Pannenberg most closely, Bradshaw added, “he may be evolving the shape of a solution in terms of a new theology of the Logos.”¹⁰⁸

AN EARLY REJECTION AND SUBSEQUENT REHABILITATION OF LOGOS THEOLOGY

Rejection

Jesus was identified as having been routinely considered the “Second Person of the Trinity [and the Logos]” in Pannenberg’s *JGM*, in his opening critique of the ways in which Christologies “from above” had normally been approached.¹⁰⁹ A key problem from Pannenberg’s perspective at the time he wrote that opening critique was the manner in which Christologies had been derived largely from the first chapter in John’s gospel, verse 14. There one reads, “And the Word [Logos] became flesh and lived among us. . . .”¹¹⁰ A more appropriate definition, in Pannenberg’s view, could be found in a passage from Romans, chapter 1, verses 3ff. Romans 1.3ff. begins decidedly “from below” with a genealogical reference: “the gospel concerning his Son, who was descended from David according to the flesh and was declared to be the Son of God with power according to the spirit of holiness by resurrection from the dead, Jesus Christ our Lord. . . .”¹¹¹

Pannenberg’s *JGM* was intended to criticize attempts at a Christology from above. He wanted to offer an alternative methodology to one in which a doctrine of the Trinity was a presupposition, and the usual question posed was, “How has the Second Person of the Trinity (the Logos) assumed a human nature?”¹¹² Three primary reasons Pannenberg considered a Christology from above “not feasible” are offered. The idea of Logos figures prominently among them as problematic. Recounted here in brief paraphrase,¹¹³ these are:

1. A Christology from above presupposes the divinity of Jesus. The most important task of Christology is, however, precisely to present the reasons for the confession of Jesus' divinity. 2. A Christology that takes the divinity of the Logos as its point of departure and finds its problems only in the union of God and man in Jesus recognizes only with difficulty the determinative significance inherent in the distinctive features of the real, historical man, Jesus of Nazareth. 3. There remains one final reason why the method of a Christology "from above" is closed to us: one would have to stand in the position of God himself in order to follow the way of God's Son into the world. As a matter of fact, however, we always think from the context of a historically determined human situation. Therefore, our starting point must lie in the question about the man Jesus; only in this way can we ask about his divinity. How the divine Logos, the Second Person of the Trinity, would be thought of apart from the incarnation and thus apart from the man Jesus completely escapes our imagination.¹¹⁴

In addition to these guiding concerns, Pannenberg elaborates at various points on certain problems, making a truthful set of observations one could take to be the death toll of any possible continuance today of a viable Logos. These are the connected facts that in earlier centuries of Christianity, at the writing of John or the time of the Apologists, the philosophy declaring the cosmos to be unified as a whole through the Logos was held widely. Almost any educated person of that time period understood what the Logos was without requiring extensive explanations.¹¹⁵

Still, Pannenberg felt at the time of writing *JGM* that there were both advantages and disadvantages to the idea as considered by second century Apologists. A prime advantage was that in the Logos theory one has an acceptable, if not superlative, way to describe Jesus' relationship to the Father. With it one can make Jesus' unity with the Father, and at once his differentiation, intelligible.

In the Hellenistic society of the Apologists the Logos was, again, already understood as a power necessary to the world as it was then conceived. To link Jesus with the full power and expression of Logos not only aided the early Christians in understanding and working out for themselves who Jesus might be. It was also a puissant cross-cultural mediating strategy. But there were powerful negatives to use of the theory also. The prevailing Platonic cosmology made subordinationism (the idea that the Logos is subordinate to the Father, or that the Holy Spirit is subordinate to both), which was considered by the early church to be heretical, difficult to avoid. Also, the issue of a potential "loosening" of the vital connection between the divinity of the Son with the historical man Jesus is a great dilemma. Thirdly, Logos Christology, borrowing heavily from a prevailing philosophical tradition rather than emphasizing revelation through the history of the man Jesus, potentially obscured a thorny issue further rather than clarifying a solution.¹¹⁶ Pannenberg

indicated serious misgivings about the “renewal” of Logos Christologies as they appeared after World War I. This was not least because “the figure of a Logos mediating between the transcendent God and the world no longer belongs to today’s scientific perception of the world.”¹¹⁷

Rehabilitation

These concerns notwithstanding, indications of what Bradshaw predicted to be a potential “rehabilitation” of the Logos doctrine in Pannenberg are also in *JGM*. This is long before Logos actually finds its rehabilitated, well-articulated and pivotal form in *ST*. A decade after its original publication, the afterword to the fifth German edition of *JGM* indicated further clear developments in Pannenberg’s thought on the relevant issues:

The trinitarian solution to the task of conceiving the constitution of Christ’s person on the basis of God’s deity cannot be carried through without a renewal of Logos Christology. This is the case because God’s relation to the world as a whole must be taken into consideration in connection with the person of Christ in order to be able to understand Jesus Christ as the incarnation of God. . . .

In the course of these considerations, however, the basis has in fact been laid for a new form of Logos Christology that is eschatologically and historically oriented, even though the Logos concept renewed in this way has not yet become the theme of trinitarian reflection with regard to the incarnational constitution of the person of Christ. After preliminary considerations about a new foundation for the doctrine of God and creation, connected with a clarification of the relation between theology and natural science, this task no longer appears to me as a hopeless undertaking.¹¹⁸

The “task” is undertaken and developed especially in *ST* a couple of decades later, where Pannenberg’s extensive development and “renewal” of Logos appears.

THE SHAPE AND CHARACTER OF PANNENBERG’S LOGOS RENEWAL

Intricate descriptions of the functioning of the Logos in a renewed conception for a creation theology take place primarily in Chapter 7 of *ST*, II. In §1 of that volume on “Plurality and Unity in Creation”¹¹⁹ it becomes clear that the Logos functions both as the principle of the world’s order and unity, which one would expect, but also “as the generative principle of the diversity (and therefore plurality) of creatures.”¹²⁰ Unity and diversity (plurality) in creation are both principally wrapped up in Jesus as Logos. The

presentation is set against the backdrop of the existence of finite creatures, particularly although not necessarily living creatures, and especially human beings, which are the most highly developed among them. This includes the man Jesus, and all others.

Of what might be taken to be the necessary existence of a “plurality of creatures,” Pannenberg writes:

The creation of a reality that is distinct from God, but one that God also affirms and thus allows to share in fellowship with himself, is conceivable only as the bringing forth of a *world* of creatures. A single creature would be too tiny face to face with God’s infinity. As a finite creature it would have no lasting entity. A finite being is limited by other beings, not merely by what is infinite, but by other finite things. It has its distinctiveness only vis-à-vis other finite things. Only in this distinction does it exist. Hence the finite exists as a plurality of what is finite.¹²¹

These initial statements reflect widely referenced thoughts from classical theological history. Surprisingly, Pannenberg does not reference similar lines of thought from Thomas Aquinas, and he could have included John Duns Scotus, mentioned earlier as one of Cartwright’s personal heroes.¹²²

Aquinas and Duns Scotus are both mentioned occasionally in Pannenberg’s accounting of creation, yet not with regard to unity and plurality. Aquinas made much of creation as a diversified reflection of God’s “absolutely simple” (meaning “unified”) nature.¹²³ In his view, each separate occurrence of what Gerard Manley Hopkins later called “inscape” reflects a fractional aspect of God’s overall perfection. In Aquinas’ work, the creatures, or “fractions” of the natural world, speak more of God’s unity than of God’s Trinity or “threeness.”¹²⁴ Considered overall, creation was for Aquinas the complex product of an absolutely simple producer.¹²⁵ Some allusion to this concept in so significant a thinker as Aquinas might be deemed appropriate by a critic. Few theologians in history have taken up these issues with regard to unity and plurality in this manner. Pannenberg wrote his doctoral thesis on Scotus.¹²⁶ Thus a lack of any reference to Duns Scotus on the differentiation of creatures, even if to disagree with him, could seem unusual. Scotus’ emphasis on the principle of *haecceitas* (“thisness”), or the regulation of differentiation between what might otherwise appear to be evident similarities among creatures, is prominent.¹²⁷ Any critiques of this nature notwithstanding, Pannenberg as a senior theologian could also, contrarily, have come to these matters of his own accord and reasons, presented now in his own works.

Pannenberg relates the unifying function of Logos to natural law while carefully differentiating between the scientific and philosophical concepts. The differentiating or diversifying function of Logos he also relates to physical science. This he does by connecting the common relativist cosmological view of “the plurality of finite phenomena to a Big Bang, associating the

plurality of material forms and figures with the expansion of the universe" to Logos.¹²⁸ His theological observation on this is, "It would be in this way that the Logos would work as the generative principle of the diversity (and therefore plurality) of creatures."¹²⁹ The order of the world is an expression of God's wisdom, which may be identified with Logos. At the same time the Logos is also this "generative principle" of the finiteness of all reality. This inherently involves differentiation.¹³⁰

Clues to one possible reason for Pannenberg's avoidance of Duns Scotus and the theory of *haecceitas* could lie in Pannenberg's insistence that the differentiation of one thing from another is grounded in "the self-distinction of the eternal Son from the Father."¹³¹ This would be as opposed to any inherent power of difference within a thing itself apart from the Son. The universal Logos functions in the world inseparably from the activity of bringing forth particular *logoi* in and among the multitude of specific creatures. In keeping with expressed concerns in *JGM* that the Logos was in Hellenistic thought primarily an abstract philosophical idea and problematic for theology, and in an additional effort to differentiate between the Logos and natural law, Pannenberg adds,

The Logos is not the abstract order of the world but its *concrete* order. It is so because in the concept of the divine Logos we cannot separate the eternal dynamic of self-distinction (the *logos asarkos*) from its actualization in Jesus Christ (the *logos ensarkos*). The universal Logos is active in the world only as he brings forth the particular *logos* of each creature, namely, with the "flesh" of each individual person.¹³² With the Logos who permeates the world coming to reside in its ultimate manifestation in the man Jesus, all of heaven and earth are summed up in him (Ephesians 1.10).¹³³

He begins approximately halfway through the fifteen pages of §1 a transfer of attention to several matters relating to the processes of history. These are never far from his mind, given an eschatological orientation. They provide for him an effective focus toward the eventual end of explaining the creative work of the Spirit. The Logos is of primary importance in Pannenberg's reinterpretation of creation in trinitarian terms. But the intra-trinitarian functioning of Son (Logos) with Spirit is an inseparable matter and also key. Mention is made not only of history and eschatology, but also again of contingency and natural law, of the ultimate goal of creation as "the participation of creatures in the trinitarian fellowship of the Son with the Father." Nomological regularity is necessary for the development in time of forms independent of their God. This regularity of nature's laws, which the Trinitarian God "has bound his creative action to," actually facilitates, rather than inhibits, God's ability continually to create (*creatio continua*) and bring forth that which is new. Natural laws are constituted by what may properly be called open, rather than closed, systems. By this characteristic

the laws “have an indispensable ministering function” in that which Pannenberg reads as a “trinitarian history of creation.”¹³⁴

The unifying Trinitarian God uses laws of nature to create plurality. By Pannenberg’s understanding and accounting, the laws certainly exist; they clearly have unifying functions in addition to contributing overall to plurality (as opposed to a roughshod accounting only concerned with demonstrating unity), and are in no perceptible state of disarray. So concerning laws, Pannenberg appears to display alliances and disagreements both with unifying physicists, as demonstrated in Chapter 1, and with Cartwright, as shown in Chapter 2. Pannenberg’s concern is to demonstrate how unity and plurality function together, as this best fits his understanding of the *Trinitarian* God as Creator.

THE CREATIVITY OF THE SPIRIT IN CREATION

It is within the context of discussing the cooperative activity of Son and Spirit in creation that Pannenberg references Irenaeus and the notion of their collective divine works as the “two hands of God.”¹³⁵ Pannenberg concurs with Irenaeus’ view implicitly and openly,¹³⁶ as indicated in a lengthy section on “The Spirit of God and the Dynamic of Natural Occurrence.” There Pannenberg sets about to complement his discussion of the Logos as both the principle of unity and differentiation in creation with a discussion of the Spirit’s shared functions.¹³⁷ In a sense his entire Trinitarian theology of creation, with its unusual characteristics, rests on his ability to show how the Son and Spirit cooperate together in creation. This he takes up briefly, although explicitly, in several pages late in Part II.¹³⁸ Tacit additions and nuances to this explicit section are easily spotted throughout the entirety of Chapter 7. One could read Pannenberg at this point to be violating somewhat his own observation in Volume I, that the distinctions between Son and Spirit were not very clear in the inchoate theology of the second and third centuries. That early lack of distinction, we learn from Pannenberg, resulted in repeat instances of a default “cooperation,” if not a confusion of roles. Any such early perplexity, Pannenberg eventually makes clear, was principally for lack of the more skillful or informed delineations we now either have access to, or possess the knowledge to construct.¹³⁹ All of that considered, one of the remaining issues in creation that Pannenberg sets for resolution is precisely to demonstrate how it might be that a divine collaboration between Persons works itself out in his system. In so doing, Pannenberg bears the early history and its problems in mind.

As with the Logos, his aim is to improve on earlier deficient efforts, this time with regard to the place of Spirit for the purposes of ameliorating a Trinitarian account of divine action. He elects this over diminishing or avoiding the matter altogether. To deny a full and detailed Trinitarian account would be easier, and to many preferable, particularly within the parameters of a

theology seeking some conciliation with modern scientific viewpoints. But that maneuver would not be in keeping with Pannenberg's goal of presenting a systematic account "more thoroughly trinitarian than any example I know of." The latter chosen option is especially consequential given his sentiments that both the internal hidden relations of Son and Spirit and their outward activities have everything to do with the character of creation.

*The Logos is generative of diversity, and mediates the unity and order of particularity among the sequence of forms of creatureliness. The Spirit mediates the very working of the Logos in both creation and the Incarnation.*¹⁴⁰ *The Spirit is "the creative principle of movement as well as life," or, "the life-giving principle, to which all creatures owe life, movement, and activity."*¹⁴¹ Later, Pannenberg puts the collaborative activity in other terms, writing,

Whereas the creative dynamic in the events of creation relates to the Spirit, the Logos is the origin of the distinguishing form of the creature in the totality of its existence and in the ensemble of distinctions and relations of creatures in the order of nature. *But we cannot separate the creative dynamic [the Spirit] and the specific form of its expression [the Logos]. The two go together in the act of creation.* In the first creation story this fact comes to expression in the idea of the creative speaking of God by which the dynamic of his Spirit becomes the origin of the specific creaturely reality.¹⁴²

In Pannenberg's arguments, God and all of creation are guided by an impulsion toward a future consummation of the Kingdom of God. Everything in the world is permeated with purpose by virtue of its Creator and the eschatological endpoint toward which the Creator is taking it. That which is created comes from this "future of God" and is on course to return to its point of origin in fulfillment.¹⁴³ The work of the Spirit is replete with notions of a "consummation in the kingdom of God" at a coming point in creation history. This historical-eschatological orientation relates closely to Pannenberg's primary theses since the early 1960s.¹⁴⁴

No such teleological inclinations exist in physics and its talk of laws of nature and forces regulating the world today. This is despite the illustrious manner in which scientists as late as Newton or Faraday, and even Einstein more than is supposed, tended to blend their science with metaphysical or religious views formally or materially.¹⁴⁵ Some recent primary unifying physicists like Steven Weinberg have made a regular habit of noting that talk in physics is now oblivious to notions of ultimate or intelligent purposes.¹⁴⁶ But there is still a scientific correspondence to be accounted for in relation to natural laws, which Pannenberg connects with the work of the Spirit and which he considers may call for a "fresh formulation of physical cosmology." This is how a "field theory relates to the evolution of life,"¹⁴⁷ processes which are by no means bereft of purpose, even if not of a divine variety. The evolution of life on earth Pannenberg connects closely with the Spirit's works.

Pannenberg's efforts to relate the idea of "spirit" or the Holy Spirit to physical theories of "fields of force" in this manner are well known. He begins almost immediately in the section on cooperation, after a few Biblical references relating the Spirit to "life," with such assertions. One notes his care in proceeding, however, in *ST*, following criticism of his earlier efforts with "fields of force." He has grown cautious after years of speculation concerning how erroneous his theories in this regard may have been. "The principal differences between the ways of describing reality in physics and in theology prohibit us from offering a direct theological interpretation of the field theories of physics," he states in *ST*.¹⁴⁸

In a series of articles in *Zygon*, Pannenberg gives a standard explication of these issues; careful criticisms are then offered by physicist John Polkinghorne, and counter-critiques are then entered by Pannenberg.¹⁴⁹ Philip Hefner has a turn after the exchanges offering his own thoughts on the matters.¹⁵⁰ Pannenberg's arguments both in *Zygon* and *ST* are based on the fact that the biblical concept of *spirit* (*pneuma*) and the Stoic concept of *pneuma* are similar. Physicist Max Jammer has argued that the Stoic *pneuma* concept is the immediate precursor to the field concept in modern physics, possibly warranting a serious comparison. Pannenberg proceeds to effect such a comparison by relating the divine eternity and immensity of God to the physical concepts of space and time. These concepts are presupposed in any and "all concepts of parts of space or time (or space-time), therefore in all mathematical and physical measurement."¹⁵¹

The concepts are different, of course, in that the Stoic version of *pneuma* refers to a cosmic principle, while the biblical idea is one of a divine creativity transcendent of the world though working in it.¹⁵² Even so, Pannenberg has judged there to be enough similarity for deeper investigations, referencing the necessary mediating function of philosophy between science and theology rather than a dialogue based on either straightforward scientific or religious discourse. These moves avoid the Platonic notion of a divine mind, *Nous*, which some, like Origen, have identified with the idea of God as *pneuma*.

On these exact points Pannenberg and Polkinghorne have exchanged criticisms for a number of years.¹⁵³ Polkinghorne agrees that philosophy is a vital mediator between theology and science, but disagrees over whether a "field" is a material or immaterial entity. He argues for the former, as fields are carriers of both energy and momentum.¹⁵⁴ They agree that contingency is an important category for allowing time "to be taken seriously as a source of novelty." But Pannenberg sticks to field theory, and Polkinghorne expresses what may be read as pleading for an "appropriate metaphysical interpretation of quantum theory and chaos theory."¹⁵⁵

Pannenberg's reply displays again his desire not to give automatic prevalence to a scientific over a theological viewpoint. Why is it that a theologian cannot at least offer ideas that call for a reformulated or extended use of field language, as in describing fields as functioning "in a holistic perspective

of natural processes that might also account for the rise of complex forms of creatures"?¹⁵⁶ This matter and the related issue of contingency serve below as bases for further investigations and critiques of Pannenberg's connections between fields and a novel development of forms. It has been characteristic of his critiques and "questions to scientists" to pose these challenging sorts of queries and bold counter-critiques.¹⁵⁷

Pannenberg's understanding of the Spirit's activity intertwined with that of the Logos toward not only the unity and differentiation of creatures, but also the development and novelty of forms in the evolution of creatures, are among the most promising aspects of Pannenberg's doctrine of the Spirit's part in creation. These represent also some of the most promising aspects of his entire Trinitarian doctrine of creation for potential further development.

Section three of Chapter 7 in *ST*, II, on "Sequence of Forms," is dedicated to a furtherance of the issue of evolution and God's creative activity in the light of extensive explanations and hypotheses regarding Logos and Spirit preceding it. Engagement with figures like Darwin and Teilhard de Chardin, although occasional in *ST*, do appear in clear efforts to ground theological hypotheses with acceptable and authoritative scientific information.¹⁵⁸ Pannenberg's entire chapter on a Trinitarian creation ends unsurprisingly with a discussion of eschatology. Pannenberg writes, "Creation and eschatology belong together because it is only in the eschatological consummation that the destiny of the creature, especially the human creature, will come to fulfillment."¹⁵⁹

In addition to the "concrete" aspects of Pannenberg's Trinitarian creation presented here, there are discussions of "abstract" matters scattered over several of Pannenberg's works besides *ST*. These include the matter of a *Grundprinzip*, or basic principle, from which to view the entire corpus of his thought. This is given brief consideration below in Chapter 5. More importantly, first are discussions from Pannenberg's "Whole and Part" epistemology showing additional ways in which he has likewise considered the matter of unity and plurality in the context of scientific discussions of our world. Pannenberg develops "wholes" and "parts" into additional considerations of unity and plurality toward a further category of "meaning." In this way, too, he can be understood to mediate between extreme "unifier" or "pluralist" viewpoints.

Still, pressing questions present themselves now at the end of these supposed indications of a hypothetical Pannenbergian synthesis. We have seen ways in which Pannenberg's scientifically informed concepts of a Trinitarian God, and a Trinitarian-enhanced creation, might be understood to synthesize certain dialectical problems between a unifying physics and a pluralizing philosophy of science on divine and natural order. Pannenberg's argument (in Ted Peters' terms) is for theology as a "field-encompassing field," capable of coherently integrating itself and harmonizing disparate data from other disciplines. Whether stated hypothetically or not, one can ask, however: how far in a world beyond the parochial considerations of theology can such

supposed mediations extend toward actually resolving a conflict between physicists and philosophers of science? Even if presuming some such synthesis to have merits, what are the limits of dialogue between the three sets of disciplines and thinkers involved, both generally for cross-disciplinary reasons, and in the specific cases represented here?

NOTES

1. Peters, "Pannenberg on Theology and Natural Science," 7.
2. Richard L. Kirkham, "Realist and Nonrealist Theories of Truth," in *Theories of Truth: A Critical Introduction* (Cambridge, MA: MIT Press, 1992), 73–79. The terms "real" and "state of affairs" have specific meanings in philosophical discussions. In distinguishing between realist and nonrealist theories of truth, realist theories argue that a state of affairs can be asserted with a declarative statement, and that anything real exists not just as a mental entity. Considering Pannenberg, we begin to ponder his proposals that would say each side of our dialectic could be seeing mind-independent truths about the world. Whether or not one should conclude this by the end is a separate matter.
3. Philosopher Rom Harré, at an Oxford University seminar, explained the long-standing existence of "One or Many" disagreements by arguing that these could simply be due to the dynamics of "personality bent." One could argue on that basis that such disputes in their essence may never be settled.
4. Stephen Toulmin, *Cosmopolis: The Hidden Agenda of Modernity* (New York: The Free Press, 1990), 180–181. Murphy discusses differences between modern and postmodern thought in *Anglo-American Postmodernity*, 10. Modernity has preferred discussion of the theoretical, general, universal, and timeless. Postmodernity is marked by a preference for the particular, local, timely, and practical.
5. See Keith Ward's *Religion and Creation*, where one can see a variety of unifying and diversifying perspectives appearing across several religious contexts.
6. Wolfhart Pannenberg, ed., *RAH*, trans. David Granskou (New York: Macmillan, 1968; London: Sheed and Ward, 1969). Originally published in German as *Offenbarung als Geschichte* (Göttingen: Vandenhoeck und Ruprecht, 1961).
7. This group came to be known as the "Pannenberg Circle," with Pannenberg the systematic theologian among the contributors to *RAH* with whom the fresh conception of revelation became most associated.
8. Pannenberg, *RAH*, 135.
9. In the preface to the American edition of *Offenbarung als Geschichte*, the authors stated, "This reinterpretation of the idea of revelation is directed against both the Barthian and the Bultmannian understanding of the word of God as the basis of the theology." See "Preface to the American Edition," Wolfhart Pannenberg, ix–x.
10. Pannenberg has credited his colleague Rolf Rendtorff, a Hebrew Bible scholar, with the initial impetus toward understanding revelation as God indirectly revealing God via historical events. E. Frank Tupper, "The Task of Contemporary Systematic Theology," in *The Theology of Wolfhart Pannenberg* (Philadelphia, PA: Westminster Press, 1973), 23.
11. James M. Robinson, in *Theology as History*, ed. James M. Robinson and John Cobb, Jr. (New York: Harper & Row, 1967), 12–13.
12. It is difficult to know an exact number for each category, but by 1988 it was known, for instance, that at least 32 English-language doctoral theses had been

- focused primarily upon Pannenberg, in addition to the number of scholarly articles and books concerning his work. *The Theology of Wolfhart Pannenberg: Twelve American Critiques, with an Autobiographical Essay and Response*, ed. Carl E. Braaten and Philip Clayton (Minneapolis, MN: Augsburg, 1988), especially Stanley J. Grenz, "The Appraisal of Pannenberg: A Survey of the Literature," 19–52.
13. E.g., claims made by Pannenberg throughout *TPS* (1976), *TTN* (1993), and in the more recent 3-volume *ST* (1991–1998; German ed. 1988–1993).
 14. *TPS*, 283, 296, 303, 309, 330, 332, 368, 380, 388, 423–424.
 15. *TPS*, 296.
 16. *TPS*, 303.
 17. Peters, "Pannenberg on Theology and Natural Science," 7.
 18. Stewart, *Reconstructing Science and Theology in Postmodernity*, 24.
 19. Conversations with specialists including Timothy Bradshaw at the University of Oxford have confirmed a relative lack of evaluation on this aspect of Pannenberg's work.
 20. E.g., Christiaan Mostert, *God and the Future: Wolfhart Pannenberg's Eschatological Doctrine of God* (Edinburgh: T&T Clark, 2002), 168ff. Pannenberg's creation in *ST*, II, receives some treatment, including the ideas of "whole" and "part" appearing in works prior to the *ST*. But connections between these ideas and the unities and pluralities of Pannenberg's creation are not a focus. Mostert writes, "Many of his early ideas are found in the completed material on creation. It is beyond the scope of this chapter to present an outline of this material; the focus is on the idea of creation from the future" (168).
 21. E.g., Wentzel van Huyssteen, "Truth and Commitment in Theology and Science: An Appraisal of Wolfhart Pannenberg's Perspective," in *Beginning with the End: God, Science, and Wolfhart Pannenberg*, ed. C. Albright and J. Haugen (Peru, IL: Open Court Publishing Company, 1997), 360–377, or Ted Peters' editor's introduction to Pannenberg, *TTN* (Louisville, KY: Westminster John Knox Press, 1993), 1–14. An example of the corresponding issues in the work of Pannenberg can be seen in "Theological Questions to Scientists," in *TTN*, 15–28.
 22. E.g., Willem B. Drees, "Contingency, Time, and the Theological Ambiguity of Science," in *Beginning with the End*, ed. C. Albright and J. Haugen, 217–247. The issues appear in Pannenberg's works in several places, such as "Contingency and Natural Law," in Pannenberg, *TTN*, 72–122.
 23. E.g., John Polkinghorne, "Fields and Theology: A Response to Wolfhart Pannenberg," in *Zygon* 36.4 (December 2001): 795–797. Pannenberg addresses "spirit and field" in many places, among them "The Doctrine of the Spirit and the Task of a Theology of Nature," "Spirit and Energy: The Phenomenology of Teilhard de Chardin," and "Spirit and Mind," consecutive essays in Pannenberg, *TTN*, 123–161.
 24. Pannenberg, "The Creation of the World," chap. 7 in *ST*, II, 1–161.
 25. This intention was made clear nearly one decade prior to the publication of *ST*, I, in the original German edition (Vandenhoeck & Ruprecht, 1988), and a full decade prior to the appearance of the first English translation (Eerdmans, 1991).
 26. Pannenberg, "God's Presence in History," in *The Christian Century* (11 March 1981): 263.
 27. Philip Hefner, "Pannenberg's Fundamental Challenges to Theology and Science," *Zygon* 36.4 (December 2001): 801–808.
 28. Pannenberg claims theology to consist precisely of "untestable hypotheses" that are provisional for now, but which should become clear at the end of all history.

29. Hefner, "Pannenberg's Fundamental Challenges to Theology and Science," 806.
30. Ibid.
31. In *ST*, II, chap. 7, "The Trinitarian Origin of the Act of Creation," is §3 of I: Creation as the Act of God (20–35); "Plurality and Unity in Creation" is §1 of II: The World of Creatures (61–76); "The Spirit of God and the Dynamic of Natural Occurrence" is §2 of II: (76–109); and "Cooperation of Son and Spirit in the Work of Creation" is subsection "e" of that same larger division, §2 of II (109–115).
32. *ST*, II, 5.
33. As in "Plurality and Unity in Creation," *ST*, II, §1, 61–76.
34. Pannenberg, "Theology and the Categories 'Part' and 'Whole,'" in *Metaphysics and the Idea of God* (Grand Rapids, MI: Eerdmans, 1990), 143–144. This work hereafter appears as *MIG*. Originally published in German as *Metaphysik und Gottesgedanke* (Göttingen: Vandenhoeck & Ruprecht, 1988).
35. Hefner says that Pannenberg "introduces" relation, but it is more accurate to say "emphasizes," though this is to an extraordinary degree. Relation was introduced by a longer process that predates Pannenberg, which he recounts himself. The way that Pannenberg discusses God's inner life in so much detail, and relates it with such particularity to creation, is more accurately nameable as "introductory."
36. Ward, *Religion and Creation*, 321–329. Ward writes, "Much contemporary Trinitarian thought deploys the notion of a 'social Trinity,' thinking of God as a society of persons in loving relationship" (321). He includes Pannenberg as a major contributor to this movement.
37. E.g., Ted Peters in *God as Trinity* (Philadelphia, PA: Westminster Press, 1993), 136ff., indicates that Pannenberg emphasizes relationality more acutely in his Trinitarian thought than anyone prior to him.
38. One example prior to Pannenberg's work on what he terms "this dialectic in the relation of essence and attributes" is in Hegel, *Science of Logic*, II, 484ff.
39. Shults, *The Postfoundationalist Task of Theology* (Grand Rapids, MI: Eerdmans, 1999), 98.
40. Colin Gunton, *The One, the Three, and the Many: God, Creation, and the Culture of Modernity* (Cambridge: Cambridge University Press, 1993). References to "relation" are numerous in Gunton's book, and include detailed applications of the meanings inherent in relation and relationality.
41. *ST*, I, chap. 6, "The Unity and Attributes of the Divine Essence," 360.
42. *ST*, I, 360–361.
43. Ibid., 360.
44. Ibid.
45. Ibid., 360–361.
46. Ibid., 361.
47. Ibid.
48. Ibid.
49. *ST*, I, 360–367.
50. *ST*, I, 362.
51. Cf. Barth's *Church Dogmatics*, II/1, 329.
52. *ST*, I, 361–366. Pannenberg covers all of this development before arriving finally at "divine action."
53. *ST*, I, 367.
54. Ibid.
55. Ibid.
56. *ST*, II, 1. Pannenberg footnotes instructions to "See vol. I, 367ff., 384ff."

57. Important examples prior to the 1980s include the work of A. N. Whitehead (*Process and Reality*, 1929) and Charles Hartshorne (*Reality as Social Process*, 1953) on "process thought," and more recently Ian Barbour in *Issues in Science and Religion* (1966).
58. Owen C. Thomas, ed., *God's Activity in the World: The Contemporary Problem* (Chico, CA: Scholars Press, 1983).
59. Keith Ward, *Divine Action* (London: Collins, 1990).
60. Robert J. Russell et al., eds., *Scientific Perspectives on Divine Action Series* (Berkeley, CA: Vatican Observatory and CTNS), including *Quantum Cosmology and the Laws of Nature* (1993), *Chaos and Complexity* (1997), *Evolutionary and Molecular Biology* (1998), *Neuroscience and the Person* (1999), and *Quantum Mechanics* (2001).
61. Nicholas Saunders, *Divine Action and Modern Science* (Cambridge: Cambridge University Press, 2002). Excerpts from Saunders' research, originally his Ph.D. thesis at Cambridge University, appeared as "Does God Cheat at Dice? Divine Action and Quantum Possibilities," *Zygon* 35 (2000): 517–544. Wesley Wildman has appraised the overall "Divine Action" project of CTNS and the Vatican Observatory, and mentions Saunders briefly in "The Divine Action Project, 1988–2003," *Theology and Science* 2.1 (April 2004): 31–75.
62. As in the work of Arthur Peacocke, *Theology for a Scientific Age* (Minneapolis, MN: Fortress Press, 1993), who discusses God in terms of Logos, Spirit, etc., and later in *Paths from Science toward God* (Oxford: Oneworld, 2001) discusses God as "One—but a diversity-in-unity" (129ff.), and as Father, Son, and Holy Spirit (167ff.).
63. E.g., Denis Edwards, "The Discovery of Chaos and the Retrieval of the Trinity," in *Chaos and Complexity*, ed. Robert J. Russell et al., 157–175, and in that same volume, Jürgen Moltmann, "Reflections on Chaos and God's Interaction with the World from a Trinitarian Perspective," 205–210.
64. *ST*, I, 367.
65. Of course, real and impersonal action, like acceleration due to gravity, also exists.
66. *ST*, I, 369.
67. *Ibid.*
68. *ST*, I, 368–370. Pannenberg considers Herman Cremer's brief *Die christliche Lehre von den Eigenschaften Gottes* of 1897 for illustrating these and related problems.
69. *ST*, I, 384–396.
70. *ST*, I, 388.
71. *Ibid.* Emphasis mine.
72. *ST*, II, chap. 7, "Plurality and Unity in Creation," 62ff. There are no published instances of Pannenberg engaging Cartwright or any of the prominent "metaphysical pluralists" directly. But that some of his claims deny, and some sanction, aspects of Cartwright's account becomes clear not far into his descriptions and arguments of natural law and plurality in creation.
73. *ST*, II, chap. 7, 1.
74. *ST*, II, chap. 7, 11.
75. *DW*, 33.
76. *Ibid.*
77. Peters, editor's introduction to Pannenberg, *TTN*, 9.
78. *Ibid.*
79. Pannenberg, "Contingency and Natural Law," in *TTN*, 108.
80. *Ibid.*, 116.
81. *Ibid.*, 113.
82. Robert John Russell, "Contingency in Physics and Cosmology: A Critique of the Theology of Wolfhart Pannenberg," *Zygon* 23.1 (March 1988): 23–43.

83. *Ibid.*, 24.
84. Pannenberg, "The Doctrine of Creation and Modern Science," *Zygon* 23.1 (March 1988): 3–21.
85. Russell, "Contingency in Physics and Cosmology," 24.
86. Pannenberg, "Contingency and Natural Law," in *TTN*, 76.
87. *ST*, II, 31.
88. *ST*, II, 8–9. A more complete discussion of "The Trinitarian Origin of the Act of Creation" appears in vol. II, 20–35.
89. Laws of nature are discussed in several of the essays, but most pointedly throughout chap. 4 on "Contingency and Natural Law," 72–122.
90. *ST*, II, 62.
91. Rom Harré, *Laws of Nature*, ed. Roy Harris, Interpretations Series (London: Duckworth, 1993).
92. *Ibid.*, 9–10.
93. *Ibid.*
94. *ST*, II, 35ff. Ted Peters discusses this scheme in *TTN*, 11.
95. Peters, *TTN*, 10.
96. *ST*, II, 109.
97. *Ibid.*
98. *Ibid.* Pannenberg attempts to summarize his creation scheme.
99. Discussions of Logos begin in the very first paragraph of the first page of *ST*, I, and maintain an importance in all three volumes.
100. See Pannenberg, *Jesus—God and Man* (Philadelphia, PA: Westminster John Knox Press, 1977), 160ff., where Pannenberg discusses this history in the context of expounding a classical Logos Christology. Hereafter appearing as *JGM*. Cf. *ST*, II, 292ff.
101. Cf. *ST*, II, 63.
102. *Heraclitus: The Cosmic Fragments, with Introduction, Text, and Translation*, ed. G. S. Kirk (Cambridge: Cambridge University Press, 1954).
103. *The Gospel of St. John*, 1.1–2 (ca. 80–120 ce), New Revised Standard Version.
104. See Polkinghorne, *Faith, Science, and Understanding* (London: SPCK, 2000) and *Belief in God in an Age of Science* (New Haven, CT: Yale University Press, 1998), and Peacocke, *Paths from Science toward God* (Oxford: Oneworld, 2001) with regard to Logos, Word, and divine action.
105. See John Polkinghorne, "The Metaphysics of Divine Action," 148–156, and Arthur Peacocke, "God's Interaction with the World," 263–287, in *Chaos and Complexity: Scientific Perspectives on Divine Action*, ed. Robert J. Russell et al. (Berkeley, CA: CTNS & Vatican Observatory, 1997).
106. *ST*, II, 63.
107. *Ibid.*
108. Bradshaw, *Trinity and Ontology*, 344.
109. Pannenberg, *JGM*, 33ff. Pannenberg had in mind several figures and trends in ancient Christianity, and particularly Karl Barth in the modern period. From Ignatius of Antioch and the Apologists, a Christology "from above" had been much more common in the early church. The Alexandrian Christology of Athanasius and that of Cyril in the fourth and fifth centuries, as well as some New Testament concepts indicating a descent of the Son of God from above and into the world, also count in the development of Christologies from above.
110. *The Gospel of St. John*, 1.14, New Revised Standard Version.
111. *The Letter of Paul to the Romans*, 1.3–4, New Revised Standard Version.
112. *JGM*, 34.
113. In *JGM* these points take a couple of pages.
114. *JGM*, 34–35.
115. *Ibid.*, 168.

116. Ibid., 163–166.
117. Ibid., 166.
118. Ibid., 409. Pannenberg still had the two primary reservations that a renewed Logos should not be constructed as a “personalistic and authoritarian theology of the word,” and held to an earlier criticism that the Son of God should not be simply associated with a “definite concept available in the philosophical world at that time.”
119. *ST*, II, 61–76.
120. Ibid., 61.
121. Ibid. Pannenberg's emphasis.
122. *DW*, 104.
123. Thomas Aquinas, *Summa Theologiae*, trans. and ed. Timothy McDermott. Thomas Gilby, 1a. 3 through 1a. 4, 3 in vol. 2, “Existence and Nature of God,” Blackfriars Edition, 61 vols. (London: Eyre and Spottiswoode, 1964–1981): 19–59. Also, “Creation, Variety, and Evil,” 1a. 45 in vol. 8: 24–63 on creation. Aquinas' writings are replete with the idea of creation. References to God's unity and nature's diversity, and unity and diversity generally, occur over and again in various sections.
124. Thomas Aquinas, *Summa Theologiae*, 1a. 45, 7 in vol. 8: 55.
125. Philosopher Norman Kretzmann puts it this way in part two of his two-volume work on Aquinas's ideas concerning creation, *The Metaphysics of Creation: Aquinas's Natural Theology in Summa Contra Gentiles II* (Oxford: Clarendon Press, 1999), 196.
126. Wolfhart Pannenberg, *Die Prädestinationslehre des Duns Scotus in Zusammenhang der scholastischen Lehrentwicklung* (Göttingen: Vandenhoeck & Ruprecht, 1954).
127. John Duns Scotus, *Philosophical Writings* (Indianapolis, IN: Bobbs-Merrill Educational Publishing, 1962).
128. *ST*, II, 61.
129. Ibid.
130. *ST*, II, 62.
131. Ibid.
132. *ST*, II, 63. Pannenberg explains this idea in more detail in *ST*, I, 263ff. and 310ff., in developing the doctrine of the Trinity.
133. Ibid.
134. *ST*, II, 73.
135. Irenaeus, *Against the Heresies*, 4.20.1 and 4.20.3. Pannenberg discusses Irenaeus' use of the terminology in *ST*, II, 109, and in *ST*, I, 270ff.
136. *ST*, II, 109, where Pannenberg writes, “As Irenaeus said, the Son and Spirit are the two hands of God by which he created all things.”
137. *ST*, II, 76–136.
138. *ST*, II, 109–115, “Cooperation of Son and Spirit in the Work of Creation.”
139. *ST*, I, 270–271. These two pages give vital background information to Pannenberg's deliberations concerning the activity of Son and Spirit together in creating.
140. *ST*, II, 110–114. Emphasis mine.
141. Ibid., 79 and 76. Emphasis mine.
142. Ibid., 110. Emphasis mine.
143. Ibid., 109.
144. Since *RAH* in 1961. See *ST*, II, 109.
145. See chap. 1 in this volume, and Jammer, *Einstein and Religion*, for more on Einstein and the impact of religion upon his physics.
146. In *The First Three Minutes*, Steven Weinberg states, “[T]he more the universe seems comprehensible, the more it seems pointless.” He recounts this in

Dreams of a Final Theory, 255, commenting similarly on 245 that “premature as the question may be, it is hardly possible not to wonder whether we will find any answer to our deepest questions, any sign of the workings of an interested God, in a final theory. I think that we will not.”

147. *ST*, II, 109.
148. *ST*, II, 83.
149. Pannenberg’s initial essay is “God as Spirit—and Natural Science,” *Zygon* 36.4 (December 2001): 783–794. An essay offering some version of the same issues is “The Doctrine of the Spirit and the Task of a Theology of Nature,” in *TTN*, ed. Ted Peters, 123–137. Polkinghorne’s reply, “Fields and Theology: A Response to Wolfhart Pannenberg,” appears also in *Zygon* 36.4, 795–797, and in that same volume Pannenberg’s counter-critique, “Response to John Polkinghorne,” 799–800.
150. *Ibid.*, Hefner, “Pannenberg’s Fundamental Challenges to Theology and Science,” 801–808.
151. Pannenberg, “God as Spirit—and Natural Science,” 783 and 790.
152. Pannenberg, “The Doctrine of the Spirit,” 787.
153. See John Polkinghorne, *Belief in God in an Age of Science* (New Haven, CT: Yale University Press, 1998), 82, and an earlier critique by Polkinghorne in a separate issue of *Zygon* (34 [March 2001]: 23–43), “Wolfhart Pannenberg’s Engagement with the Natural Sciences.”
154. Polkinghorne, “Fields and Theology: A Response to Wolfhart Pannenberg,” *Zygon*, 36.4 (December 2001): 796.
155. *Ibid.*, 797.
156. Pannenberg, “Response to John Polkinghorne,” 800.
157. See Pannenberg, “Theological Questions to Scientists,” in *TTN*, 15–27.
158. A greater engagement with Teilhard de Chardin appears as “Spirit and Energy: The Phenomenology of Teilhard de Chardin,” and de Chardin figures prominently in “The Doctrine of the Spirit and the Task of a Theology of Nature,” both consecutively (in reverse order as I list them here, giving preference to the amount of space dedicated to de Chardin) in Pannenberg, *TTN*, 123–147.
159. *ST*, II, 139.

4 Material Limits

The unifying physicists, Cartwright, and Pannenberg all apparently consider the same matters. These are unity and plurality in the natural order centering on concepts of laws of nature, and the possible God behind these phenomena. We have seen initial indications of how Pannenberg's Trinitarian creation is conceivably relevant to the physics/philosophy dialectic by way of numerous contact points. His work, by way of intrinsic material and methodological factors, might even be argued to synthesize some aspects of the dialectic.

A kind of testing of these proposals now begins by demonstrating material limits on the contact points and idea of synthesis. The principal aim is to show that the occurrences of similar concerns across the materials of the several disciplines, while noteworthy, can be deceptive. Despite appearances, limits occur in how the physicists, Cartwright, and Pannenberg define and use the concepts apparently shared between them. They are often not discussing quite the same things even when using the same terms. This is a more impactful distinction than simply disagreeing about the same things. An additional aim is to show that similarities, contact points, and intriguing apparent syntheses do still remain. But certain limits in the dialogue must first be clarified, for better or worse, by way of these further comparisons.

CONTINUING A HYPOTHETICAL (PANNENBERGIAN) APPROACH

The most fruitful way to clarify these limits is to continue the hypothetical Pannenbergian approach of the previous chapter. Granted, the hypothetical ideas presented in Chapter 3 might be deconstructed by a critic in many less intricate ways. But these could prematurely either halt or inhibit an illuminating dialogue on the shared matters, to positive or negative ends.

The most obvious approach, for example, might summarily be to assume Pannenberg's theology unhelpful in all scientific matters and end there. A type of scientific fundamentalism, believing the sciences without metaphysics or theology to be the only reliable paths to knowledge, might do this.

Such presumptions are common caricatures of how science and religion *must* interact: by not interacting.¹ Yet the projects of unification and diversification in physics and philosophy, as demonstrated in the first two chapters, have each already made constructive uses of concepts of God. These ideas invite commentary and critique by Pannenberg, who takes up both God and the same scientific matters as our other parties.

A less caustic critique might allow limited credit to Pannenberg's theology as being at least potentially illuminating. But even that allowance could be assumed while rejecting Pannenberg's unusual presupposition, described by Ted Peters as theology acting like a "field-encompassing field." That strong notion empowers the idea of interdisciplinary synthesis being tested here. It can be seen as a step too far, even for those not otherwise discounting metaphysical or theological possibilities. Accepting the idea requires faith in a theology with the explanatory power to synthesize other disciplines. This includes Pannenberg's idea of the God behind theology as an All-determining Reality (*Alles bestimmende Wirklichkeit*).

So, while copious approaches might work, a more discriminating route than some obvious options is simply to maintain a Pannenbergian approach throughout. Implied are objectives other than simply working to indicate the relevance of Pannenberg's theology. Pannenberg himself is clear when introducing his creation thought in *ST* that "in the process we keep in view the plurality and debatability of all religious truth claims."² To presume fully on Pannenberg's concept of theology working hypothetically carries the interesting risk of turning his own ideas, like theology as "field-encompassing field" and God as "All-determining Reality," on their heads.

DEFINING SHARED CONCEPTS: TRUTH, REALITY, EXPLANATION, AND UNDERSTANDING

The following exercise consists of first dissecting the arguments of the previous chapters into several main constituent terms and ideas shared by all three explanatory schemes. The process involves looking more deeply at what we may call the "interpretative frameworks"³ wielded by each of our three parties. Interpretative frameworks are assumptions, usually philosophical and generally all encompassing, acting as grand ways of interpreting the world. For this reason they are referred to as master narratives or metanarratives. These sometimes hidden hermeneutical factors tend to drive what each party believes and argues for explicitly.

The shared terms and ideas in question here are "truth," "reality," "explanation," and "understanding." The ways in which these abstract-sounding categories are defined have clear effects on key ideas like "laws of nature" and "God," and vice-versa. The interpretative frameworks are different in each case. When examined they indicate the unifying physicists to be acting essentially as "moderns" and Cartwright roughly along "postmodern" lines,

with Pannenberg fitting in the middle in what has been called a mediating, “postfoundationalist” mode of thinking. These frameworks give rise to the differing definitions and ideas in each case, and perpetuate how these definitions and ideas are used to construct each party’s arguments.

The comparative format is suggested by a study found in a section on the “Four Bold Claims” of science in Hugh G. Gauch, Jr.’s *Scientific Method in Practice*.⁴ Gauch, a practicing scientist, has identified four principal claims that most scientists using a broadly accepted methodology (in effect, “the scientific method”) routinely make about the world during their investigations. These claims are to do with “rationality,” “truth,” “objectivity,” and “realism.”⁵

Any idea that science proceeds by a “fixed sequence of steps” is misleading, Gauch teaches. Scientific processes are instead “highly variable and creative.”⁶ Nevertheless, certain claims are universally made, with several of the same elements usually present. “The business of scientific method,” Gauch states, “is *theory choice*—the choice of what to believe about the physical world.”⁷ Scientists’ claims about rationality, truth, objectivity, and realism are informed choices. Thus a greater examination of these choices can only better the process. It is for these reasons that Gauch outlines and discusses “Science’s Four Claims,” inherent in all scientific activity.⁸ He argues viewpoints on each term consistent with his orientation as a scientist. Because the physicists, Cartwright, and Pannenberg all assume some version of scientific method, Gauch’s commentary gives important general background for comparing them on deeper levels.

Of *rationality*, he writes that it is what “first and foremost is needed for science’s method.”⁹ A presumption is made by scientists that the world is of a rationally accessible, understandable, and explicable structure. *Truth* is “a property of a statement, namely, that the statement corresponds with reality.”¹⁰ In its simplest form, a truth statement is understood in science to correspond (more or less) directly with what occurs in the real world—with “reality.” Truth statements bear facts about what is “really real”; people only bear the statements.¹¹ This is a reference to *objectivity*, which can be described as the idea of truth statements being about objects, not about the people making the statements. The object determines the truthfulness of the statement; the beliefs of the person involved do not.¹² Gauch defines *realism*, “as regards the physical world,” as “the philosophical theory that both human thoughts and independent physical objects exist and that human endowments render the physical world substantially intelligible and reliably known.”¹³ The natural sciences appeal to the general public largely because a “common sense belief in reality is practically universal.” Stated otherwise, the view is that “reality does not come in degrees, because something either does or does not exist.”¹⁴ Scientific methods appeal to this collective public idea that the sciences reveal reality.¹⁵

The four claims of science operate alongside a common-sense “reality check,” revealing underlying assumptions.¹⁶ The “reality check” is an appeal to the “sense” commonly held by people, appearing when pressed

about aspects of scientific method (like laws of nature and their character). Gauch points out that even David Hume's writings, so often used to attack the idea of laws, "reflect an awkward tension between common sense and philosophy that never gets resolved."¹⁷ Various presuppositions are at play in these common-sense reality checks, of ontological, epistemological, and logical varieties. That is, there are presuppositions of certain characteristics of real things (ontological characteristics), that certain truths about these real things may be known (epistemologically), and that there is coherence in these ontological and epistemological presuppositions (logically). The presuppositions are themselves chosen beliefs. They are largely unproven, although presented as bearing good evidences for being believed. Given the differences already evident between the unifying physicists, Cartwright, and Pannenberg on the same matters, something of informed choice must also be at work in their views on God and the world.

Like the American Association for the Advancement of Science's (and Gauch's) terms, "truth," "reality," "explanation," and "understanding" work together as a whole to form each narrative of the natural world shown in the previous chapters.¹⁸ They merge as a single explanatory scheme, interactively supporting each party's sets of theory choices and arguments. At a more fundamental level than has thus far been shown, *the physicists, Cartwright, and Pannenberg are all making differing claims, or "theory choices," about what counts as truth, reality, explanation, and understanding in their interpretations of the natural world, and of the ways in which these ideas shape their expressions of concepts like God, laws, unity, and plurality.*

I. TRUTH AND REALITY

Indications of the physicists', Cartwright's, and Pannenberg's positions on "truth," "reality," "explanation," and "understanding" have appeared in previous chapters, but have been scattered throughout their arguments on unity and plurality. These philosophical positions can now be compiled and further elucidated to show the similarities and differences between them, beginning with the physicists. For comparison, "truth" is linked with "reality" here in Part I, and "explanation" with "understanding" in Part II, after conventions occurring naturally in the respective materials of each party.¹⁹ The first matter is to clarify the stances in the abstract, which in each case has far-reaching implications.

Varieties of Realists

Most who work in the sciences, philosophy, or theology—and as Gauch argues, even the general public—will have some understanding of "realist" positions. Like "truth" or "reality," these terms appear in a variety of disciplines and contexts denoting different shades of meaning. One can see on

comparing realisms how the physicists, Cartwright, and Pannenberg are all realists, but of differing varieties. To borrow a phrase from Rom Harré, they represent “varieties” of realists.²⁰ The shades of difference between their realist positions have far-reaching effects on defining “truth” and “reality,” which partly accounts for the great variability between them.

Physics and Realism

The realism in physics, like the realism appearing in both Cartwright’s and Pannenberg’s writings, is not so much a position as a way of thinking about the world. Realism, generically, is belief that a thing exists independently of the human mind or its awareness. Gauch’s scientific definition of realism, derived from common thinking about that which constitutes “the scientific method,” indicates this standpoint. If Gauch is correct, physicists may not be given to ready philosophical self-examination. That idea was the very impetus for his book reflecting on “the scientific method.”²¹ Physics self-defines as a “realist” enterprise, and this realism is especially evident when laws of nature are discussed.²² It is because the realist view of laws in physics is so resolute that Cartwright has called it a “realist fundamentalism.” Fundamentalism aside, the realist scientific worldview informs what truth and reality are said to be in physics, and not least with regard to its laws. This creates sets of similarities and differences between unifying physics, Cartwright, and Pannenberg, and is one vital similarity requiring special clarification, as laws are common to all three accounts.

Regarding laws of nature, this realism means that physicists believe them straightforwardly to exist, objectively governing natural phenomena independently of the human mind. Steven Weinberg writes with cognizance that he describes laws in “what a historian of philosophy would call a ‘realist’” sense, “of believing in the reality of abstract ideas” similar to Plato’s arguments for universal forms.²³ Laws of nature, physicists like Weinberg claim, are in operation whether one believes in them or can always readily demonstrate them or not. The role of science is to discover and understand the aspects of reality we call laws, not to manufacture them. This is scientific realism.

Bas van Fraassen, when commenting on scientific realism and its alternatives, has argued that although statements such as “physicists are scientific realists” may be naïve, they do still have “the right flavor.”²⁴ That is, while one must admit that there have been a variety of views and revolutions of interpretations throughout the history of science about what can be known as real and true, and how we might get at that reality and truth, scientists are nevertheless realists. There are even terms and movements related to the sub-class of realism known as *scientific* realism. But for the purposes of comparison with other realisms or alternatives, it is still realism. In the last century, scientific realism has included prominent movements like the logical positivism of the Vienna Circle (sometimes called “logical” or “linguistic” empiricism), discussed in the context of Cartwright in Chapter 2. Their concerns were not only the verifiability of scientific truth claims, but also

the unity of science. They allowed no room for metaphysical or theological thought in their system, both of which were considered to be unverifiable. Scientific realisms have been attacked by van Fraassen's own "constructive empiricism," which says that "acceptance of a theory involves as belief only that it is empirically adequate."²⁵ This is a pragmatic matter concerned only that a theory should correctly describe what is observable. But such shades of difference are really the concerns of philosophers, not working physicists. van Fraassen admits that, momentarily placing the history of various distinctions aside, scientists have remained realists throughout the history of such arguments because they labor to answer two main questions. These are to "characterize a scientific theory as a story about what there really is, and scientific activity as an enterprise of discovery, as opposed to invention."²⁶

Gauch admits that among scientists, "the very concept of a presupposition," which might indicate this universalized idea of unity to be an unfair assumption on the part of physicists, or might reveal a conflict with a scientific straightforwardness on laws broadly, "is often vague."²⁷ Physics in this way resonates with everyday people, who assume a similar common-sense view of laws insofar as they are understood to exist "before critical philosophical discussion has affected our attitudes."²⁸ Even so, A. J. Ayer, a positivist philosopher, began an essay entitled "What Is a Law of Nature?" decades ago assuming these commonalities between science and what he described as "pedestrian common knowledge." "There is a sense in which we know well enough what is ordinarily meant by a law of nature," he wrote. "We can give examples."²⁹

When physicists give examples, they might debate concerning what *exactly* may be true of a particular law, or about delineating the limits of certain nomological powers. Arguments may ensue about definitive accounts of all laws, as in theories of everything, or whether string theories among TOEs are best considered "science" or "philosophy." Works like John W. Carroll's *Laws of Nature* and Friedel Weinert's *Laws of Nature: Essays on the Philosophical, Scientific, and Historical Dimensions* illustrate these variations.³⁰ Still, that all of science and particularly physics is built around a firm belief in nature's laws in a true and real sense is undeniable.

Rom Harré agrees that a "law of nature" is already a definitive and far-reaching idea about what is true and real. He has written in *Laws of Nature*, when commenting on the standard scientific view:

When we think of a law of nature we think of a statement not just true usually or for the most part, but strictly and universally true. Nor do we take laws to be recordings of what happens perchance or for the most part, but specifications of what happens necessarily. To announce a law of nature is to make a strong claim indeed.³¹

Steven Weinberg illustrates a physicist's realism in *Dreams of a Final Theory*, when he writes of laws:

My argument here is for the reality of the laws of nature, in opposition to the modern positivists, who accept the reality only of that which can be directly observed. . . . As a physicist I perceive scientific explanations and laws as things that are what they are and cannot be made up as I go along, so my relation to these laws is not so different from my relation to my chair, and I therefore accord the laws of nature (to which our present laws are an approximation) the honor of being real. . . . But I have to admit that my willingness to grant the title of “real” is a little like Lloyd George’s willingness to grant titles of nobility; it is a measure of how little difference I think the title makes.³²

Weinberg adds in an essay titled “Against Philosophy,” “Physicists do of course carry around with them a working philosophy. . . . [I]t is a rough-and-ready realism, a belief in the objective reality of the ingredients of our scientific theories.”³³

Unifying physics derives from the existence of these laws a world with a detectable order and intelligibility, and the unified or conceptually unifiable state of it. “Law of nature” is already a unifying concept, retaining this function from its origins in the context of natural philosophy.³⁴ A basic intention is that the laws are at least approximately true explanations of observable phenomena.³⁵ Laws represent either a bringing into connection, or a recognizing and formalizing of regular patterns already existing in connection between, otherwise seemingly disparate phenomena. Nomological unification projects seek to join multiple nomic (“law-like”) connections into increasingly encompassing ones.

The consequences of the laws of nature can be experienced, but are usually expressed and explained in terms of mathematics. Seen in raw form, “every one of our laws is a purely mathematical statement in rather complex and abstruse mathematics.”³⁶ Mathematics, the chief way of describing and expressing laws, is seen to be demonstrative also of their simplicity, beauty, and symmetry. The standard relations of laws to mathematics, and the connected idea of nomological symmetry, are among the aspects of nomological character commonly discussed in treatments.³⁷ Each aspect is believed to say something about a law’s truth, reality, and universality. When physicists consider what may be counted as “law” and as a valid unification of laws, these factors inherent in the mathematics are considered to be among chief indicators of the best candidates.³⁸

An understanding that the key to unlocking nature’s secrets lay in an “unassailable mathematics” has been noted as the “first major breakthrough in science.”³⁹ Roger Penrose, in *The Road to Reality: A Complete Guide to the Laws of the Universe*, discusses various philosophical implications of laws, and even mentions God. But he spends the majority of the 1000-plus page book on the finer points of the mathematical language of laws, often using only mathematics ranging from geometry and real numbers calculus, to Reimann surfaces, higher dimensional manifolds, mathematical infinities,

and regions inaccessible and unprovable even to mathematicians, such as those suggested by Gödel's theorem.⁴⁰ When physicists can argue that higher dimensional manifolds are an "essential notion for almost all modern theories of basic physics,"⁴¹ they could argue that anyone not "speaking the language" is ruled out of meaningful discussions of laws. This is so even though, as Penrose shows, there remain philosophical implications with mathematics, as with laws, including those that touch on "God."⁴²

Mathematical law statements are understood to be statements of "facticity," seen as truths or approaching truths.⁴³ "Mathematical Platonism" is a related view, arguing for an objective, or mind-independent, mathematical reality. Those holding this view "maintain that these entities have an ontological status coordinate with physical and other natural entities, sharing with them the attribute of existing whether or not they are known by human beings, but because of their abstract character not subsumable under the class of entities in nature."⁴⁴ This envisioned realm of "mathematical reality," as G. H. Hardy called it in his famous *A Mathematician's Apology*, is considered as real as the material world of "day and night, earthquakes and eclipses, the world which physical science tries to describe,"⁴⁵ only this one not locatable in space and time.⁴⁶ The function of a mathematician or physicist using mathematics for the expression of laws becomes one not of "creating," but of observing and discovering something both ontological and doxastic.⁴⁷ Hardy framed his descriptions of the variety of views with thoughts on the potential conceptual power to be had if one could aptly understand and describe mathematical reality: "A man who could give a convincing account of mathematical reality would have solved very many of the most difficult problems of metaphysics. If he could include physical reality in his account, he would have solved them all."⁴⁸ Penrose has argued for a similar mathematical Platonism. He describes mathematical Platonism in terms unequivocally indicating that what he means by this "existence" "is really just the objectivity of mathematical truth."⁴⁹ Yet one observes at the same time that he sublimely, if not reverently, also indicates mathematics practically to have a life of its own.⁵⁰

That physicists have for some time now assumed the reality of laws in such ways,⁵¹ and at least the provisional facticity of specific statements and discussions of them can be illustrated from a variety of physics teaching texts. It is telling that physics teaching materials, whether designed for students at high school/upper school or university, or at the graduate level, rarely evidence a need even to *define* "law of nature." There appear no easily locatable instances of defending the notion of "law" in these texts, either. Following this pattern, the same is true of physics texts supporting professional scientific practice.⁵²

Richard P. Feynman wrote his lectures on *The Character of Physical Law* illustrative of such straightforward realist assumptions, demonstrating a certain faith in the truthfulness of statements made about them.⁵³ Feynman makes only elusive efforts to define "law of nature," and demonstrates no

sense of need to defend the concept, as in physics textbooks. This is even as his lectures in *The Character of Physical Law* were subsequently recorded for broadcast to a vast BBC audience. Instead, Feynman began the first lecture discussing directly “The Law of Gravitation, an Example of Physical Law.”⁵⁴

Norman Swartz and Friedel Weinert point out that the terms “law of nature,” “scientific law,” and “physical law” imply vital nuances. Weinert demarcates between a “law of science” and a “law of nature.” The former is a true natural regularity, but the understanding of the laws of science is often affected by the people working with them. Their explication becomes “subject to various kinds of modifications.”⁵⁵ The latter are not subject to these adjustments. The addition of displacement current to Ampère’s law is one example of a scientific law.⁵⁶ Cartwright has called these “phenomenological laws,” holding only on account of more fundamental ones.⁵⁷ Norman Swartz distinctly emphasizes “physical” in the terminology. Whether or not Feynman cared for such distinctions is unclear. He nevertheless chose a distinction that happens to comply with Swartz’s “physical law.” Swartz defines and portrays “physical law” as bearing strong realist assumptions in this way:

Physical laws are propositions, that is, they are the sorts of things that bear truth-values. There is no such thing as a false physical law. . . . “Physical law” is a success term: If something we have taken (assumed, believed, etc.) to be a law is subsequently learned to be false, that proposition is not a false law, but no law at all.⁵⁸

Swartz asserts that “physical laws,” his chosen way of denoting “laws of nature” or “natural laws,” are “true” in some sense in the real (“physical”) world. He adds several sentences later, “In this essay, when I refer to ‘laws’ I am talking about a certain class of truths about this world, a class wholly independent of whether or not anyone successfully discovers, formulates, announces, believes, or promotes those truths.”⁵⁹

Feynman’s descriptions of the character of physical law he notes are a definition by description, by implication of a thing’s characteristics:

At first the phenomena of nature were roughly divided into classes, like heat, electricity, mechanics, magnetism, properties of substances, chemical phenomena, light or optics, x-rays, nuclear physics, gravitation, meson phenomena, etc. However, the aim is to see *complete nature* as different aspects of *one* set of phenomena. That is the problem in basic theoretical physics, today—to *find laws behind experiment*; to *amalgamate these classes*.⁶⁰

“Laws,” other physicists resound with him, “by their very nature, refer to classes of process,”⁶¹ “out there” somewhere, with G. H. Hardy’s Platonic mathematics, awaiting discovery and proper mathematical expression. They

have a kind of ontology, not like most physical objects, *but still a real and objective existence having certain effects upon physical objects*.⁶² Feynman's, like Weinberg's or Penrose's, is a plausible scientific realism akin to the "common sense" type appealing to most people.⁶³ While physicists like Feynman, Weinberg, and Penrose each place confidence in the idea of scientific uncertainty, their implicit trust in mathematics and way of using mathematical formulae can nevertheless give rise in unifying physics to the realism of "scientific fundamentalism," so anathematized by Cartwright with her differing realism of local Aristotelian causes. To these differences concerning laws we have seen added Pannenberg's insistence not only on maintaining the idea of God in a realist sense, but on a Trinitarian God, who has enacted and uses laws to continue the processes of creation.

Cartwright and Realism

Nancy Cartwright has been so astute at self-description that her position in relation to realism will be almost entirely clear already. There are just a couple of additional nuances. She agrees that a view arguing laws to describe true facts about reality "is a pedestrian view" that virtually "any scientific realist" will hold.⁶⁴ But her rejection of these *simpliciter* views, however common, is due to her belief that "the fundamental laws of physics do not describe true facts about reality."⁶⁵ Cartwright similarly claims in *DW* an "a priori metaphysics" to be at work in nomological unification.⁶⁶ She does not deny making metaphysical "theory choices" herself. Yet her confidence is that her beliefs are more consistent with actual evidences, using more reliable methods.

The impetus behind Cartwright's philosophy has been to examine the scientific presuppositions and definitions supported by terms like truth and reality. Hence what is "true" and "real" about laws are for Cartwright not such straightforward matters as they appear to be for physicists. Perhaps the most explicit articulation of her position is when she says the laws of physics "lie," if assumed to state true facts about reality.⁶⁷ Truth about a model used to describe or explain a law may be indicated, but not truth about reality. The added view in unifying physics that real laws, few in number, constitute a simple, graceful universal order, and may even be reduced to a *single* theory or statement in future, is the "realist-fundamentalism" she detests. But what is she, then—an "antirealist-fundamentalist," or at least an antirealist?

The view that physicists may be called realists does not make Cartwright an antirealist. Cartwright's view can be described as existing between modified views of realism (not antirealism) and instrumentalism. Antirealism, contrary to realism, indicates a claim that human beings are in some way constructing what they argue to be real. Van Fraassen counts himself as a second kind of antirealist, which he describes by stating,

according to the anti-realist, the proposer does not assert the theory to be true; *he displays it*, and claims certain virtues for it. These virtues

may fall short of truth: empirical adequacy, perhaps; comprehensiveness, acceptability for various purposes. . . . The idea of a literally true account has two aspects: the language is to be literally construed; and so construed, the account is true. *This divides the anti-realists into two sorts. The first sort holds that science is or aims to be true, properly (but not literally) construed. The second holds that the language of science should be literally construed, but its theories need not be true to be good.*⁶⁸

It is fair to say that antirealism, like realism, is not meant to be a blanket claim to cover everything encountered. Instead, it is a tendency, applied to specific cases as and when they are encountered. Cartwright does intend her view to cover many of the claims physicists make about laws and our world as ordered by them. Her idea of “nomological machines” implies precisely that regularities often called “laws” can prove to be situations engineered by human minds. She does not stop there, however, even if she did at the time she wrote *HLPL*. “A number of years ago I wrote *How the Laws of Physics Lie* . . . generally perceived to be an attack on realism,” she has recollected. “Nowadays I think that I was deluded about the enemy; it is not realism but fundamentalism that we need to combat.”⁶⁹

Cartwright now calls herself a realist, but of a circumscribed variety. Hers is the “dappled” advocacy of a “local realism about a variety of different kinds of knowledge in a variety of different domains across a range of highly differentiated situations.”⁷⁰ It is this localization that means “laws can be true, but not universal.”⁷¹ She does not deny the existence of laws, but argues “against laws that are unconditional and unrestricted in scope.”⁷² In relation, she has realist views about causal factors, which physics often extends to argue for the existence of universal laws. Cartwright calls her view Aristotelian, arguing that any knowledge we do have of laws, which are generated by nomological machines, is due to our knowledge of capacities, which are local realities existing within things themselves.⁷³

There is a further nuance. Cartwright also represents a modified instrumentalism. Instrumentalism, like antirealism, views the theories of science as not necessarily true descriptions of realities. Instrumentalists see theories as instruments of prediction, and of the ordering of the world around us. This appears in Cartwright’s arguments that laws of physics may lie about what is true if taken to state facts—but this does not prevent them from predicting or explaining. That she is realist with regard to causal factors sets her apart from many instrumentalists.⁷⁴ But, like most instrumentalists, she has described her principal interest as “in intervening.” This is why she begins from “a different question: how can the world be changed by science to make it the way it should be?”⁷⁵ Cartwright’s disagreements with unifying physics are principally to do with how one comes to conclude the categories of “true” and “real,” and with the scope each category is allowed, either universal or local.

Pannenberg and Realism

Wolfhart Pannenberg's argument that God is the "All-determining Reality" makes God, in Pannenberg's thinking, the guarantor of all that is true and real in every field of investigation, including the sciences. In arguing for this God's existence, Pannenberg has undertaken to give more extensive treatments to "truth" and "reality" *per se* than can generally be found in unifying physicists or Cartwright. Following earlier essays and books like "What Is Truth?"⁷⁶ and *Faith and Reality*,⁷⁷ Pannenberg begins his entire *ST* with an involved discussion describing faith and reality as inseparably linked to God.⁷⁸

Pannenberg writes forthrightly of truth and reality as being inextricably parts of the same schemes of explanation. This is so both in relevant works prior to *ST*, and especially in *ST*, I. There Pannenberg gives his most mature theological explication of truth and reality to date. But he wrote explicitly of the two concepts and their interrelation, and relations to Christian thought, in some of his first major publications. In the early 1960s essay "What Is Truth?," Pannenberg argued that the answers provided by Christian theology regarding questions of its claims to "truth" about "reality" were experiencing a critical moment. The crisis was one facet of the problem he first mentioned in *Revelation as History*, and for which he first became known. He described Christianity as at a crossroads of being either sent to a peripheral "ghettoized" existence, or of asserting instead a continuing relevance. He wrote:

Since the Enlightenment, the question of the truth of their faith has been put to Christians with constantly increasing poignancy. It is the question of its power to encompass all reality—even that of modern science, the technological control of nature, and the forms of individual life—and to claim them all as evidence for the content of the Christian message. The question about the truth of the Christian message has to do with whether it can still disclose to us today the unity of the reality in which we live, as it once did in the ancient world, which was the basis for the victory of Christianity in the ancient *oikumenē* [inhabited world] surrounding the Mediterranean Sea. Thus the question regarding the truth of the Christian faith is not concerned with a particular truth of one kind or another but with truth itself, which in essence can only be one. It asks whether the Christian faith still contains the truth that gathers together everything experienced as real.⁷⁹

Through a process of looking at truth and reality in Greek thought, modern philosophy (especially Hegel) and a "biblical-Christian" view, Pannenberg offered several theses. Although subsequently updated and expressed in differing forms, and at times only implicitly present in his writings, these points do not change through to their appearance in *ST*. Each of the following early theses regarding truth and reality has remained constant in Pannenberg's thought and works:

- (1) From the standpoint of the history of thought, the subjectivization of truth in the modern period is grounded in the Christian faith.
- (2) Subjectivity cannot understand itself and its thought as truth without presupposing God as the one origin of everything real. In this regard, the act of adopting this presupposition can only mean having an open question, not an actual knowledge of God.
- (3) Subjectivity must presuppose God as the origin and unity of everything real. Only such a God, who embraces everything, can be the truth itself. For this reason, every representation of God is to be tested as to whether it permits understanding reality as a whole, and thereby satisfies the unity of truth.
- (4) Since the emergence of historical consciousness, the unity of all reality is conceivable only as a history. The unity of truth is still possible only as a historical process, and can be known only from the end of this process.
- (5) The unity of truth is possible only if it includes the contingency of events and the openness of the future.
- (6) For this reason, the unity of truth is constituted only by the proleptic revelation of God in Jesus Christ.⁸⁰

God in Jesus Christ becomes in Pannenberg's arguments the ultimate location and unification of all truth and reality.

Just over a decade later, Pannenberg's essays on *Faith and Reality* appeared. The aim was to address "a wider public" with a general theme "which may be described as the confrontation of the Christian tradition of faith with the contemporary experience of reality."⁸¹ The book's ten chapters investigate matters like the concept of God as it relates to our understanding of reality, a Biblical view of reality, problems raised by the natural sciences, and political views.

Pannenberg concedes that reality is problematic to define. Modern human beings tend not only to attach the word to "almost everything with which we are concerned," but "what is more everything regarded as an entirety." Thus, it may be said that we apply "reality" also to "the whole of being." The Bible does not resolve the matter, as there is no single clear "biblical" view of reality. Rather, the meanings of terms like "God," "the world," and "sin," both in the Old and New Testaments, show how understanding "differs considerably according to the author and the time of composition."⁸² Nevertheless, the apparent diversity only indicates richness, Pannenberg claims, and there is a unity to be found. The unity "cannot be found in a one-dimensional, logical agreement between all the scriptural statements," however, "but rather in the continuity of the history of God and his dealings with man in the Bible."⁸³ This continuity endures even today, as the proclamation of God's activity in Jesus Christ still invites people worldwide to become part of the history of God "which began three thousand years ago with the people of Israel."⁸⁴

Pannenberg is contrasting in such statements a Trinitarian Christian view of God with less distinctly Christian ones. He has no particular objection to Greek or philosophical concepts of God, but argues that they focus on limited aspects of the reality of God.⁸⁵ The historical nature of intelligible divine activity may be seen as the key difference in the Judeo-Christian view, when contrasted with the alternatives. For Pannenberg, all reality is historical by virtue of God's activities in time. He writes,

It is in the light of this understanding of God that we can come to some conclusion regarding our understanding of all reality as history . . . the "constantly new and often astonishing events that occur in history are experienced as fundamental to that reality."⁸⁶

This historical activity is not a matter of events in simple juxtaposition, nor mere "temporal succession" or a state of disconnected confusion. God, rather, acts in history in accordance both with the ways in which God has acted before, and by introducing novel and "extraordinary" events.⁸⁷ All truth is still God's, for Pannenberg, and is historical in that it comes to us now from God's future, to be fulfilled over time.⁸⁸

Pannenberg's emphasis on history as a dynamic theological category has not included interaction with certain trends in recent "science and religion" studies involving "truth" and "reality." Specifically, Pannenberg has not been a proponent of the "critical realist" positions of scientist-theologians like John Polkinghorne, Arthur Peacocke, and Ian Barbour, even though sharing their wider interests.⁸⁹ This is despite critical realism being considered "one of the most important positions in the current science and theology debate."⁹⁰ Critical realism has been traced by Barbour via Mary Hesse back to A. N. Whitehead. A critical realist stance aims for a middling position between "the creativity of man's mind *and* the existence and patterns in events that are not created in man's mind."⁹¹ The general idea is that science and theology do not grant us access to direct, unfettered truth and reality, but do at least offer a verisimilitude approaching truth and reality.⁹² The entities approached by both theology and the sciences are often not directly observable; hence no naïve objectivity is possible.⁹³ Polkinghorne has been among the most prominent arguing these points in favor of critical realism in recent years,⁹⁴ positing that both scientists and scientist-theologians are, whether "consciously or unconsciously," critically realist.⁹⁵ Alister McGrath has written of critical realism in terms of recognizing what Roy Bhaskar has called "the stratification of reality," which must be approached according to its presentation along different strata, defying attempts at either scientific or theological reductionism.⁹⁶ While Pannenberg has been suspicious of these moves, which he has seen precisely in terms of postmodern hermeneutical trends, he has nevertheless supported them by espousing similar arguments and methods.⁹⁷ One may say that Pannenberg has sought to discuss not only the natural world, but also God and God's activities from a view of them as objective states of affairs.⁹⁸

Contrasts to be drawn between Pannenberg's positions and those of the physicists and Cartwright include the divergence between a biblical, ordered, historical view of divine activity and what can be more closely aligned with the Greek perspective of an immutable, law-abiding cosmos without the personal divine activity of Judeo-Christianity. There is a dissimilarity between a God acting freely via His law-governed universe (Pannenberg's view) and a universe automatically ordered without necessary divine intervention, correlating with both ancient Greek and modern physics views.⁹⁹

Other contrasts involve the characterizing of the progress of history itself, and the place of God and humanity throughout these changes marked by continuity. The leading of past into future is not to be seen as a process of evolution. Rather it leads one in the opposite direction, from the present or future back into the past, shedding light on it. This is an aspect of Pannenberg's emphasis on *prolepsis*, that only in the unfolding of future events does God become clearly understood to have been active in the past or present. In this process centrality is reserved for God, in contrast to the usual anthropocentric way that human beings tell the story of history.¹⁰⁰

More recently, Pannenberg began his *ST* with an involved and updated discussion of truth, reality, and God.¹⁰¹ As Christoph Schwöbel has noted, the earlier works were "successive steps in the development of the theological conception that was programmatically introduced in *Revelation as History*," but with *ST*, "this conception is now presented in its full systematic *Gestalt*."¹⁰² After this manner, Pannenberg investigates the categories in chapters that take up issues like "The Truth of Christian Doctrine as the Theme of Systematic Theology," "The Concept of God and the Question of Its Truth," and "The Reality of God and the Gods in the Experience of the Religions."¹⁰³ In *ST*, I, the idea of the truth and reality of the Christian God is the organizing theme around which all other true and real elements are discussed. This then becomes strikingly evident in *ST*, II, where the conceived reality of the Trinitarian God affects all aspects of Pannenberg's conception of creation.

Among the most important problems with Pannenberg's conceptions of truth and reality, as perceived by critics, are universal intonations, especially of truth. Pannenberg argues that truth itself is really "one," however properly or improperly it may be apprehended:

Subjective assurance of truth cannot in principle renounce the universality or universal validity of truth, no matter how great the tensions that might exist in this regard. My truth cannot be mine alone. If I cannot in principle declare it to be truth for all—though perhaps hardly anyone else sees this—then it pitilessly ceases to be truth for me also.¹⁰⁴

God is, in Pannenberg's explanations, the locus of all that is true and real. Thus truth ostensibly has this objective guarantor. The human perception of truth is a separate problem, and is not to be equated with the definition

of what is or is not true. We do not create or destroy truth by our conceptions of it. Following Augustine, Pannenberg says in *ST*, I, "The thought of Augustine that God is truth (*De lib. arb.* 2.15) rests on perception of the coherence and unity of all that is true. God is the locus of this unity."¹⁰⁵

Pannenberg's conception of universal truth and the reality of which it speaks is, then, not dissimilar to truth as conceived in unifying physics and science generally.¹⁰⁶ While this is so, Pannenberg's ideas are put forward as based in a distinctive Trinitarian concept of God. Physicists are routinely today not simply agnostic but atheistic in practice, with no evident negative effects on scientific success. Anomalous to a theologian like Pannenberg, however, is that the universe through the lens of the physics of a Steven Weinberg, for example, is admitted to be without meaning.¹⁰⁷

Pannenberg's views are not much like Cartwright's view of localized truths that do seem to have much to do with utility, explanations, and contextualized understandings. But for Pannenberg's critics, there appears to be an inadequate accounting of contextualization on the matter of truth, which amounts to an inadequate consideration of postmodernism. F. LeRon Shults, who has been a Pannenberg defender, has also criticized him in the following terms:

While we may follow Pannenberg in thematizing the truth of Christian doctrine in systematic theology, we must recognize that our postmodern situation requires another step: the very idea of the unity of truth (as guaranteed by and requiring some concept of God) must itself become a theme. The radical nature of the postmodern challenge is precisely at the level of the very need to define truth conditions. It is dangerous to privilege the concept of a unity of truth the way Pannenberg does; this is what has led to his being simply dismissed by so many postmodern thinkers, particularly in North America.¹⁰⁸

One might argue that Pannenberg's view of truth and reality as provisional or contingent upon God could in some way comply also with Cartwright's arguments for the contingency of theoretical truth, but this would be largely unsupportable. Pannenberg's views on the "explanation and understanding" of what "truth and reality" are as sets of concepts building on each other, reveal an apparent middle way between the unifying and pluralizing views of the physicists and Cartwright.

Pannenberg's positions on truth and reality overall reveal him to be, like the physicists and Cartwright, clearly a type of realist. His location of both categories in God means that truth and reality are for him universal concepts. Both his way of seeing all truth and reality as based in a distinct view of the Christian Trinitarian God, and the universalizing effects that ensue, provide major differences between his views and those of most physicists, and of Cartwright. His conception of universal truth, however, is similar to truth as conceived in unifying physics and science generally. Pannenberg's

view is not much like Cartwright's idea of localized truths. This is despite the way in which he can be argued to side with her in emphasizing plurality, albeit coexisting with unity in his Trinitarian creation scheme.

THREE CATEGORIES OF GOD AND LAWS: NECESSITARIAN, REGULARIST, AND PRESCRIPTIVIST

Differences in the physicists', Cartwright's, and Pannenberg's abstract positions on truth and reality are illustrated concretely when placing what each says about "laws of nature" and "God" within the light of several main contested nomological positions. The previous chapters have shown how each party discusses "God" and "laws" in their written materials, with Cartwright and Pannenberg necessarily depending on nomological accounts in physics. Ironically, "God" and "laws" are also the principal sources of variety between the three accounts.

Indeed, these key ideas are defined in each set of materials in such widely varying ways that "God" and "laws" are simply not quite the same things when the three sets of uses are more closely compared. The views expressed by each party are different enough to approximate to three specific, principal, and generally contradictory nomological perspectives from the history and philosophy of science. These are the Necessitarian, Regularist, and Prescriptivist accounts.

Necessitarian, Regularist, and Prescriptivist Accounts

Philosopher Norman Swartz has written of Necessitarian, Regularist, and Prescriptivist nomological accounts in *The Concept of Physical Law* (2003).¹⁰⁹ Building on all observations to this point from each chapter, the physicists, Cartwright, and Pannenberg can be shown to fit the three accounts well. The accounts map approximately onto their respective viewpoints and arguments, and reflect the variety of realist stances illustrated. The physicists are largely Necessitarian, Cartwright primarily Regularist, and Pannenberg Prescriptivist, although there are vital nuances and exceptions to be noted.

The Prescriptivist Theory came first chronologically. It dates back to the time in the history of science when natural philosophers first came to the idea of laws of nature. Widely assumed was that there must have been a Prescriber of the laws appearing to govern the natural world. Physical laws, Swartz explains, were believed to have been set in place by God, who "has prescribed that Nature should (would?) behave in certain ways and not in others." He adds that "the very etymology of the expression 'physical laws' evidences this antique mode of regarding this class of propositions."¹¹⁰ Swartz explains further that the Prescriptivist Theory, where it remains, does so exclusively in religious writings. While Swartz indicates no awareness of Pannenberg at all, Pannenberg's views fit the Prescriptivist

Theory. Not only does Pannenberg advocate God to be responsible for and to use laws to continue the processes of creation, but he also shows how this divine activity can be understood to fit Trinitarian terms. Later, we shall come to further evidence of Pannenberg's Prescriptivism, along with the notion that Pannenberg is attempting to salvage the Prescriptivist Theory in a new guise, in similar fashion to his reinvigoration of Logos philosophy.

Following the gradual demise of the Prescriptivist view in physics and philosophy, two theories remain: Necessitarian and Regularist. *Necessitarianism can be described as the view that physical laws determine what must occur. Regularism states that physical laws only express what does happen to occur.*¹¹¹ It is principally between these two views that debates continue to rage into the twenty-first century. Both theories can have theological implications, just as Prescriptivism has had.

The Necessitarian Theory Swartz criticizes as being "the latter-day successor to the Prescriptivist Theory, that is nothing but Prescriptivism-without-a-Prescriber."¹¹² We have seen how two features of laws have survived the centuries, although both are now devoid of religious meaning: universality and necessity.¹¹³ This residual necessity is a leftover ingredient from an earlier, theologically rich view of laws that is no longer logically vital. It is akin to Weinberg's search for a theory of everything without expecting that an end result should indicate anything existentially "meaningful." These drives remain in physics, but without their original theological content. The resulting awkwardness is the product of the principal theological implications of Necessitarianism. Why should it be that certain laws are necessarily as they are, but arbitrarily? The Necessitarian Theory shares with the Prescriptivist Theory that "physical laws are irreducible to statements about what happens," as in, nature is "this way" or "that way." Instead, physical laws are statements not only about what can, but about what is *constrained* to, occur. This view that physical laws are irreducible Swartz calls "The Autonomy Theory of Physical Laws."¹¹⁴

As Swartz's criticism implies, Necessity without its original divine guarantor begs questions that are virtually theological even to secularists, while supplying no such answers. Swartz, who is not obviously religious in any way, calls the situation a "nonlogical, natural (ontological) necessity."¹¹⁵ Physicists themselves appear rarely, if ever, to express this necessity as if it is anything in particular to be concerned about. Nomological "necessity" in physics is like the term "real" for Weinberg, who reasons that his decision to label something as "real" means very little in relation to its actual status. A thing either is or is not real to begin with, like a chair. And laws for many secular physicists, as described in the previous section, are real, objective, true, universal, beautiful—and necessary.

David Hume may have been the first to articulate Necessitarianism, when in the course of criticizing it with an alternative viewpoint, he argued that "[o]ne event follows another; but we can never observe any tie between them.

They seem *conjoined*, but never *connected*.”¹¹⁶ The Regularity Theory, as Swartz explains it, being at direct odds with Necessitarianism, can be seen as a “negative theory.” Regularity “is the theory that there is no natural necessity, either *in re* or in physical laws.” It is a denial of “natural necessity in both its forms and under all its names.” Necessitarianism and Regularity both see laws as descriptions, but that is where the similarity ends. Regularity

issues from the same Empiricist sentiments that so effectively challenged the doctrines of substance and spirit. Like substance and spirit, the presumed causal nexus was radically unobservable. Hume argued that the causal nexus (it understood to be a species of necessary connection) was not to be observed either in external events or in internal ones, for example in willing one’s limbs to move.¹¹⁷

Nancy Cartwright is certainly not a Necessitarian. She is more like a Regularist in the sense articulated by van Fraassen, when he stated that the realism in physics is not actually naïve, but that understanding it that way indicates the right flavor. The “right flavor” in this case would be that in Cartwright’s view, laws are in a much looser association than anything approaching necessity. This sounds Regularist and Humean, yet Cartwright is not quite either; there are subtle differences.

Many so-called laws of physics are to Cartwright what simply *happens* to occur, rather than what *must*. One important difference between Cartwright and Regularists, among several, is her key idea of nomological machines. What passes for a law in physics is often what has been *engineered to happen to occur*. Not only are human minds seeing connections between cause and effect that may not be present (and are not, therefore, “necessary”), but they are creating the situations for apparent necessities to occur. In this way the scientists who engineer the nomological machines are like the Prescriber. And yet God can easily become a mere philosophical illustration from the privileged perspectives that scientists enact and that Cartwright understands so originally. Nevertheless, there are subtle twists in Cartwright’s view, which can be understood either to strengthen ties between nomology and theology or to sever them entirely.

Cartwright describes herself as being essentially at odds with the Humean tradition, despite any similarities. This presents a considerable problem for understanding her as straightforwardly Regularist. The reasons for her conflict with Hume are subtle. She sides with Hume in being empiricist. Her desire is to “argue for the centrality of singular causes and capacities in an empiricist world.”¹¹⁸ Her advocacy is of a “strong practical empiricism, which for better or for worse wants to make a difference to how science carries on.” Describing her complex relationship to Hume she writes,

My position is opposed to the tradition of Hume. I begin with the assumption that the causal language of science makes sense, and that causality is

an objective feature of our scientific image of nature. This does not yet separate me from the Humean tradition. Hume too took causal claims to have an analogue in reality. He began with singular causal claims, looking for some special connection between the individual cause and its effect, a connection that would be strong enough to constitute causation. He failed to find anything more than spatio-temporal contiguity, so he moved to the generic level. This marks the first stage in the Hume program: (1) for Hume, singular causal facts are true in virtue of generic causal facts. But the program was far bolder: at the generic level causation was to disappear altogether. It was to be replaced by mere regularity. This is the second thesis of the Hume program: (2) generic causal facts are reducible to regularities. This book challenges both theses.¹¹⁹

Hume was understood by contemporaries to write in skeptical and even atheistic terms about matters like causality and connections in nature, and even more clearly about religious beliefs in volumes like *Dialogues Concerning Natural Religion* (1779). Cartwright's depiction of God as being perhaps a Metaphysical Pluralist is a mere philosophical illustration. Yet she has argued that there are inextricable implications between any conceivable concept of a law of nature and the concept of God.¹²⁰ She insists in a currently unpublished paper, "No God, No Laws,"¹²¹ that one simply cannot settle for one concept without the other. Her argument from the outset is that "the concept of a law of Nature cannot be made sense of without God."¹²² Laws of nature since the Scientific Revolution are not only descriptive, but are themselves *prescriptive*, said to be *responsible* for what occurs in nature. Neither feature, Cartwright argues, is sensible without God. In pressing the argument, she makes a strong case that this stipulation includes not only purely religious Prescriptivist accounts, but also Necessitarianism and Regularism. She subsumes both under varieties of "Empiricism" (in essence Regularism) and "Platonism" (Necessitarianism), and also discusses "Instrumentalism." "What Platonists call 'laws' as well as what empiricists call 'laws' need God and his direct control of the world if these are to be laws at all," she says. Instrumentalists are not affected really, since, according to her, "they give up on laws of Nature altogether."¹²³ She means that the measuring utility of laws, whether they are real or not, and from wherever they may or may not come, is all that matters to an instrumentalist. Her conclusion includes her own view of laws, which is that they should be replaced by the idea of Aristotelian natural powers. Even her view, *if* it is still to consider laws to be real at all, must include God. She writes, "Without God there cannot be laws of Nature, *nor anything else with their crucial characteristics*."¹²⁴

Pannenberg differentiates between scientific descriptions of reality using terms like natural law, and the concrete actualization of the Logos in Jesus Christ. He is clear that the description of reality in terms of scientific or theological statements is "made on different methodological levels."¹²⁵ But

the one is no more or less true than the other, just because one is scientific and the other theological. His aim is for a total understanding of reality, including both laws prescribed, as understood by natural science and theology, and a Prescriber. "In principle," he writes, "theology can integrate scientific statements into its coherent description of the world as the creation of God."¹²⁶ He also articulates an obviously Prescriptivist viewpoint when he writes, "God has bound his creative action to the laws of nature, which are grounded in his creative action. . . . The laws of nature, then, have an indispensable ministering function in the trinitarian history of creation."¹²⁷

Pannenberg, like Cartwright, engages with regularity. But the regularity to which he refers is not simply imagined, nor is it engineered in the creation of law-producing machines. Rather, "the regularity of events in elementary processes is the basic presupposition for the development of permanent forms."¹²⁸ He explains,

The uniformity of natural occurrence is on the one hand an expression of God's faithfulness and constancy in his activity as Creator and Sustainer, while on the other hand it is the indispensable basis for the development of ever new and more complex forms in the world of creatures.¹²⁹

He even asks whether one might think of contingency, which he asserts against any notion of necessity, as "comprising the regularity of nature." He seeks to challenge the "uncritical use of the principle of regularity in scientific explanation. The old form of determinism is gone; modern physics is more modest in its view of physical and scientific law."¹³⁰

While Pannenberg is aware that most of the scientific world no longer takes Prescriptivist views seriously, he is attempting to reintroduce "God" to "laws" just as he has worked to revivify Logos in a modern scientific context. In this idea of the contingency of events in nature, Pannenberg has imagined what could be a "point of departure on the basis of which talking about a personality of divine action could become again a meaningful element in the frame of a presently relevant understanding of reality."¹³¹

Pannenberg's God is not simply a Prescriber, after the manner in which monotheism gave rise to the idea of laws and a Law Giver in the first place. His is a Trinitarian Prescriber set within a specific scheme in *ST*, II, in which this "trinitarianness" is supported with exacting illustrations and further connected structures. Theological specificity, set in relation to particular theories in natural science, might be understood to work against the more general goal of asserting the idea of God at all. A God, or god, who creates and uses laws, makes the best of contingency, and introduces a scheme into creation featuring both unities and pluralities, and whose reality begs for reintroduction into a modern scientific worldview, need not be the Christian God at all. Of course it could be the Christian God. But nothing in Pannenberg's material can, of necessity, and by his own admission, dictate that.¹³²

Be that as it may, in Swartz's taxonomy Pannenberg's view is unmistakably Prescriptivist. Likewise, the views asserted by the unifying physicists and Cartwright approximate to the tensions between Necessitarian and Regularist accounts. And all of that must be fine-tuned by Cartwright's additional descriptions, which include that she is not quite Regularist, and that no account of laws can be made sense of without God—that is, with the exception that her idea of Aristotelian powers can be understood to transfigure the entire problem, providing an alternative to both laws and God.

II. EXPLANATION AND UNDERSTANDING

Concepts of “explanation” and “understanding” follow logically from ideas of “truth” and “reality.” An explanation—scientific, philosophical, or religious—is meant to offer understanding of why a thing is as it is, in effect telling us the way in which a thing is said to be true and real. Explanations are sentences, propositions, or arguments making claims of understanding about ontological status.¹³³ Describing what is true and real is the larger subject, but in any field of enquiry these related questions remain. As Bas van Fraassen describes these conceptual relations in the sciences, “Science aims to find explanations, but nothing is an explanation unless it is true (explanation requires true premises); so science aims to find theories about what the world is like.”¹³⁴

Ideas of laws of nature, which are linked with notions of cause and effect, possess these intimate conceptual connections. Laws are meant to explain why various phenomena behave as they do, thus providing not only structure but also understanding of the natural world. The proposed theory of everything sought by physics is meant to be a *complete* explanation of all known forces and interactions in the material universe. The constituent laws and theories of laws comprising the sought-after theory of everything are meant to explain and offer a complete understanding of less comprehensive aspects of reality.

Wolfgang Pannenberg's views on explanation and understanding, when weighed against the dialectic of views between the unifying physicists and Cartwright on the same matters, appear especially to offer possible syntheses. Pannenberg's positions on truth and reality, which are reflected in microcosm in his Prescriptivist accounts of laws, can seem either outmoded via Swartz's taxonomy, or still viable in the light of Cartwright's less conventional argument that talk of laws *must* include God. The aim in the following section is to show how, with explanation and understanding, the idea of a limited Pannenbergian middle way can appear an even more promising proposal than with truth and reality, albeit again not unequivocally.

Physics on Explanation and Understanding

Explanation and understanding in Richard Feynman's straightforward manner of considering physics were all about fitting phenomena into “the rhythms

and patterns” of nature. Laws of nature compose these rhythms and patterns. In the first volume of his *Lectures on Physics*, Feynman asks what kind of “understanding” nomological explanations grant:

What do we mean by “understanding” something? We can imagine that this complicated array of moving things which constitutes “the world” is something like a great chess game being played by the gods, and we are observers of the game. . . . [I]f we watch long enough, we may eventually catch on to a few of the rules. *The rules of the game* are what we mean by *fundamental physics*. . . . We must, therefore, limit ourselves to the more basic questions of the rules of the game. If we know the rules, we consider that we “understand” the world.¹³⁵

Steven Weinberg, in similarly colloquial terms, has written in *Dreams of a Final Theory* that scientific explanations are best seen as

a mode of behavior that gives us pleasure, like love or art. . . . I do not mean that scientific explanation can be pursued without any constraints, any more than can love or art. In all three cases there is a standard of truth that needs to be respected, though of course truth takes different meanings in science or love or art.¹³⁶

Scientific explanation, he continues, most often “clearly has to do with the deduction of one truth from another,” although not only that, since merely deducing one truth from another “does not necessarily constitute an explanation.”¹³⁷ There are cases in which “either can be inferred from the other,”¹³⁸ Weinberg indicates, in that scientific explanations bear a type of “direction,” or teleology:

Explanation, unlike deduction, carries a unique sense of *direction*. We have an overwhelming sense that the photon theory of light is more fundamental than any statement about heat radiation and is therefore the explanation of the properties of heat radiation. And in the same way, although Newton derived his famous laws of motion in part from the earlier laws of Kepler that describe the motion of planets in the solar system, we say that Newton’s laws explain Kepler’s, not the other way around.¹³⁹

Explanation and understanding, for Feynman and Weinberg, are all about laws of nature. While arguing that a question about whether or not laws are real is nearly unworthy of consideration, Weinberg derides Wittgenstein for having implied that laws of nature are not explanations of natural phenomena, likening that to “telling a tiger stalking prey that all flesh is grass.”¹⁴⁰

The standard model of physics counts as a good explanation because it is not merely “an assortment of odds and ends thrown together in whatever

way works. . . . Rather, the structure of the standard model is largely fixed once one specifies the menu of fields that it should contain and the general principles (like the principles of relativity and quantum mechanics) that govern their interactions.”¹⁴¹ A final unification of laws represents for Weinberg an ultimate understanding as far as our current comprehension of the world through science is concerned.

The convergence of laws is a nexus of explanations.¹⁴² The final theory will be one in which a grand explanation, “the ancient search for those principles that cannot be explained in terms of deeper principles,” will have reached an end. Other “wonderful phenomena,” like human thought, or turbulence, will still need explaining. Thus the location of a “final theory” would not mean the “end of science.”¹⁴³ It would not actually be *the* final theory, despite the title of Weinberg’s book. Understanding is a circumscribed category for Weinberg, as any full sense of understanding will likely remain elusive, especially if the metaphysical and theological senses offered by a theologian like Pannenberg are implied.¹⁴⁴

Two thinkers in particular have provided all sciences with important foundations for the concepts of explanation and understanding expressed by Feynman and Weinberg. First, Aristotle’s (384–322 bce) ancient ideas in *Physics*, about various types of causes—formal, material, efficient, and final—and their effects were arguably the first real attempts at systematically explaining physical phenomena.¹⁴⁵ For Aristotle, the world was imbued with teleology; everything had a cause and resulting effect bound up within its nature.¹⁴⁶

Early modern science began to reject this notion, dividing between the teleological and the scientific. Francis Bacon (1561–1626) argued for knowledge of nature’s laws based on repeated, or experimentally repeatable, sets of circumstances. He disputed with Aristotelian “science” on this account, arguing that Aristotle had “corrupted” natural philosophy by making it subservient to his logic, rendering it disputatious and virtually useless.¹⁴⁷ Bacon’s empirical, inductive methodology was meant to ensure that the more comprehensive a law was found to be, the more certainty it offered as an explanation.¹⁴⁸

Bacon was expressing in embryonic form the idea later to be understood especially through twentieth-century logical positivism as a “covering law.” A covering law is intended to link an *explanans*, or that doing the explaining, with an *explanandum*, that requiring explanation. The *explanans* is made up of initial conditions combined with a set of explanatory laws, and from this combination of factors one shows that the *explanandum* is the result.¹⁴⁹ The notion is that a reproduction of reliable circumstances relating to phenomena (Bacon’s repeatable “prerogative instances”), such that the circumstances are *always* found to be in connection with the phenomena or *absent* in its absence, gives an explanation. Succinctly, a law covers a situation as its explanation, offering understanding of a given phenomenon.

Following Bacon’s intent to transform wholly the methods for interpreting nature in use during his lifetime, the idea of laws covering phenomena

became essential for the foundations of scientific method. Not least, this applied to the interpretation of natural laws themselves. The idea of covering laws has prevailed into the twenty-first century, despite the later protests from Hume, and other Regularists today, in which regularity, or mental association, is favored over nomological necessity in physics. The carefully realized idea of a covering law, and related statistical constituent laws, carries the strongest possible notion not only of necessity, but also of explanation.

The concept of a covering law is now standard, but was given its seminal and most thoroughgoing expression in the work of philosopher of science Carl Hempel (1905–1997). His accounts of covering laws attempt to reconstruct sound parameters for the actual practices of the sciences in systematic terms. In *Aspects of Scientific Explanation* (1965), Hempel detailed how “*an explanation is an argument whose premises include laws and whose conclusion is a description of the phenomenon to be explained.*”¹⁵⁰ In a classic treatment, he wrote that,

A scientific explanation may be regarded as an answer to a why-question, such as: “Why do the planets move in elliptical orbits with the sun at one focus?” . . . There are other modes of formulating what we will call *explanation-seeking questions*: we might ask what caused the failure of the television apparatus on Ranger VI, or what led Hitler to his fateful decision. But a why-question always provides an adequate, if perhaps sometimes awkward, standard phrasing.¹⁵¹

He further elucidated other types of questions needing explanations, including *explanation-seeking-why-questions* (“Why is it the case that p?,” where the place of “p” is occupied by an empirical statement specifying the explanandum), and *reason-seeking* or *epistemic* questions, which solicit evidence in support of assertions.¹⁵²

From such delineations Hempel distinguished “two basic types of scientific explanation, *deductive-nomological* and *inductive-statistical*. . . .”¹⁵³ In deductive-nomological (D-N) explanations, the premises entail the required conclusions. Inductive-statistical explanations show an explanation to be at least probable.¹⁵⁴ D-N explanations, as the stronger among the two types of statements, presuppose general, all-encompassing laws connecting all like causes and their effects.¹⁵⁵

This widely accepted idea of the completely comprehensive character of covering laws as explanations raises two matters of particular relevance for comparing the three accounts of explanation and understanding. One is that an important aspect of scientific explanations involving general or theoretical laws is an almost necessary emphasis on explanation against understanding. Cartwright has made much of this trend by way of illuminative criticism. In essence, she has emphasized, as a reaction, understanding against explanation. While unifying physicists and Cartwright alike seek explanation and understanding, these separate emphases occur. Physicists

arguing for covering and theoretical/fundamental laws necessarily emphasize the larger picture, and thus the “whole,” which sacrifices understanding of partial aspects of the whole in the course of explaining. Cartwright’s arguments not only value but require an emphasis on the “parts.” This energizes her claims to a more exacting depiction and understanding of the truth and reality of given situations and the world overall, which constitute the very arguments of her several recent theses on laws. The same trends also provide one of the interesting footholds for a seeming Pannenbergian synthesis, because Pannenberg works consciously to synthesize both types of trends together, inclusive of concepts of the “whole” and the “parts” across the natural and human sciences.

A second matter is the way in which physics has connected unity itself with explanatory power. In *Unifying Scientific Theories*, mathematician and philosopher Margaret Morrison reminds us that

[a] unified theory is simply one that explains several different phenomena using the same laws. And frequently, what it means for a theory to have explanatory power is analyzed in terms of its ability to unify. The best explanation then typically will be the one that unifies the greatest number of phenomena.¹⁵⁶

Morrison argues against such notions, positing a two-fold thesis aiming for a mid-point between classic understandings of unity in physics and what she sees as unnecessarily extreme reactions in colleagues countering with a metaphysics of disunity.¹⁵⁷ As for the first thesis, she admits that although unification has been, and remains, important to the processes of science, a closer analysis reveals that often there are no real implications either for a reductionist metaphysics, or for the idea of an ontological unity of nature.¹⁵⁸ In her second thesis, she attempts to mediate extreme reactions to a reductionist metaphysics of unity. Still, she confirms throughout by virtue of arguing the first thesis that, indeed, physics links explanation with ideas intent on explaining the *whole* of our world. Morrison contends that unification should not be understood in terms of explanatory power, however, since the facilitation of unification and explanation are not necessarily governed by the same mechanisms, mathematical or otherwise. They represent different processes.

Morrison’s theses both affirm some of Cartwright’s and mollify the tendencies of a metaphysical pluralist like Cartwright to posit an opposite, and arguably equally unwarranted, metaphysics of disunity. Morrison provides from within the philosophical community the kind of mediation Pannenberg’s thought can offer. For now, Cartwright makes Morrison’s first specific point herself extensively, against linking explanation with unity. Cartwright also argues that covering laws and related concepts come at the expense of true explanation, providing examples of what she considers better explanatory principles.

Cartwright on Explanation and Understanding

We have seen that Cartwright advocates retaining some of Aristotle's emphases, even if they were gradually replaced by the developing scientific method from the time of Francis Bacon. With regard to explanation and understanding, she also attacks directly Hempel's accounts of covering laws and the D-N model of explanation and by implication any similar models. Cartwright's arguments on explanation and understanding carry her contention that most laws, being *ceteris paribus* descriptions, require various machinations to make them true in the real world.

Her deconstructions of nomological explanations in physics can be seen clearly in two successive essays in *HLPL* (1983). In "The Truth Doesn't Explain Much," she critiques notions that the D-N and similar explanatory models tell us what they claim about laws governing phenomena and how to explain them.¹⁵⁹ In "Do the Laws of Physics State the Facts?," Cartwright describes why formulations of fundamental laws of nature necessarily trade truth (in essence, understanding of what is true) for supposed explanation, due to attempting to explain too comprehensively (or "cover") the realities of various phenomena.¹⁶⁰

The "truth" derided in "The Truth Doesn't Explain Much" is that the fundamental laws of physics describe true facts about real situations, and that by this describing one explains reality. Cartwright calls this the "facticity view of laws." Hempel's D-N model and several other covering law models, like those offered by Patrick Suppes ("the probabilistic model of causation"), Wesley Salmon ("the statistical relevance model"), and Bengt Hanson ("the contextualistic model"), use similar reasoning to make these same claims. That is, they use laws of nature for choosing which factors to offer in explanations that are meant to cover a wide range of like phenomena. Cartwright argues contrarily and with examples that "the fundamental laws of physics do not describe true facts about reality. . . . [R]endered as descriptions of facts they are false; amended to be true, they lose their fundamental, explanatory force."¹⁶¹

She begins to explain her thesis, and such statements, by contrasting biology with physics. If laws are to tell us the truth, they must describe true facts about real things, which should be a minimal requirement for any truth statement. Biology, she contends, does this, but physics does not. One biology textbook offers a detailed description of the behavior of gymnotoids, or American knife fish, by telling us that they are "slender fish with enormously long anal fins," and describing how they "swim slowly with the body straight by undulating this fin." The description continues to tell a reader that the fish "are found in Central and South America" and that, "unlike the *characins*, they hide by day under river banks or among roots, or even bury themselves in sand, emerging only at night."¹⁶² Fundamental physical laws, by contrast, do not tell us "what objects in their domain do." And thus Cartwright wants to know: if they do not do at least this, then

what do they do? What they do *not* do, she argues, is “provide true descriptions of reality.” She shows how part of the explanatory role of fundamental laws is to *not* give such descriptions. What she means is that they have to “trade-off” truth for the sort of wide-ranging explanatory power they attempt to offer.¹⁶³ One goal must be traded for the other; in emphasizing an explanation for the *whole*, they cannot emphasize the same for the *parts* they attempt to describe as true.

Nevertheless, laws are presented as universally true statements and descriptions—although a careful eye will notice that they are only true when presented with various refinements. An example is Snell’s Law,¹⁶⁴ as compared with the preceding biological description of the gymnotoids:

Snell’s Law: At an interface between dielectric media, there is (also) a *refracted ray* in the second medium, lying in the plane of incidence, making an angle θ_t with the normal, and obeying Snell’s law:

$$\sin \theta / \sin \theta_t = n_2 / n_1$$

where v_1 and v_2 are the velocities of propagation in the two media, and $n_1 = (c/v_1)$, $n_2 = (c/v_2)$ are the indices of the refraction.

Only some five hundred pages later, as presented in Miles V. Klein’s *Optics* (1970), does one learn that Snell’s Law is not *quite* true. It is only true when presented for media whose properties are isotropic, or the same in all directions. Anisotropic (not the same in all directions) media will usually require there to be “two transmitted waves.” Thus, what is true in actuality is a *refinement* of Snell’s Law,¹⁶⁵ which is necessarily a localized version. In essence, the true law must focus on a *part* of reality, rather than the *whole*, in order to be actually true:

Refined Snell’s Law: For any two media which are optically isotropic, at an interface between dielectrics there is a refracted ray in the second medium, lying in the plane of incidence, making an angle θ_t with the normal, such that:

$$\sin \theta / \sin \theta_t = n_2 / n^1$$

The previous (nonrefined) formulation from Klein is yet another example of what Cartwright calls a *ceteris paribus* law. *Ceteris paribus* laws are only true in special circumstances, and as long as nothing interferes. Snell’s Law is intended to “cover” the behavior of light rays passing through various media with isotropic optical properties—but nearly all optical media are anisotropic. Hence the adjusted “Refined Snell’s Law.” Cartwright’s question is, why keep the first instance of Snell’s Law on the books at all, when we know perfectly well that it is not quite true, and even have a refinement that is true? Such instances of widespread *ceteris paribus* laws

indicate explanatory commitments. They show what types of explanations are allowable.

The D-N model and similar covering law models assume the universe to be a tidy, well-ordered place. Cartwright argues that there is no evidence for such metaphysical conclusions; further, there is as much evidence for an alternative understanding. “God,” she contends, “may have written just a few laws and grown tired.”¹⁶⁶ We cannot, she asserts, conclude decisively from the evidence whether we are in a tidy or an untidy universe, since we cannot possibly measure each and every instance of all nomological possibilities. So, “whichever universe we are in, the ordinary commonplace activity of giving explanations ought to make sense.”¹⁶⁷

Covering-law theorists like Hempel, according to Cartwright, will see what she calls *ceteris paribus* explanations as “elliptical” for general covering law explanations considered to be from true laws—we simply do not yet know them.¹⁶⁸ To use Snell’s Law once again as an example, this means affording a “bet” that the law, even for anisotropic media, will have values “close enough” to those derived for the original version of the law. Cartwright’s admitted “extreme metaphysical possibility,” which is one that she “in fact, believes,” does not include that there must be laws to cover every instance. She thinks that laws are probably more like “people in societies,” which do not operate by any universal “covering law” stipulations. Rather, the behavior of people “is constrained by some specific laws and by a handful of general principles, but it is not determined in detail, even statistically. . . . [W]hat happens on most occasions [may be] dictated by no law at all.”¹⁶⁹

Michael Ashooh and Paul Tang have responded directly to Cartwright’s claims made in “The Truth Doesn’t Explain Much.” They argue that she misrepresents the nature of the D-N model of explanation, asserting further that Hempel’s ideas can accommodate her criticisms.¹⁷⁰ Hempel, they maintain, need not be construed as endorsing the “ontologically robust” notion of the truth requirement attributed to him by Cartwright. She is confusing Hempel with earlier traditions that required theories to involve *verae causae*, they contend—although they fail to cite any examples of these traditions. Hempel, they say, has only been concerned with representing what the scientific community allows by consensus, of what must be true of laws. In effect, he has proposed models that characterize what scientists indicate by their practices that they believe. Hempel allows elsewhere that there may well be nomological exceptions of a Humean variety to be accounted for, such as in a later work, when he wrote that rather than requiring sentences to be true, they should at least be “highly confirmed by all the relevant evidence available.”¹⁷¹ But even in what seems perhaps mostly about defending Hempel, ensuring that his D-N model is not “burdened” with unnecessary problems (like whether or not Cartwright is correct), they admit that her insights and observations must be “well taken.”¹⁷² Certainly, Cartwright’s fundamental views had not changed at the time of *DW* (1999) from those

that Ashooh and Tang critique in *HLPL* (1983). Her views only became more refined, and were asserted more astutely. Cartwright's view of explanation reflects her self-admitted take on understanding the metaphysics of reality. That is, that our dappled world is comprised of a beauty made up of parts. And in order to understand the world truly, one must adequately explain its parts, not settling for far less accurate (and less truthful) attempts at describing the whole.

Pannenberg on Explanation and Understanding

Pannenberg relates categories of truth and reality intricately to the concept of God. He ties categories of explanation and understanding to philosophical concepts of "part" and "whole," toward a further concept of "meaning." He argues that all parts and wholes in existence have their ultimate meaning in God, the definitive possible whole beyond all wholes. Pannenberg's discussions of these matters contain some of the most promising aspects of his thought for interdisciplinary conversations with the sciences or philosophies of sciences.

All of reality has a "semantic structure," according to Pannenberg. That is, in both the sciences and humanities, one must interpret any individual thing (a part) of a set of given things (a whole) in relation to a "semantic horizon." A semantic horizon represents all that can be understood, interpreted, and discussed about a thing or set of things using knowledge in an investigative field at a given time in history. Reality itself is "open"; the processes of human and natural scientific investigation will continually push past the present "horizon" toward new understanding, interpretation, and discussion, just as there is further reality beyond the horizon of an actual geographical plane that can only be seen on continual approach.¹⁷³

Pannenberg's view of reality with this semantic structure relates to his emphasis on history and *prolepsis*. What we now know is "part," while the "whole" of knowledge is to be revealed in the future of God, who knows all things.¹⁷⁴ Reality, like a text, features such wholes and parts reciprocally illuminating each other toward a meaning. In each regard, reality as a whole may be interpreted via a "hermeneutical" method, after the manner that a text can be approached. Dialectic, if stalemated as thesis and antithesis, can be moved toward a synthesis using this proposed hermeneutical method. "The experience of meaning," Pannenberg demonstrates from various thinkers in several disciplines, "both objectively and subjectively requires the evaluation of individual phenomena in the network of the relevant whole. . . ." Therefore, "there is a need for a total consideration which cannot be replaced by a causal analysis. This is the premise of both hermeneutical and dialectical method."¹⁷⁵

Thinkers in the sciences or philosophy like the physicists and Cartwright may understandably ignore Pannenberg's talk of the Trinity, Logos, or creation, though his arguments on explanation, understanding, part, and whole

touch on common ground across the scientific disciplines. Nevertheless, the theological aspects of Pannenberg's arguments are, for him, not separable from the other aspects, but are instead the most important features of his theses. Appreciating Pannenberg's treatment of explanation and understanding provides the very basis for comprehending his view of the interdisciplinary character of theology among the natural and human sciences.¹⁷⁶ F. LeRon Shults argues that perhaps Pannenberg's most important contribution to interdisciplinary dialogue has been precisely

his dual emphasis, on the one hand, on the similarity of theology to the other sciences due to the fact that they all must interpret reality with the categories of whole and part and, on the other hand, on the uniqueness of theology among the sciences due to its special relation to the concept of "whole." The main point . . . is that the relation of part and whole is key to Pannenberg's view of hermeneutics, and to his claim that theology involves both explanation and understanding.¹⁷⁷

Pannenberg expresses his views on explanation and understanding, and part and whole, most clearly in *TPS* (1973) and *MIG* (1988). He sounds as if he could have had both unifying physics and Cartwright in mind (he was not thinking of Cartwright), when he defines explanation and understanding in terms debated by them, including the D-N model. "Explanation," he writes commenting on the divergent emphases, "is generally taken to mean the inclusion of individual phenomena under a general rule [a law statement], in contrast to understanding, which considers the individual in the context of the whole to which it belongs."¹⁷⁸

From such definitions of contrasts, Pannenberg details how explanation and understanding have become separated in the modern sciences, and he envisions a way in which they might once again be brought together. Part and whole are concepts of explanation found most often in the human sciences. His desire is to show how the same concepts might be applied across all disciplines, including the natural sciences, using his proposed hermeneutical method. Hence he argues for a reintroduction of the category of "meaning" back into scientific discussions.

Pannenberg's contention is that categories of part and whole can serve together in the same schemes, amounting to explanations not devoid of understanding, and vice versa. For our principal dialectic, this could mean schemes emphasizing equally both explanatory wholes as in unifying physics, and constitutive parts as in Cartwright's philosophy, all at once. Pannenberg works to illustrate how use of his proposed hermeneutics could augment, and perhaps effectively replace, points of contention involving explanatory methods like Hempel's D-N model.¹⁷⁹ To these ends, he construes sets of part and whole categories throughout his writings, while discussing various matters including the doctrine of creation in *ST*. The categories appear in his schemes of unities and pluralities constituting descriptions of

creation.¹⁸⁰ He accomplishes all of this in tandem with, and as part and parcel of, a Trinitarian understanding of reality.

Recently, several evaluators besides Shults have considered Pannenberg's views on explanation and understanding and part and whole relations, albeit in the course of considering primarily other aspects of his work.¹⁸¹ One straightforward description by the Christian philosopher Nancey Murphy offers Pannenberg's views on explanation and understanding as involving a quite basic method whereby one places various phenomena to be explained (the parts) within ever-enlarging contexts (the wholes). The process as she describes it edges phenomena under investigation by the natural and human sciences toward a suitable "meaning" within a specified context. This implies moving phenomena toward an interpretative framework through which one can make truthful sense of them. Hence, "we may envision the development of science, history, theology, as the development of a series of concentric spheres or circles, each circle providing a wider framework of interpretation, a broader horizon of meaning."¹⁸²

Murphy's straightforward description and the succinct definitions I have provided are all helpful, yet they belie the complexity of the history and materials Pannenberg considers in constructing his arguments. Looking further especially into *TPS*, with *MIG*, provides a more complete picture. Capturing every nuance intended by Pannenberg requires not only acknowledgement of his definitions but also of his resource materials and historical tracings. *TPS* is the principal source for understanding what one may venture to call Pannenberg's "metaphysical hermeneutics."¹⁸³ *MIG* contains a more succinct version of the same ideas.

While Pannenberg's *TPS* was written several decades ago, it remains crucial for understanding his long-standing program for doing theology as a science in relation to other sciences. The book provides an applicable interpretative tool for all of his later material, including *ST*.¹⁸⁴ Of greatest consequence is the book's first half (Chapters 1, 2, and 3). There Pannenberg outlines his "science of meaning" for interpreting the whole of reality, to which all theological and scientific statements must necessarily be related.¹⁸⁵ The second half (Chapters 4, 5, and 6) develops arguments regarding theology as "theological science," according to the conclusions of the first half.¹⁸⁶

In the first half Pannenberg undertakes to explain the nature of the sciences, both natural and human, and of special pertinence to both, hermeneutics. Chapters 2 and 3 in *TPS* reveal the heart of Pannenberg's hermeneutical understanding. He works there to establish and develop three primary theses, building on them to make his arguments for the validity of theology as a science in the final chapters. These several theses give him a vital "framework for an explicit consideration" of the subject of hermeneutics as bearing on all of the sciences.¹⁸⁷ The points bear significance here toward relating Pannenberg's hermeneutical method to the dialectic between philosophers and physicists. His first thesis is, "The aim of hermeneutic is the understanding

of meaning, and meaning is to be understood in this context as the relation of parts to whole within a structure of life or experience.”¹⁸⁸

Pannenberg spends the entirety of Chapter 2 in *TPS* tracing how divisive emphases and seemingly necessary choices between categories like explanation (*Erklärung*) and understanding (*Verstehen*), as intimately related to “whole” and “part,” are aspects of an unfortunate Cartesian cultural inheritance that can be corrected.¹⁸⁹ The separation between the natural and human sciences is one prominent result. The dislocation of theology from all other sciences—including the struggle to consider theology a science at all—is symptomatic of the same divides. These inheritances have been accepted by Western civilization, and are now endemic to the sciences, philosophy, and theology as they investigate the world in our current cultural context.¹⁹⁰ To these other symptoms may be added the theses and antitheses disputed by the unifying physicists and Cartwright, which according to Pannenberg’s categorizations could be seen as emanating from the explanation versus understanding, and natural versus human, scientific divides. There are separate legitimate arguments between the physicists and Cartwright of an insularly scientific nature, concerning factors like mathematics and theory formulation in unification. But that the chief dialectic between them is largely metaphysical, centering on explanation, understanding, and what Pannenberg calls whole and part relations, is undeniable.

Pannenberg’s hermeneutical solution in *TPS* occurs within the context of formulating his overall method for locating theology amidst the “multiplicity and unity of the sciences.” This would include placing theology alongside both unifying physics and a philosophy of science like Cartwright’s in terms of its validity to comment on and explain reality. By engaging with several thinkers relevant to the overall historical development of these themes, in *TPS* Pannenberg advances his view of hermeneutics and whole/part relationality as a means of explaining reality.¹⁹¹ The issues and thinkers he considers figure into many thorough accounts of hermeneutics. Chronicling similar to his own appears in a number of volumes, supporting his reading of the history and key issues.¹⁹²

Pannenberg’s proposed synthesis seeking to mediate between emphases like unity (whole) or plurality (part) is based on a critical interpretation especially of the German theologian and philosopher Wilhelm Dilthey (1833–1911). Dilthey, like Pannenberg, was influenced by his interactions with Hegelian idealism. While it is disputed whether or not one may call Pannenberg “Hegelian,” at least a Hegelian *influence* on both appears in dialectical and historical modes of viewing and dealing with numerous problems.¹⁹³ These emphases appear in the unities and pluralities coming together with an added emphasis on history (*prolepsis*) in Pannenberg’s creation thought, as described above in Chapter 3. In Dilthey’s writings, one finds similar discussions concerning topics like a “unity of (intelligent) life which links all individuals.”¹⁹⁴

Dilthey, unlike Pannenberg, has argued for “meaning” in individual human experience as the key reason for separating what he called the human

sciences, such as philosophy or theology, from the natural sciences, like physics. It was certainly not a reason to think of bridging the spectrum of ideas typically investigated by each area of enquiry.¹⁹⁵ The original Cartesian notion that distinctions between “nature” and “mind” were differentiations of *substance* was lost with the advent of modern scientific understandings. But from that original distinction in Descartes, Dilthey pronounced meaning as the vital rationale for continuing at least a *methodological* divide between the *Geisteswissenschaften* (human sciences) and the *Naturwissenschaften* (natural sciences).¹⁹⁶ His argument was to shift our perspectives and methods from a focus on a natural scientific emphasis on nomological explanations to a human scientific emphasis on understanding, which is usually construed in terms of categories of part and whole.

Dilthey subsumed beneath the *Geisteswissenschaften* “the totality of the sciences which have as their object historical and social reality.”¹⁹⁷ The list of human sciences for Dilthey comprised those disciplines seeking to interpret the world through “language, myth, art, religion, philosophy and science.” Included were any concerned with “structures of life in state or society, laws, morals, education, the economy and manufacture.”¹⁹⁸ Dilthey built his concept of the human sciences on John Stuart Mill’s notion of separate “moral” sciences alongside the natural sciences, and Hegel’s idea, seen mostly in his students, that philosophy and science are not distinct, but constitute together a *Geisteswissenschaft*, or “science of mind.”

Dilthey’s differentiation between human and natural sciences on the basis of meaning had as its starting point

the vital “unity,” the “psycho-physical unity of life,” of the individual which is given in “internal experience,” in which not only the unity of personal consciousness, but also “the whole external world . . . is given.” This unity of life, “which fills us with the immediate sense of our undivided existence,” is “broken” by the methodology of the natural sciences.¹⁹⁹

For Dilthey, the idea that the only fit for a whole “unity of life” was the individual human person made any notion of the constructive use of categories like “unity and multiplicity, whole and part” *beyond* considering an individual person (even for human society as a whole) a useless enterprise. Dilthey later recognized that when considering individuals, an adequate understanding of the ways in which they are parts of larger wholes featuring a “totality of historical and social life” had significant merit.²⁰⁰ This caused him to develop more fully “the logic of the mutual relationship between whole and part,” constituting a more mature view of his hermeneutic for interpreting human experience. He never extended a constructive use of whole and part categories to the natural sciences, however, believing it impossible to relate a concept of meaning to the nomological explanations found in and used by them.²⁰¹

Pannenberg argues, in contradiction to Dilthey, for bringing all of the natural and human sciences under the same kind of explanatory hermeneutic of whole and part. This move could be extended to all similarly divided problems in scientific human enquiry. He begins his case with a litany of objections to Dilthey's ideas by several thinkers.²⁰² Among the various protests, which were mostly arguments about how one might arrange the sciences differently to Dilthey's vision, are pivotal arguments about *systems* from Andreas Angyal and Ernest Nagel. Pannenberg's second principal thesis in Chapter 2 of *TPS* is constituted by his effort to show how "[i]t proved possible to connect the idea of whole with E. Nagel's idea of pattern, and in this sense with that of system, which in turn made possible a connection between theory construction in hermeneutic and theory construction in natural science."²⁰³

Angyal, in 1939, was among the first to relate the concept of "whole" to "system" as in "systems theory," which was developed later in the 1950s.²⁰⁴ Systems theory studies properties of systems as wholes from an interdisciplinary perspective. The systems studied can be of any type, covered by any discipline. Even systems of musical notes constituting melodies, as studied in music theory, would fit the parameters.²⁰⁵ In his essay "The Whole Is More Than the Sum of Its Parts," Nagel had argued similarly to Angyal.²⁰⁶ He offered numerous examples from various disciplines showing how "wholes, sums, and organic unities" are all reasonably similar across numerous fields, including mathematics and physics. Nagel argued that no special distinctions may be said to exist for individual wholes of a physical, biological, psychological, or social variety, despite scientific claims to the contrary.²⁰⁷ He specifically contradicted the claim that some special distinction of these individual organic wholes effectively limits "the scope of the methods of physics" from being similarly considered.²⁰⁸ Nagel's examples of different wholes and constitutive parts, although not considered by Pannenberg, include a number of ways in which any "x is said to be whole in relation to something y." Covered are spatial properties like length, area, or volume; temporal periods; classes, sets, subsets, or aggregates of elements; properties and processes like forces in physics, as constituted by lesser or different forces; patterns of relations; concrete objects; and finally, any systems whose parts stand in various relations of dynamical interdependence.²⁰⁹

The idea of systems theory in Angyal and Nagel provides a turning point in Pannenberg's arguments around the simple fact that "the search for the 'meaning' of parts in the network of a 'whole' is by no means restricted to the study of human experience or even of organic life."²¹⁰ The significant idea for Pannenberg was that

the introduction of the concept of system and related cybernetic considerations can correct the exclusive association of questions of meaning with the human sciences and clarify the meaning of such fundamental hermeneutical concepts as whole and part by relating them to the

problems of general systems-theory. . . . There seems therefore to be hope, after all, of overcoming the exclusion of the subject of meaning from the methods of natural science.²¹¹

Pannenberg works throughout *TPS* to achieve his goal of breaking down the perceived opposition between “explanation” and “understanding,” with regard to placing meaning back into natural scientific discussions on several fronts. He desires to show how hermeneutics, interpreting parts and wholes together toward an expanding semantic horizon, is a form of explanation superseding other forms like the D-N model. As his third thesis in *TPS*, Chapter 2, states,

the distinction frequently said to exist between “understanding,” in the sense of the understanding of meaning, and “explanation” by means of hypothetical laws cannot be maintained. . . . Rather, every guide to understanding, and so every hermeneutical aid to understanding, must itself be treated as an explanation. Explanation of this sort may take the form of inclusion under hypothetical laws, but it is not limited to this form.²¹²

He discusses explanation and understanding generally in relation to scientific theories, showing how neither explanation nor understanding can truly be achieved without the other, even though they are distinct concepts.²¹³ On this point, Pannenberg’s argument that all fields of enquiry, including the natural sciences, should be able to proceed in explaining and understanding by interpreting wholes and parts according to the semantic structure of reality appears. The “semantic horizon,” the ultimate acceptable framework for interpreting and explaining phenomena and ideas in any field at any time, gradually gets pushed to new levels of understanding as innovative explanations (or “experiences”) come to light. Pannenberg explains how this process functions in the sciences and beyond, when commenting on Kepler and Newton as examples of an advancing horizon of explanations:

understanding operates within a frame of reference which in this case is provided by the *explanation* offered by Newton’s theory. An explanation can therefore provide a framework for understanding, which is concerned with the relation of individual phenomena—in this case Kepler’s laws and deviations from them—within this framework. . . . Where we understand, no explanations are needed. It is only when we do not understand that explanations are required. . . . It is only to the extent that particular segments of this semantic horizon are made uncertain by surprising experiences that an *explanation* is required. The explanation explicates the existing frame of reference used by the person who seeks understanding, and at the same time partly replaces it with an intellectual construction of the totality of meaning under question. It is not just the sciences which do this; the process also occurs in religion and art.²¹⁴

The same occurred later in history when Newtonian gravity largely gave way to Einstein's relativity; quantum theory brought a similar revolution. This would occur again if a concept like string theory were more decisively accepted over any previous understanding, revolutionizing our current comprehension of reality at its most basic levels to include multidimensional vibrating string-like structures.²¹⁵ Stephen Toulmin straightforwardly refers to this process of new explanations being required when current frameworks of understanding become unintelligible as "making sense" of the new observations.²¹⁶

Pannenberg sounds like Cartwright when he concurs with A. C. Danto that "a law deals only with a general *class* of events, though in fact the events themselves are not homogenous, and this means that bringing an individual event under a law does not explain its particularity."²¹⁷ Pannenberg, then, rejects any notion that "understanding" can be successfully subsumed beneath "explanation," just as Cartwright interprets Hempel's D-N model to be attempting to do unsuccessfully.

Hempel's covering law model, to which Pannenberg assigns the basic definition "the inclusion of individual phenomena under natural laws,"²¹⁸ differs from the way in which Dilthey's argument can be said to have required "understanding to have a universal nomothetical structure, and so indeed serve to 'explain understanding.'" While the phenomenon of "understanding" itself might well be subjected to a nomological explanation, in the sense of *explaining* understanding, "this is no more than an explanatory statement about the *process* of understanding."²¹⁹ Better, argues Pannenberg, one might say that explanation always presupposes understanding. This means that a scientific explanation using laws is but a special form of understanding. But as for reducing understanding to explanation, Pannenberg firmly concludes that the "reduction of understanding to the pattern of deductive-nomological explanation turns out to be impossible even though understanding itself can perfectly well be the object of this type of explanation."²²⁰ The D-N model itself "requires a broader concept of explanation even to be intelligible as an individual form of explanation. . . . [I]t alone is inadequate to show how deductive-nomological arguments function as an explanation."²²¹

While the humanities, including the philosophy of Cartwright, may be seen to emphasize understanding and thus *parts* in the network of a whole set or system, Pannenberg's arguments in critique of Hempel and the D-N covering law model cannot be taken as a wholesale emphasis on "part" in the same way that Cartwright emphasizes plurality or parts. He argues instead that even in the human sciences, where part or understanding might be the first principle, "the concept of the whole plays a fundamental role . . . similar to that of law in the natural sciences."²²²

In emphasizing the idea of the "whole," Pannenberg underscores the way in which one may say that "explanations are sentences, propositions, or arguments making claims of understanding about ontological status."²²³ His

philosophy of what exists in reality, based on a *proleptic* understanding of God and interpreted through a part and whole hermeneutics toward an ultimate meaning in God, has even been called an “ontology of the whole.”²²⁴ Christiaan Mostert explains:

The notion of an ‘eschatological ontology’ is unusual but it accurately describes what Pannenberg sets out to achieve. . . . Pannenberg’s ontology is indeed an eschatological ontology, in which the future has ontological priority. But there is a more fundamental feature of his thought, which should be discussed first. This is his determination to think about *reality as a whole*. This phrase, against the stream of much recent philosophy, immediately identifies the background of Pannenberg’s philosophy. It suggests speculation on the grandest possible scale.²²⁵

Mostert is referring to Pannenberg’s determination to discuss “reality as a whole” by making metaphysics a necessary conversation partner with theology and the sciences. Pannenberg’s stress on a renewed role for metaphysics defies the general direction of philosophy and theology in recent decades. What is now widely called a postmodern mode of doing philosophy and theology includes refraining from a focus on grand scales that consider notions like universals. Cartwright is a modified exception in that she seeks to dismantle the metaphysics of unity advanced by a physics of unification, but then posits in its place a grand metaphysics of disunity. Still, her tendency toward part (plurality) and not whole (unity) could be interpreted as post-modern. Philosophy and theology have limited their investigations similarly to partial, immediate, and contextualized concerns.

Pannenberg also focuses on the particular and contextual, but not at the expense of equal attention to the whole of reality at once. This grandiose style of thinking is the very stuff of metaphysics. Pannenberg believes not only that one must be willing to consider such a grand metaphysics, but again that both unity (whole) and plurality (part) are true aspects of reality, which can only be held successfully together by virtue of such metaphysical considerations. Pannenberg’s focus on metaphysics follows the manner of early Greek premodern philosophies like Aristotle’s. While Pannenberg shows similarity to unifying physics by asserting that the “whole” must be emphasized, he is also like Cartwright in desiring to reinstate not only “part,” but also an Aristotelian emphasis back into scientific reflection, in his case on both the consideration of metaphysical categories and a modified version of meaning.

When Aristotle referred to the categories (*katēgorein*), he “did not develop his doctrine . . . as a doctrine of the meaning structures of language or of the assertion as a linguistic form, but also as a doctrine of the most general forms of what is [*des Seienden*].”²²⁶ This idea of the “most general forms of what is” implies as it sounds, “that every category is related to the totality of knowledge (and thus to the totality of what is). . . .”²²⁷ Ideas for

how to catalogue the totality of “what is” have differed over the centuries, and even at the same times in history depending on the field of investigation doing the cataloguing. In the natural sciences today “law is the foundational category,” and in a similar fashion, “the concept of the whole plays a fundamental role in the so-called human sciences.”²²⁸

Several major themes in Pannenberg’s thought, inclusive of his whole/part hermeneutics, come full circle around these arguments for reinstating metaphysics and meaning. His contention that theology is especially situated to comment on trends in the human and natural sciences is due to its unusual position among the sciences as a science of the ultimate whole, God. He argues that the science of theology itself, whatever its focus, “proceeds by a constant dialectic of the particular and universal.”²²⁹ Mostert has written of Pannenberg’s material that “Pannenberg’s agenda, in part, is the age-old problem of the one and the many.”²³⁰ The God of theological reflection is the Whole beyond all other parts and wholes, who has authored a world made up of parts and wholes that must be held together to form a true depiction of reality, while the anticipation of the final meaning of this reality awaits the future *eschaton* of God. Theology can neglect this special relationship to the other sciences, and the associated opportunity for explaining and contributing to a consummate understanding of ultimate reality, if it wishes. But Pannenberg believes the opportunity is there to be had, and that the commentary on potential offer from theology is not just about God, but also the character of natural order:

The particular significance which the category of the whole holds for theology (and continues to hold, even when the individual theologian shies away from taking this fact into account) is conditioned by the idea of God. Whoever uses the word “God,” particularly as a singular, makes a claim at the same time about the totality of what exists finitely. The Christian doctrine of God as the Creator of the world has this significance.²³¹

It is when this special situation and opportunity are neglected that theology becomes relegated to being a “nonscience,” left to a dreaded existence ghettoized from other disciplines. And theology for Pannenberg has something vital to say to the sciences attempting to make sense of a world seemingly riddled with “gaps,” which only consideration of the All-determining Reality can make complete. Accepting this task requires theology to realize its important position among the plurality of the human and natural sciences. Theology must also rekindle the field of metaphysical reflection, being only then able to comment on the character of the world as disputed between physicists and philosophers of science. Only by taking up metaphysical reflection, Pannenberg argues at length both in *TPS*²³² and *MIG*,²³³ can theology retain this relevance. That theology has not always retained it is not unconnected with a paucity of theological metaphysics; the relationship is

reciprocal. He himself says succinctly, “More than anything else theological discourse about God requires a relationship to metaphysical reflection if its claim to truth is to be valid,” and such “talk of God is dependent on a concept of the world, which can be established only through metaphysical reflection.”²³⁴ Reciprocally, the interrelating of the world to God, if God is argued to be the All-determining Reality, depends on successfully relating the whole and all of its parts together in the sense that

substantiation of talk about God requires that everything which exists should be shown to be a trace of the divine reality. This requirement applies, however, not to objects in abstract isolation, but to their unbroken continuity: “all,” as used in the concept of an all-determining reality, refers not to each individual thing on its own but to each in its continuity with all others. Theology as the science of God would then mean the study of the totality of the real from the point of view of the reality which ultimately determines it both as a whole and in its parts.²³⁵

This quote in particular provides a fitting synopsis of the entirety of Pannenberg’s system of “God and world,” “whole and part.” The reality inclusive of each of these emphases, insofar as it is an accurate depiction, he argues is best interpreted using a form of his suggested hermeneutics, which seeks to include whole, part, and the Whole beyond all parts and wholes, who is the author of all of things, together.

This chapter has continued the hypothetical approach begun in Chapter 3 of this volume, assuming Pannenberg’s scientifically and philosophically informed Trinitarian creation to be relevant to the physics/philosophy dialectic by way of offering limited material and methodological syntheses. The hypothesis has been tested by comparing several key terms and concepts in the three sets of materials on which each respective worldview is based. This method has shown that each party means something quite different when discussing principal constituent concepts like truth, reality, explanation, and understanding.

The idea of a proposed Pannenbergian synthesis fares only so well with regard to truth and reality. Each party represents a variety of realism, but with differing epistemological commitments drawing contradictory conclusions. This appears most pointedly with regard to laws of nature, where each party represents one of three major and mostly antithetical views on laws in relation to God. The success of Pannenberg’s Prescriptivism depends on the limits of his account, which is chronologically outmoded in the scientific community, to make good on an argument like Cartwright’s that “talk of laws *must* include talk of God.” In this way, there still remains some promise of a reasonable Pannenbergian mediation.

Regarding explanation and understanding, Pannenberg’s hurdle from reintroducing premodern metaphysical reflections from the likes of Aristotle, connecting these to nineteenth-century theories on hermeneutics, all

toward successful theological apologetics, is vast. God cannot be indisputably *proven* in this way. This is true however well Pannenberg's explanations appear to fit a problematic like that disputed between physics and Cartwright on whether the world is primarily best explained and understood as a whole, or as a system of disjointed parts. Pannenberg's material is equally intriguing, however, in that his vision is so carefully considered and complete in scope that it addresses quite closely our specific dialectic, the details of which Pannenberg would have had no prior knowledge.²³⁶ Pannenberg's idea that theology must engage once again with metaphysics by formulating grand ideas explaining reality as a whole is fitting for our dialectic also. After all, both the unifying physicists and Cartwright have boldly acted likewise. Theology will only escape further relegation to a Dark Age not by avoiding metaphysics, but by seeking at least to address the metaphysics that twenty-first century physics and philosophy of science dare to formulate—especially when these disciplines mention God. Pannenberg, although not himself engaging specifically with Cartwright's work, has answered their metaphysical dispute on whether God is a Unifier or Pluralist by offering a God who is a Unifier and Pluralist at once, along with the seeds of a hermeneutical method whereby one might interpret meaningfully the entire world of wholes and parts created by this God.

NOTES

1. Scientists like Richard Dawkins, Peter Atkins, and Steven Weinberg all display an antimetaphysical, antitheological viewpoint especially in their popular works, e.g., Dawkins, *The Blind Watchmaker* (1986), Atkins, *Creation Revisited* (1994), and Weinberg, *Facing Up* (2001). Their professional scientific writings demonstrate the total irrelevance of theology to those works.
2. *ST*, II, xiii, and in a private interview at Oxford University. At the interview Pannenberg was unaware of Cartwright's work, and had not considered his ideas on laws of nature or Trinitarian creation in light of a scientific unifier/philosophical pluralist dialectic. He affirmed that he considered the method employed in this volume to be an excellent idea, and test case, for his claims and methods.
3. Ronald N. Giere, "The Skeptical Perspective: Science without Laws of Nature," in *Laws of Nature: Essays on the Philosophical, Scientific, and Historical Dimensions*, ed. Friedel Weinert (Berlin: Walter de Gruyter, 1995), 120–138. Giere's essay discusses the "fact about humans that their practices are embedded in interpretative frameworks."
4. Hugh G. Gauch, Jr., *Scientific Method in Practice* (Cambridge: Cambridge University Press, 2003).
5. *Ibid.*, "Four Bold Claims," 27ff.
6. *Ibid.*, 3. Gauch quotes the findings of a report by the American Association for the Advancement of Science, *Designs for Science Literacy* (Oxford: Oxford University Press, 2000), 18.
7. *Ibid.*, 406. Gauch no doubt intends that "theory choice" include the usual necessary components of devising and testing, i.e., the processes of experimentation, theory construction, and the testing of hypotheses.

8. Ibid., 27–73.
9. Ibid., 30.
10. Ibid., 31.
11. Ibid., 33.
12. Ibid., 35.
13. Ibid., 38.
14. Ibid., 38.
15. Ibid., 39.
16. Ibid., 138ff.
17. Ibid., 136, 120. People are commonly aware that despite any questions about laws, a walk off a cliff will always results in a fall, wherever, whenever, and by whomever the feat is attempted. Contrarily, there is an arguable breakdown of common sense when matters like quantum physics are considered, with reality at micro level acting counter-intuitively and otherwise defiantly of ordinary experience. See Lewis Wolpert, *The Unnatural Nature of Science* (London: Faber and Faber, 1992).
18. Ullica Segerstråle, in *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond* (Oxford: Oxford University Press, 2000), shows how contextualizing terms like “truth” makes them concrete and manageable. Examples of similar accounts of all four terms considered in this volume include Michael Friedman, “Explanation and Scientific Understanding,” *Journal of Philosophy* 71 (1974): 5–19, and an earlier account by Carl G. Hempel and Paul Oppenheim, “Studies in the Logic of Explanation,” *Philosophy of Science* 15 (1948): 135–175.
19. Each category leads to the other even in common discourse, as Gauch indicates. We discover “truths” about “reality,” and “explanations” inform our “understanding.” Cf. Shults, *The Postfoundationalist Task of Theology*, 43–81. Shults divides similar terms into “four couplets of postfoundationalism.” These are “experience and belief,” “truth and knowledge,” “individual and community,” and “explanation and understanding.”
20. Rom Harré, *Varieties of Realism* (Oxford: Blackwell, 1986).
21. Gauch, 142.
22. Larry Laudan has attacked these strong realist characterizations in a number of writings, including “Ex-Huming Hacking,” *Erkenntnis* 13 (1978): 417–435; “A Confutation of Convergent Realism,” *Philosophy of Science* 48.1 (1981): 19–49; and “Realism without the Real,” *Philosophy of Science* 51.1 (1984): 156–162.
23. Weinberg, *Dreams of a Final Theory*, 46.
24. Bas C. van Fraassen, “Arguments Concerning Scientific Realism,” in *The Scientific Image* (Oxford: Clarendon Press, 1980), 7.
25. Ibid., 6–13.
26. Ibid.
27. Gauch, 131.
28. Harré, “Realism and Antirealism,” chap. 2 in *Varieties of Realism*, 34.
29. A.J. Ayer, “What Is a Law of Nature?,” in *The Concept of a Person* (London: Macmillan, 1963), 209–234.
30. John W. Carroll, *Laws of Nature* (Cambridge: Cambridge University Press, 1994), and *Laws of Nature: Essays on the Philosophical, Scientific, and Historical Dimensions*, Friedel Weinert, ed. (Berlin: Walter de Gruyter, 1995).
31. Harré, *Laws of Nature* (London: Duckworth, 1993), 9. Emphasis mine.
32. Weinberg, *Dreams of a Final Theory*, 46–47.
33. Ibid., 167.
34. Harré, *Laws of Nature*, 9. David B. Malament, ed., *Reading Natural Philosophy: Essays in the History and Philosophy of Science and Mathematics*

- (Chicago: Open Court, 2002), provides a resource for these overlapping concerns: "Ancient and Seventeenth-Century Science" (part I, 9–125), "Nineteenth- and Twentieth-Century Science" (part II, 129–293), and "General Epistemology and Philosophy of Mathematics" (part III, 297–405).
35. Hence Cartwright's question in *HLPL* (55), "[I]f physics' basic explanatory laws do not describe how things behave, what do they do?"
 36. Feynman, *The Character of Physical Law*, 39.
 37. Ibid., chaps. 2 and 4: "The Relation of Mathematics to Physics" (35–58) and "Symmetry in Physical Law" (84–107). An extended discussion of symmetry and its effects upon modern physics appears in Anthony Zee, *Fearful Symmetry: The Search for Beauty in Modern Physics* (Princeton, NJ: Princeton University Press, 1999 [1986]).
 38. While Cartwright is a mathematician and philosopher, the mathematical language of physics limits Pannenberg principally to philosophical discussions of laws. E.g., *ST*, II, 152–153, where laws of nature in the context of the doctrine of creation are discussed, but only one occurrence of the subject of mathematics is indexed. See also Pannenberg, "Contingency and Natural Law," in *TTN*, 72–122, where laws are discussed in terms of their philosophical and theological implications, but not their mathematics.
 39. Penrose, *The Road to Reality*, 9.
 40. Ibid., e.g., chaps. 2, 6, 8, 12, 16.
 41. Ibid., 217.
 42. Ibid., 730, 757–781. Wherever Penrose discusses a "Creator" he uses quite complex mathematics.
 43. *HLPL*, 54. This is Cartwright's terminology for a straightforward view of physical laws as telling the truth. She has written, "I propose to call this doctrine the facticity view of laws. (The name is due to John Perry.)"
 44. Abner Shimony, "Some Intellectual Obligations of Epistemological Naturalism," in *Reading Natural Philosophy*, ed. David B. Malament, 300.
 45. G. H. Hardy, *A Mathematician's Apology* (Cambridge: Cambridge University Press, 1992 [1947]), 122–124.
 46. Alexander George and Daniel J. Velleman, *Philosophies of Mathematics* (Oxford: Blackwell, 2002), 7.
 47. Ibid., with "doxastic" being a reference to characterizing relations between truth and belief.
 48. Hardy, 123.
 49. Penrose, *The Road to Reality*, 13.
 50. Ibid.
 51. Ruby, "The Origins of Scientific Law," 341–359. Ruby states, "Apparently without reservation, for over three hundred years scientists have called the intelligible, measurable, predictable regularities they find in nature 'laws.'"
 52. Examples of texts for students and professionals surveyed include, M. Nelkon, *Principles of Physics* (Essex: Longman Group UK, 1981); David Halliday, Robert Resnick, and Jearl Walker, *Fundamentals of Physics* (New York: Wiley, 2001); Raymond A. Serway, *Physics for Scientists and Engineers* (New York: Saunders College, 1986); Hugh D. Young and Roger A. Freedman, *University Physics with Modern Physics* (San Francisco: Addison-Wesley, 2000); Charles A. Poole, *The Physics Handbook: Fundamentals and Key Equations* (New York: Wiley, 1998). Scientific encyclopedias like Rita G. Lerner and George L. Trigg, *Encyclopedia of Physics* (New York: VCH Publishers, 1991) contain no general entries on "law of nature" or "physical law," beginning instead by assuming "law" and expounding specifics.
 53. Feynman, *The Character of Physical Law* (New York: Penguin, 1992 [1965]). This seems so despite Cartwright's argument that "at least Feynman does not

- claim that the laws he studies describe the facts.” Cf. Cartwright, *HLPL*, 55. Any difference seems semantic.
54. *Ibid.*, 13–34.
 55. Friedel Weinert, “Laws of Nature—Laws of Science,” in *Laws of Nature: Essays on the Philosophical, Scientific, and Historical Dimensions*, 4–5.
 56. *Ibid.*, 5.
 57. *HLPL*, 100.
 58. Norman Swartz, *The Concept of Physical Law*, 2nd ed. (Cambridge: Cambridge University Press, 2003), 3. Emphasis his.
 59. *Ibid.*, 4.
 60. Richard P. Feynman, *The Feynman Lectures on Physics*, vol. 1 (London: Addison-Wesley, 1963), 2–2. Emphases Feynman’s.
 61. Paul Davies, “Algorithmic Compressibility, Fundamental and Phenomenological Laws,” in *Laws of Nature: Essays on the Philosophical, Scientific, and Historical Dimensions*, ed. Friedel Weinert, 257.
 62. Grover Maxwell, “The Ontological Status of Theoretical Entities,” in *The Nature of Scientific Theory*, ed. Lawrence Sklar (New York: Garland, 2000), 1–25.
 63. Feynman was known for his gift of making the deep complexities of physics accessible, perhaps aided by his approach to physics as being akin to common sense.
 64. “Do the Laws of Physics State the Facts?” in *HLPL*, 55.
 65. *Ibid.*, 54.
 66. *DW*, 12.
 67. *HLPL*, 54–73. The book’s title suggests Cartwright’s principal thesis.
 68. Van Fraassen, *The Scientific Image*, 10. Emphasis mine.
 69. *DW*, 23.
 70. *Ibid.*
 71. *Ibid.*, 37.
 72. *Ibid.*, 59.
 73. *Ibid.*
 74. *HLPL*, 56.
 75. *DW*, 5.
 76. Pannenberg, “What Is Truth?,” in *Basic Questions in Theology*, vol. 2 (London: SCM Press, 1971), 1–27. Hereafter appearing as *BQT* with volume number.
 77. Pannenberg, *Faith and Reality* (London: Search Press, 1977).
 78. *ST*, I, chaps. 1–3, 1–188, *passim*.
 79. Pannenberg, “What Is Truth?,” 1–2.
 80. *Ibid.*, 26–27.
 81. Pannenberg, *Faith and Reality*, vii.
 82. *Ibid.*, 8–9.
 83. *Ibid.*, 9.
 84. *Ibid.*
 85. *Ibid.*, 10–11.
 86. *Ibid.*, 11.
 87. *Ibid.*
 88. *ST*, I, 53.
 89. Polkinghorne, *Scientists as Theologians* (London: SPCK, 1996), esp. 11–25.
 90. Andreas Losch, “Our World Is More Than Physics: A Constructive-Critical Comment on the Current Science and Theology Debate,” in *Theology and Science* 3.3 (November 2005): 275–290.
 91. *Ibid.*, 275.
 92. Polkinghorne, *One World* (London: SPCK, 1986).

93. Polkinghorne, *Scientists as Theologians*, 14.
94. Polkinghorne, *Exploring Reality: The Intertwining of Science and Religion* (London: SPCK, 2005), 4.
95. *Ibid.*
96. Alister McGrath, *The Science of God* (London: T&T Clark, 2004), 139–152. McGrath describes himself as having been influenced by Roy Bhaskar, *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, 3rd ed. (London: Routledge, 1998).
97. Shults, *The Postfoundationalist Task of Theology*, 81.
98. Mostert, *God and the Future*, 1.
99. Pannenberg, *Faith and Reality*, 17.
100. *Ibid.*, 11–12 and 16.
101. *ST*, I, chaps. 1–3, 1–188, and *passim*.
102. Christoph Schwöbel, “Wolfhart Pannenberg,” in *The Modern Theologians*, ed. David Ford (Oxford: Blackwell, 1997), 180–208.
103. *ST*, I, 1–61, 63–118, and 119–187.
104. *ST*, I, 50–51.
105. *ST*, I, 53.
106. As Pannenberg argues throughout *TPS*.
107. Weinberg, *The First Three Minutes: A Modern View of the Origin of the Universe* (London: André Deutsch, 1977), 154. The word Weinberg uses is “pointless.”
108. Shults, *The Postfoundationalist Task of Theology*, 248.
109. Norman Swartz, *The Concept of Physical Law*, 37ff.
110. *Ibid.*, 37.
111. *Ibid.*, 38. Swartz’s slightly longer definitions say in essence these same things.
112. *Ibid.*
113. See chap. 1 in this volume, 27.
114. Swartz, *The Concept of Physical Law*, 39
115. *Ibid.*, 38.
116. David Hume, section VII, part II, article 58, “Of the Idea of Necessary Connexion,” in *An Enquiry Concerning Human Understanding* (1748). Emphasis Hume’s.
117. Swartz, *The Concept of Physical Law*, 39.
118. Cartwright, *Nature’s Capacities and Their Measurement*, 3.
119. *Ibid.*, 2.
120. She implies “God” in the traditional monotheist sense of an all-powerful being.
121. Nancy Cartwright, “No God, No Laws,” an unpublished paper given at the Ian Ramsey Centre for Science and Religion, University of Oxford, 25 November 2004.
122. Cartwright, “No God, No Laws,” 1.
123. *Ibid.*, 7.
124. *Ibid.*, 11. Emphases mine.
125. *ST*, II, 70.
126. *ST*, II, 71.
127. *ST*, II, 72, 73.
128. *Ibid.*, 71.
129. *Ibid.*, 72.
130. Mostert, *God and the Future*, 168.
131. *TTN*, 115, 10n.
132. *ST*, I, chap. 2, “The Concept of God and the Question of Its Truth” (63–118), and chap. 3, “The Reality of God and the Gods in the Experience of the Religions” (119–187).

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133. Peter Achinstein, *The Nature of Explanation* (Oxford: Oxford University Press, 1983), 102.
134. Van Fraassen, "The Pragmatics of Explanation," chap. 5 in *The Scientific Image*, 97.
135. Feynman, *Lectures on Physics*, vol. 1, I, 2–1.
136. Weinberg, *Dreams of a Final Theory*, 26.
137. *Ibid.*, 26–27.
138. *Ibid.*, 27.
139. *Ibid.*
140. *Ibid.*, 28. "Such warnings leave me cold," Weinberg says.
141. *Ibid.*, 24–25.
142. *Ibid.*, 43.
143. John Horgan, in *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age* (New York: Broadway, 1997), argues that certain scientific advances like the formulation of a theory of everything could mean "the end of science" as we know it.
144. Weinberg, *Dreams of a Final Theory*, 18.
145. Aristotle, book II, in *Physics*, trans. R.P. Hardie and R.K. Gaye (Adelaide: University of Adelaide, 2004).
146. Again, this is the basis for Nancy Cartwright's argument for returning to Aristotelian "natures" over the modern concept of "laws."
147. Francis Bacon, first book, *The Novum Organum of Sir Francis Bacon* (London: Printed for Thomas Lee at the Turks-head in Fleetstreet, 1676), 9. Bacon considered Aristotle to be the type of thinker who could "wrest and corrupt" true knowledge with his "preconceived fancies."
148. *Ibid.*, second book, 19–32.
149. Morrison, *Unifying Scientific Theories*, 2.
150. Achinstein, *The Nature of Explanation*, 8. Emphasis mine.
151. Carl G. Hempel, *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science* (New York: The Free Press, 1965), 334. His formulations are widely referenced.
152. *Ibid.*, 334–335.
153. *Ibid.*, 335. Emphasis mine.
154. *Ibid.*, 335–376 and 376–412.
155. *Ibid.*, 348.
156. Morrison, *Unifying Scientific Theories*, 2.
157. *Ibid.*, 237. Morrison does not argue specifically against Cartwright.
158. *Ibid.*, 5.
159. *Ibid.*, and *HLPL*, 44–53.
160. *Ibid.*, 54–73.
161. *Ibid.*, 54.
162. *Ibid.*, 55. Cartwright describes an account from R. McNeill Alexander, *The Chordates* (Cambridge: Cambridge University Press, 1975), 179.
163. *Ibid.*, 56.
164. Cartwright, *HLPL*, 46. Cartwright critiques a presentation of Snell's law from Miles V. Klein, *Optics* (New York: Wiley, 1970), 21.
165. *Ibid.*, 47.
166. *Ibid.*, 49.
167. *Ibid.*
168. *Ibid.*
169. *Ibid.*
170. Michael X. Ashooh and Paul C.L. Tang, "Was the Truth Ever Meant to Explain Much? A Critique of Nancy Cartwright," *The Social Science Journal* 36.4 (1999): 615–621.

171. Carl Hempel, "Explanation and Prediction," in *Foundations of the Philosophy of Science: Recent Developments*, ed. J. Fetzer (New York: Paragon House, 1993), 93.
172. Ashooh and Tang, 620.
173. *TPS*, 68, 215, 217. My interpretation and example of the concept appearing in Pannenberg's thought.
174. *Ibid.*, 75n, and Pannenberg, "Hermeneutic and Universal History", in *BQT*, vol. 1 (London: SCM Press, 1970), 96–136. Pannenberg appropriates Hans-Georg Gadamer's thought on hermeneutics in relation to history similarly at a number of points in *TPS*. See H.G. Gadamer, *Truth and Method* (London: Sheed and Ward, 1976).
175. *Ibid.*, 129. This comment on Wilhelm Dilthey captures much of what Pannenberg aims to do overall with the categories of "part" and "whole."
176. Shults posited a similar argument in *The Postfoundationalist Task of Theology*, 141ff.
177. *Ibid.*, 142.
178. Pannenberg, "Understanding and Explanation," in *TPS*, 135. Clarification in brackets mine.
179. Pannenberg, *TPS*, 140, 145.
180. E.g., Pannenberg, *ST*, II, chap. 7, part II, §1, "The World of Creatures," 61–76, and chap. 8, §4, "Sin, Death, and Life," 265–272; *MIG*, 130–152.
181. One see this especially in Shults, *The Postfoundationalist Task of Theology* (Grand Rapids, MI: Eerdmans, 1999), in evaluation of Pannenberg's entire theological method, and in Mostert, *God and the Future* (Edinburgh: T&T Clark, 2002), in assessment of Pannenberg's eschatological doctrine of God. See also Murphy, "A Lakatosian Reconstruction of Pannenberg's Program" in *Beginning with the End: God, Science, and Wolfhart Pannenberg* (Chicago: Open Court, 1997), 409–421.
182. Nancey Murphy, "A Lakatosian Reconstruction of Pannenberg's Program," 411–413.
183. "Metaphysical hermeneutics" because Pannenberg believes that a reality composed of wholes and parts exists behind all appearances, and that it is best interpreted by a system of hermeneutics like the one he proposes.
184. E.g., Murphy, "A Lakatosian Reconstruction of Pannenberg's Program," 411ff. Also J. Wentzel van Huyssteen, "Truth and Commitment in Theology and Science: An Appraisal of Wolfhart Pannenberg's Perspective," 360–377.
185. *TPS*, part 1 (the first half), "Theology between the Unity and Multiplicity of the Science," examines "From Positivism to Critical Rationalism" (chap. 1, 23–71), "The Emancipation of the Human Sciences from the Natural Sciences" (chap. 2, 72–155), and "Hermeneutic: A Methodology for Understanding Meaning" (chap. 3, 156–224).
186. *TPS*, part 2 (the second half), "Theology as Science," discusses whether or not, and in what sense, theology may count as a science, looking at "Theology as a Science in the History of Theology" (chap. 4, 228–296), "Theology as the Science of God" (chap. 5, 297–345), and "The Internal Organization of Theology" (chap. 6, 346–440).
187. *TPS*, 157.
188. *TPS*, 156.
189. *TPS*, 72–155, "The Emancipation of the Human Sciences from the Natural Sciences."
190. *TPS*, 36, 74–75, 128, 306–307. Since Pannenberg wrote this, the neurosciences have increasingly challenged the concept of Cartesian dualism, e.g., Antonio R. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (London: Penguin, 2005 [1994]). Damasio argues, "Nature appears to have built

the apparatus of rationality not just on top of the apparatus of biological regulation, but also *from* it and *with* it" (128). Descartes' principal error was in misunderstanding this fact, Damasio argues.

191. Ibid.
192. E.g., Werner Jeanrond, *Theological Hermeneutics: Development and Significance* (London: SCM Press, 1994), Kurt Mueller-Vollmer, ed., *The Hermeneutics Reader: Texts of the German Tradition from the Enlightenment to the Present* (Oxford: Basil Blackwell, 1986), Carl E. Braaten, *History and Hermeneutics: New Directions in Theology Today, Vol. II* (London: Lutterworth Press, 1968), and Richard E. Palmer, *Hermeneutics: Interpretation Theory in Schleiermacher, Dilthey, Heidegger, and Gadamer* (Evanston, IL: Northwestern University Press, 1969).
193. Taylor, *Pannenberg on the Triune God* (Edinburgh: T&T Clark, 2007), 13–25.
194. Examples of the unities and pluralities appear in Pannenberg, *ST*, II, part II, "The World of Creatures," §1, 61–76, and in his descriptions of "the multiplicity and unity of the sciences" investigating creation. Pannenberg shows how the categories are present in Dilthey's works in *TPS*, 75ff.
195. *TPS*, 129.
196. Wilhelm Dilthey's relevant work is *Einleitung in die Geisteswissenschaften* or "Introduction to the Human Sciences," of which only the first volume *Gesammelte Schriften I* (1883) had appeared by the time of Pannenberg's *TPS* (1973).
197. *TPS*, 72–73.
198. Ibid.
199. Ibid., 75–76.
200. Ibid., 76–77.
201. Ibid., 76.
202. Ibid., 116–135, "Critique of the Division between Natural and Human Sciences."
203. Ibid., 156.
204. A. Angyal, "The Structure of Wholes," in *Philosophy of Science* 6 (1939), 25–37.
205. Systems theory was founded in the 1950s by biologist Ludwig von Bertalanffy (1901–1972), called the "Father of General System Theory," with William Ashby (1903–1972). The theory centered on principles from physics, philosophy, and philosophy of science, and a wide variety of insights from fields as diverse as politics and economics. "Cybernetics" and "complex systems" are alternative terms for the field.
206. Ernest Nagel, "The Whole Is More Than the Sum of Its Parts," first appeared in 1955, reprinted as "The Reduction of Theories," chap. 11 in *The Structure of Science: Problems in the Logic of Scientific Explanation* (New York: Routledge and Kegan Paul, 1961).
207. Nagel, "Wholes, Sums, and Organic Unities," 380–397.
208. Ibid., 380–381.
209. Ibid., 381–397.
210. *TPS*, 129.
211. Ibid., 129 and 131.
212. Ibid., 157.
213. Ibid., 153.
214. Ibid., 154.
215. Ibid. Einstein's theory of general relativity superseded Newton's theory of gravitation. Newton's theory is not obsolete, but remains useful primarily as a linear approximation for a different theory of gravity altogether. I have added these second and third examples to Pannenberg's Kepler and Newton illustration.

216. Ibid., 139.
217. Ibid., 145. Pannenberg refers to A. C. Danto, *Analytical Philosophy of History* (Cambridge: Cambridge University Press, 1965).
218. Ibid., 136.
219. Ibid., 136–137.
220. Ibid., 137.
221. Ibid., 140. Pannenberg interacts with Hempel and the D-N model and with both advocates and critics of D-N explanations at a number of points to make similar commentary. Cf. *TPS*, 59–60, 62, 143, 144, 145n, 147, 209.
222. *MIG*, 136.
223. Achinstein, *The Nature of Explanation*, 102.
224. Mostert, “An Ontology of the Whole,” in *God and the Future: Wolfhart Pannenberg’s Eschatological Doctrine of God*, 55–88.
225. Ibid., 56–57.
226. *MIG*, 131.
227. Ibid., 132.
228. Ibid., 136.
229. Mostert, *God and the Future*, 61, expresses Pannenberg’s views in these terms.
230. Ibid., 58.
231. *MIG*, 142.
232. *TPS*, 303–326.
233. *MIG*, 3–21, “The End of Metaphysics and the Idea of God.” The purpose of the entirety of *MIG* is to reassert the relationship of theology to metaphysics for a continuing relevance to the world at large.
234. *MIG*, 6.
235. *TPS*, 303.
236. Pannenberg has confirmed this in an interview at the University of Oxford.

5 Methodological Limits

The idea that Pannenberg's Trinitarian creation might synthesize aspects of the unifier/pluralist dialectic has been shown to have clear material limits. In this chapter, methodological limits are examined toward a similar end. Willem Drees' critiques of methods used in recent "science and religion" projects are introduced to suggest the strengths and weaknesses of Pannenberg's creation theology. We begin by noting how key categories constituting Pannenberg's theological method have arisen and function in his thought, using his own account. Pannenberg's self-account includes theologians and movements he has seen as the main alternatives to his offerings. Pannenberg's distinctive method, which is designed to aid the coherence and plausibility of theology in relation to the sciences and other disciplines, is pervasive in his works from *RAH* through *ST*.

Pannenberg's method can be understood as one in which he labors for theological *coherence* and *plausibility* toward the broadest possible *acceptability*. All three categories exist as common goals in theologies seeking positive relations with the sciences.¹ The main argument here in the light of Pannenberg's method is that when relating traditional theological ideas to scientific concepts, subtle differences should be understood to exist between the distinct categories of coherence, plausibility, and acceptability, and what may be achieved by pursuing them in interdisciplinary investigations.

PANNENBERG EXAMINES THE STATUS AND METHODOLOGY OF (HIS OWN) THEOLOGY

Pannenberg's statements in an unpublished paper, "Theology Examines Its Status and Methodology,"² give an accessible focal point through which to review principles widely present elsewhere in *ST* and beyond, but which he does not always consider so explicitly and succinctly. He argues in explicit terms that which is often only implicit in his work elsewhere: that interdisciplinary coherence and plausibility must be central and necessary concerns for all effective theology, if acceptability³ is to be achieved.⁴ Pannenberg provides in the piece his own keynote from which one can then look back

to examine the forms each of these categories have taken in his writings.⁵ The distinctive features of Pannenberg's approach (added to what might otherwise seem obvious goals for anyone seeking to relate religion and the sciences) do appear when viewing his thought in the context of the brief history of theological method that he gives there.

Ultimately, Pannenberg's answer for seeking interdisciplinary acceptability necessarily lies in a coherent, systematic presentation of the Christian God in its own right, and then in the light of wider knowledge from other disciplines. Pannenberg builds a case for his views by outlining the development of major shifts in theological method from the thirteenth century to the present, noting the evident failures of past approaches. The survey leads him to frame what in his view are theology's most important tasks today, building creatively on past mistakes and oversights. The paper overall provides an updated, microcosmic look at Pannenberg's objectives over the last several decades, straight through to his vision of creation in *ST*, II.

A BRIEF SURVEY OF THEOLOGICAL METHOD

Pannenberg's review of theological method begins with Thomas Aquinas. With Aquinas and the other examples employed, Pannenberg rehearses well-known yet vital information for his arguments. He begins by discussing how Aquinas in the thirteenth century had presented religious discourse not simply as *sapientia*, or wisdom, but also as *scientia*, science.⁶ Aquinas had argued that certain particulars of theological understanding like the concept of the Trinity are apprehended only by revelation. Human reason would never take us to an idea like the Trinity, nor prove it to the human mind in any way sufficient to support belief in a Trinitarian God. Aquinas wrote, "[L]et no man think to reach the sacred mystery of generation by his own mind. . . . [T]he trinity of persons cannot be known by reason."⁷ But one might still argue fruitfully for the existence of God generally, in Thomas' view, beginning to reason from God's effects on the world. This was a method whereby one could be led from data to principles.⁸

"Natural theology" followed this course, which was to lead from what one finds in the natural world to some measure of an understanding of God. This approach to theology continued to prosper into the eighteenth century. But from early in that period, similar "bottom-up" arguments began using the idea of "religion," rather than natural theology, as a shared point for discourse with the wider world. Friedrich Schleiermacher eventually became the most famous proponent of this species of argumentation, which featured anthropology as the basis of theology. Schleiermacher contended from the very first of his famous *On Religion: Speeches to Its Cultured Despisers* that "religion," whatever terms we apply to it, arises directly from "human nature."⁹

Neo-orthodoxy reacted in the twentieth century, as Pannenberg narrates events, with Karl Barth being the most famous proponent promoting

a “theocentric,” rather than an anthropocentric, basis for theology. God alone, Barth argued, reveals God; one cannot discover or otherwise arrive at God through reason. The problem with this approach in Pannenberg’s view has been its subjective character. Following Barth’s course requires a subjective individual decision. This subjectivity is a strike at the heart of Pannenberg’s desire that theology should promote a demonstrable interdisciplinary plausibility in the secular arena. The desire is for a plausibility beyond the dogmatic statements arising from within, and written primarily for, the Church. Pannenberg, who knew Barth personally, has agreed with many of his statements. He can even be seen as Barth’s theological ally in certain respects, sharing Barth’s central view that revelation is strictly *God’s self-revelation*, and not a revelation of truths *about* God, for example.¹⁰

Yet Pannenberg’s impulses led him to seek a greater objectivity via theological method than Barth thought desirable. Pannenberg has written of Barth, with whom he studied for a time: “I greatly admired Barth and I never ceased to do so.”¹¹ But he added of his own much wider concerns that before one could write a theology relevant for today’s complex world, “I soon became persuaded that one first has to acquire a systematic account of every other field.”¹² This includes “not only theology, but also philosophy and the dialogue with the natural and social sciences before with sufficient confidence one can dare to develop the doctrine of God.”¹³ In a private letter to Timothy Bradshaw, Pannenberg wrote likewise that “your understanding that there is a good deal of similarity between my thought and that of Karl Barth is correct.” But he noted also his own “rather fundamental criticism of his [Barth’s] procedures and style of argument. . . .”¹⁴ The letter shows that these concerns were not so much anti-Barth, as to do with Pannenberg’s concern to work toward a broader theological plausibility.

Pannenberg’s formal reaction to the “subjective” (his term) neo-orthodox turn can be seen in *RAH*, the early major book project that introduced him widely.¹⁵ For a re-injection of objectivity, he considered that there was no recourse in rescuing the plausibility of theology but to “pick up the thread of the argument where modernity has left it, in the issue of religion as a human phenomenon.”¹⁶ This conclusion led Pannenberg back to his recurring open discussions of “truth claims.” That project is one in which Pannenberg has made his name, and is perhaps also best known. It marks all of his theology from early in his career, showing up again prominently in *ST* from the first volume. In this form theology appears as a discipline marked by hypothetical assertions, done in conversation with a wide variety of human knowledge and experience from theological and nontheological disciplines.

In the course of undertaking a theology in terms of an honest and open examination of truth claims, Pannenberg deduced regarding theological disciplines that “a critical theology of religion is what is called for.”¹⁷ He highlighted this to be vital as far back as 1969, in the essay “Speaking about God in the Face of Atheist Criticism.”¹⁸ There he wrote,

In other words, theology must once again become aware of the world of non-Christian religion as a central concern, if it is to assert that a relationship to the reality which we call God is everywhere a constituent element in man as such. The world of religions, and the religious attitude of man in general to which it bears evidence, is the field in which theology must take its stand against atheism. The theologian who fails in this is acting like a revolutionary who makes a pact with the establishment in the hope that it will fall apart by itself.¹⁹

This requires, and is part and parcel of, theology taking up the search for plausibility as a major objective.

Pannenberg rehearses this theme further in other terms, indicating once again his longstanding desire that plausibility should extend beyond theological audiences to the secular world, rescuing theology from a secluded existence separated from other knowledge—and particularly from its critiques. The statement also mentions connections between *coherence* and plausibility:

When the Christian theologians incorporated philosophical monotheism in their argument for the universal truth of the biblical teaching about God and of the Christian Trinitarian doctrine, they accepted that the Christian teaching about God *must be consonant with the knowledge about the world in all its aspects, so that the claim that this God is the creator of the cosmos becomes plausible*. That implied a coherence theory of truth: *Christian teaching must be coherent with all aspects of the reality of the world and of human life. It is only under that condition that the Christian claim is plausible in the sense, that the biblical God can be understood to be the creator of this world as well as of all human beings.*²⁰

Pannenberg uses “coherence” and “consonance” interchangeably when referring to efforts to show how theological and scientific concepts can be understood to fit together. Showing coherence between theological ideas and accepted truths from secular disciplines is meant to indicate plausibility for theology’s claims.

PANNENBERG’S CHARACTERISTIC “MIDDLE WAY” AND PLAUSIBILITY

Accomplishing the aims of promoting a theology that “must be consonant (or “coherent”) with the knowledge about the world in all its aspects,” we are told, requires two agendas. Each represents the characteristic location of the “middle way” common to many aspects of Pannenberg’s theological method.²¹ First, there must be a hermeneutical effort to show that the

God argued for is consistent with the Biblical presentation. Second, there must be a clarification of the concept of “truth” as conceived by Christianity, examining its congruence with what we might call “extra-theological” ideas of truth, again reasserting a familiar theme. “Truth” and demonstrable “plausibility” are connected in Pannenberg’s thought.

The first effort to do with Biblical hermeneutics serves as evidence for anyone presupposing some idea of the divine authority of the Bible, i.e., an intended theological audience. The second effort to do with truth clarification exists primarily for a wider audience, demonstrating compatibility toward a degree of plausibility. This also helps to reinforce the beliefs of the theological audience. A strong respect for received tradition, even if extra-biblical, falls under the first effort. This one understands from Pannenberg’s labors to make plausible ideas like Logos, which have been greatly expanded in Christian tradition from Greek philosophy, and later the Bible. The second effort seeks to make theological arguments accessible for all, to the greatest degree possible, regardless of the presence or lack of presuppositions of faith.²²

The first effort fits Pannenberg’s definition of “systematic” theology, and the second effort he categorizes as “fundamental” theology.²³ Systematic theology tends to *presuppose* matters, working then to expound the contents of the presuppositions. But for Pannenberg, even the systematic effort includes a great deal of the fundamental effort, as he is ever aware of the need for apologetics. He asserts reasons for the combination in *ST*, I, in the context of discussing these distinctions in various approaches to theology:

The fact that the reality and revelation of God are debatable is part of the reality of the world which dogmatics has to consider as God’s world. If the theses of Christian doctrine do not make the world’s questioning of the reality of God, its contesting and rejecting of this reality, a question which is put to its own Christian truth consciousness, then these theses will not make contact with worldly reality but will hover above it and will not, therefore, be true. Even the contesting of the reality of God in the world necessarily has its basis in God if God is to be the Creator of this world. Hence the presentation of Christian teaching cannot begin by presupposing the truth.²⁴

Pannenberg was initially best known for considering methodological matters broadly, given his opinion that these were among the necessary stages prior to producing a full systematic theology.²⁵ Yet even while developing his method he has worked with the first effort, of theological integrity by way of a biblical presentation of God, consistently in mind. His regard for orthodoxy has only increased through the years.²⁶ Demonstrating consistency with Scripture and received theological views are aspects of his expressions of this concern.

This dynamic, dialectical wielding of both fundamental and systematic theological modes at once has been called an “interdisciplinary reciprocity.”²⁷ *ST* shows the greatest balance of concern for both efforts among all

of Pannenberg's writings to date. This includes the distinctively Trinitarian theology of creation in *ST*, II. The extent to which both the fundamental and systematic efforts exist together in the presentations of *ST* seems unique even among Pannenberg's works. This is due to the way in which the Trinity had become so prominently explicated by the time of the *ST*, with Pannenberg's usual philosophical and scientific concerns remaining intact. Holding these concerns together characterizes Pannenberg's efforts to show coherence and plausibility toward the acceptability of theological claims in a secular world.

The claim that there are these certain chief themes or aims running throughout Pannenberg's entire corpus, which one might understand in terms of a two- or three-tiered method, is not unprecedented. Pannenberg scholarship has generated much material over several decades attempting to distill from his works a "key concept," or *Grundprinzip*, appearing throughout his writings. Many scholars investigating one aspect of Pannenberg's thought or utilizing his works or methods in some way for other ends have engaged in these endeavors. Ironically, despite these efforts, reducing the works of a complex thinker like Pannenberg to a *single* underlying principle is doubtlessly counterproductive. That scholars have disagreed on what "the" basic Pannenbergian principle might be is demonstration enough that this is so.

F. LeRon Shults has covered *Grundprinzip* discussions in some depth in *The Postfoundationalist Task of Theology*, examining the decades-long projects in considerable historical and methodological detail.²⁸ Shults' undertaking rehearses past efforts before setting forth his own new reading of a Pannenbergian *Grundprinzip*. The finer details of these discussions we leave to Shults, as well as the evaluation of Shults' own effort. Suffice it to say that here we shall not put forward a new "reading" of a *Grundprinzip*—of "coherence, plausibility, and acceptability," nor even simply of "plausibility," although these principles are no doubt present and consistent throughout Pannenberg's works.²⁹ That Pannenberg has himself argued that all theology must seek these goals in dialogue with the sciences and other disciplines is more than enough basis to introduce Willem Drees' critiques, suggesting an analysis of Pannenberg's method.

WILLEM DREES' CRITIQUES

Willem Drees is uniquely qualified as a physicist, philosopher, and theologian. He has critiqued "religion & science" projects, broadly conceived, in the essay "'Religion and Science' without Symmetry, Plausibility, and Harmony."³⁰ Drees provides there "a programmatic essay on the agenda of religion and science." He analyzes a methodology that he identifies as being found widely in "science and religion" studies. This methodology is similar to that which I have been describing from Pannenberg's writings.

Drees does not mention Pannenberg in the essay. Yet he so closely describes a similar program that he could have been writing a "programmatic

essay on the agenda of *Wolfhart Pannenberg's* methodology." Drees works to deconstruct the method before reconstructing a solution toward more "reasonable and meaningful ambitions for religion and science."³¹ Examining Drees' essay provides an especially apt framework for critiquing also Pannenberg's methodology, without requiring agreement with Drees' every point. The framework allows simultaneously for a variety of considerations following from the previous chapters.

Drees' deconstruction focuses on three areas, each indicated in his essay title. Each area correlates essentially with Pannenberg's work, depicting it as representing a two- or three-tiered scheme for doing theology. The three common assumptions Drees sees as problematic are to do with "symmetry," "explanatory plausibility," and "goodness," with the latter term indicating consonance, or coherence.

An assumption of "symmetry" is the popularly held view that in some way religion and science represent two equal sides of a river, with both being applicable ways of addressing the same one reality. One can therefore build bridges between the two sides, or "banks," even if they are thought of as "two distinct and autonomous kingdoms."³² By "explanatory plausibility," Drees refers to a related view in which one sees religious and scientific explanations as offering a similarly credible descriptive facility for the same entities and processes. A theological explanation can therefore even pick up where scientific (or philosophy of science) explanations leave off.³³ Each describes assumptions relevant to those Pannenberg argues to be basic to his method, when he thinks of God as the All-determining Reality, and relates theology to other disciplines in a way describable as a field-encompassing field. Finally, Drees is concerned with any assumption of "goodness," by which he means "consonance" ("coherence" for Pannenberg). Drees defines consonance in a way that can also be shown to touch on Pannenberg's ideas when he argues that "it is theologically problematic to assume harmony or consonance between scientific knowledge and religious convictions."³⁴

Although Drees touches on each area endemic to Pannenberg's method, he does not do so in the order in which Pannenberg explains them. For the sake of consistency, Pannenberg's order will set the agenda, with Drees' critiques introduced in response to each point, followed by further relevant analysis. In Drees' terms this simply means following his concerns in backward order. I first cover coherence (section A) below, then explanatory plausibility (section B). These sections are followed by conclusions about the acceptability of a Pannenbergian synthesis for the unifier/pluralist dialectic, which can be fitted to Drees' concerns about symmetry (section C).

A. Coherence

"Coherence," generally defined, is a way of arguing for the location of what is true by showing that it "coheres" with other statements widely thought also to be true. This reasoning, often delineated as a "coherence theory of

truth,” is a simple form of philosophical logic.³⁵ Convincing arguments have been advanced that Pannenberg is not in any *simple* way a “coherentist,” however, meaning that he is not just locating coherence between his theology and other truths, unaware of interplay between factors like experience and epistemology. His search for truth avoids both a simple foundationalism and a straightforward coherentism by balancing and aiming for a mid-point between experience and belief.³⁶ Pannenberg, in his search for truth as with many concerns, tends to reach for a middle way between accepted conventions. Nevertheless, even if nuanced in this way, Pannenberg does still mean by “coherence” a manner of demonstrating what might be considered true in his theology by showing how it coheres with scientific or philosophical knowledge. While not a sufficient condition to prove what is true, this is still seen as a necessary condition, which Pannenberg labors at length to achieve in his works.³⁷ This is so even granting that he both makes theological claims and tests them for coherence with the same knowledge. In his case this is usually about the Trinitarian God of creation, and by implication about all of creation itself, both human and nonhuman.

Drees’ concerns as a physicist, philosopher, and theologian writing as a “science and religion” scholar are also largely theological. But he believes, contrary to Pannenberg, that locating coherence between “religious convictions” and scientific knowledge is “problematic,” “at least upon certain theological views.”³⁸ I shall offer a potential theological concern following that of Drees. This is that Pannenberg, by attempting to show coherence between theological ideas and scientific concepts, or correlate ideas from the philosophies of the sciences, could be in danger of attempting to demonstrate *too much* coherence between these separate fields. From a skeptical viewpoint, attempting to locate coherence between theology and specific scientific ideas too closely, even if for the sake of raising theology’s plausibility, can have an effect opposite to that originally intended—it can derail credibility.

Coherence and Consonance

Drees’ initial concern over “consonance” has to do with an increasingly liberal use of the term in science and religion projects since its introduction in recent decades by historian of science Ernan McMullin.³⁹ Drees sees the amplified use as indicating overly optimistic assumptions of coherence. This has come to be discussed in terms of “*hypothetical* consonance” between theology and the sciences.

Hypothetical consonance indicates a presumed coherence between the hypotheses of science and those of theology. The term carries connotations of theology having equality with, if not supremacy over, scientific knowledge. Pannenberg actually assumes the latter (thus field-encompassing field). Drees’ discussions of assumptions of “symmetry,” in addition to his critiques on “consonance,” are both relevant here. The discussions relate to each other. Pannenberg does seek for symmetry between theological views

and scientific aspects of the presumed unity and/or plurality of the natural world. Such seeking is about building bridges between disciplines, as Drees explains. Yet locating consonance, even if only of a “hypothetical” variety, is often seen as necessary for establishing symmetry. This is true in Pannenberg, and also in others.

“‘Consonance’ has become a flag in science and religion,” writes Drees, “especially for some who claim that there are two independent sources of insight, which happen to be in harmony.”⁴⁰ This has become so even though McMullin’s use of the term was to employ a musical metaphor to warn against finding *too* much “consonance” between science and theology. For McMullin, this was particularly to do with the question of how much theology may or may not be able to contribute to scientific knowledge.⁴¹

While that intention is clear in McMullin’s essay, one could completely misunderstand him on the basis of Drees’ account. McMullin’s tone indicates a sympathetic stance toward *both* sides of the problems encountered. McMullin was clear in 1981 on several counts, and not simply to warn against compromising science with theology. Among his concerns was that one can consider consonance between theology and science a *desired* goal, albeit seeing theology

not as an autonomous source of logical implication capable of affecting scientific theory-appraisal, but as one element in the constructing of a broader world view. The aim would be consonance rather than direct implication. The solution to our problems must in the end lie in this direction.⁴²

So McMullin was actually *advocating* the location of consonance between science and theology over more direct notions of “implication.” By this he meant to eschew any idea that theology should directly imply anything toward the formation of scientific theories or their inferences. This is particularly if the implications are to be based on a Bible written before humanity had the complex understandings of our universe afforded by modern science. McMullin believed he might be seeing the less desirable route in people like Pannenberg, in fact.⁴³ But he indicated balance, once again writing:

There are two extremes to be avoided. First is the positivist one which would restrict the label, “knowledge,” to science only, and reject on principle any cognitive claim on the part of theology. At the other extreme is the construal of the Biblical world-view which would make it sufficiently specific and assured in its cosmological assertions to render it a proper resource for the scientist concerned to construct the most general theories of physics, biology, and cosmology.⁴⁴

Realizing the presence of this equilibrium in McMullin’s view is crucial for understanding the points he was actually making. There was a cautious

advocacy—but an *advocacy* nonetheless—of what is now known as a search for consonance between science and theology. He further clarified his goal of a balanced mediation through such consonance by the end of his essay, asking,

Is there an intermediate position? The answer is not a simple one, and only the materials for it have been presented here. The Christian cannot separate his science from his theology as though they were in principle incapable of interrelation. . . . He has to aim at some sort of coherence of world-view, a coherence to which science and theology, and indeed many other sorts of human construction like history, politics, and literature, must contribute. He may, indeed, *must* strive to make his theology and his cosmology consonant in the contributions they make to this world-view.⁴⁵

So there is a proviso if accepting Drees' initial concern for "consonance." McMullin's position is far different than simply warning against allowing theology to influence the sciences too closely.

One might agree with Drees more readily on another point, however. This is that the work of those seeking consonance between theology and the sciences since McMullin can be interpreted as exercising a greater optimism about what is possible. It is in referring to those following McMullin's lead that Drees makes his comment about consonance having become a "flag" in science and religion.⁴⁶

Drees' chief example is Ted Peters, the leading scholar associated with the Center for Theology and the Natural Sciences in Berkeley. Peters has published two titles dedicated to the cause of consonance, *Cosmos as Creation: Theology and Science in Consonance*, and the more recent *Science and Theology: The New Consonance*.⁴⁷ He has championed the work of Pannenberg partly for what he reads as his pioneering work on consonance. Peters' thoughts on the matter so closely reflect Pannenberg's that Drees' critiques of Peters also apply to Pannenberg.

In the latter book mentioned, Peters edits the contributions of fifteen different scholars from various disciplinary backgrounds, all writing on the theme of consonance. The authors include not only himself but also Pannenberg and a variety of scientists, theologians, and philosophers, and there is even a brief chapter by Pope John Paul II. Peters frames the entire book with a comprehensive introduction, adding an extra chapter outlining "eight different ways in which science and religion are currently thought to be related."⁴⁸ Among the eight methodological approaches, he concedes that "the dominant view—the truce by separation view—in academic circles is what I label the 'two language theory.'"⁴⁹ But he argues that the most promise occurs in that "the advancing frontier is taking us in the direction of hypothetical consonance."⁵⁰

In using the term "hypothetical consonance" Peters makes several assumptions. He assumes that there *is* a single domain of information, with

similar concerns for the sciences and theology. The term refers to “an attempt to uncover the domain of inquiry shared by science and theology.”⁵¹ This means that each is investigating the same one reality, and shares at least some of the same interests upon investigating it. And this should lead to interplay between the normally separate fields of inquiry. When employing the term “consonance,” then, Peters is “looking for areas of correspondence or connection between the understanding of nature discerned scientifically and the understanding of the world as God’s creation discerned theologically.”⁵² Two senses, a weaker and a stronger, are implied. The weaker sense considers that since both theology and the sciences investigate the same one reality, shared understandings might eventually develop. Included is the idea of offering theological assertions as hypotheses about reality, as Pannenberg does. A stronger sense indicates full accord or harmony.⁵³

Like Pannenberg, Peters acknowledges that we are currently unable to move unambiguously beyond the weaker sense.⁵⁴ In this weaker sense, theology also assumes what might be seen as the “weaker” role in larger society, working to validate what it says about God to the sciences by showing how theology complies with scientific truth. The sciences are not expected in contemporary society to validate themselves theologically as in earlier centuries, nor do individual scientists realize a similar compulsion, unless a scientist in question has theological commitments that he or she wishes to validate. But in such cases, the scientist in question tends now to be seen as working in the mode of a “science and religion” scholar, with his or her motivations understood in terms of his or her religious commitments. While such scholars may be respected as scientists *per se*, their religious arguments are generally ignored by scientific colleagues without theological commitments. Theologically inclined scientists tend to admit this obvious fact openly.⁵⁵ Such scientists contributed to Peters’ book, and in recent years often contribute to other “science and religion” publications.

Acknowledging this “weak” role does not prevent scholars, scientists or not, from pushing toward the stronger position. This effort toward theological strength can be seen in Pannenberg, again with the view of theology Peters calls a “field-encompassing field,” and God as the “All-determining Reality” without which science is said to have areas of explanatory lack. Admission of the weaker position is also seen in Pannenberg, as well as in others Peters mentions as working at the interfaces of the sciences and theologies. There is the evident notion that these theological-scientific pioneers are taking the lead in the search for stronger connections. A further connotation is that the theologically inclined need not wait for the sciences to approve to be successful. By forging solidarity with scientific knowledge, new understandings of reality are expected to be revealed. One might argue that there appear to be faint implications that what some call “science-and-religion” (or “theology and science,” etc.) has been attempting to form a sort of “super” discipline or field. Peters writes:

some are not waiting to respond to a specific scientific stimulus before advancing a theological position. Here in this volume we find Robert John Russell, Nancey Murphy, Wolfhart Pannenberg, Arthur Peacocke, and to some extent John Haught placing science and theology in consonance and then placing theology in the leadership role. . . . Science alone is not enough. Revelation from God casts nature in a new light and leads us toward a more adequate understanding of its reality. This is a courageous move. It promises further excitement for the future of scholarship.⁵⁶

Pannenberg exercises both the weaker and the stronger senses of consonance in his written materials and method. In his work the weaker and stronger senses correlate with his uses of fundamental (often related to the weaker sense) and systematic (especially related to the stronger sense) categories for doing theology.

Several further examples beyond Pannenberg can provide additional context both for Pannenberg's uses of "coherence" and Drees' critiques of such methods. Examples abound of explicit and implicit talk on coherence (or hypothetical consonance) similar to that of both Pannenberg and Peters, throughout several decades. Keith Ward noted in 1986, shortly after McMullin's essay was published, that applying criteria akin to coherence between scientific and religious beliefs was becoming frequent, and perhaps "turning the tide" toward belief in a Judeo-Christian God.⁵⁷ Arthur Peacocke, in his Gifford Lectures for 1993, expanded on Ward's comments, arguing both for "coherence" and related ideas like "fit with the data":

I have already advocated that theology, like any other human inquiry into the nature of reality, must use the same general criteria of reasonableness as, say, science itself. So that inference to the best explanation is assessed by its fit with the data ("existential relevance"), internal coherence, comprehensiveness and general cogency ("adequacy"), simplicity ("economy") and fruitfulness in producing new ideas and, in the case of theology, in giving meaning for personal existence.⁵⁸

Nancey Murphy's first book, *Theology in the Age of Scientific Reasoning* (1990),⁵⁹ sought to demonstrate theological reasoning as coherent with scientific reasoning, using philosophers of science like Imre Lakatos as chief models. Her point was to indicate as insupportable any antiquated idea that the rise of modern science has made Christian thought obsolete. She used Pannenberg as the model theologian to combat David Hume. Her other books follow similar patterns of arguing for theological acceptability on sometimes complex postmodern grounds.⁶⁰

In John Polkinghorne's *Scientists as Theologians* (1996), he names his own overall method as one of locating "consonance."⁶¹ Alister McGrath contributed the three-volume *A Scientific Theology* dedicated to a task describable as locating coherence between Christian theology and the sciences.⁶²

Polkinghorne's *Science and the Trinity* (2004) again asserted the idea of consonance, and pointed to a fresh generation of scholars considering the same matters but with more postmodern concerns than their predecessors, being suspicious of metanarratives. Among the new generation named throughout the book are Drees, Wentzel van Huyssteen, and Niels Gregersen.⁶³

These examples provide evidence that Pannenberg's method for coherence as a means of indicating the plausibility of theology is not a newly discovered method different from what has been in use already for several decades by scholars with similar concerns. Certainly each scholar in question, including Pannenberg, puts forth sets of particularities in his or her search for coherence indicating differing concerns. The distinguishing aspect of Pannenberg's method of coherence is the daring degree to which he attempts to show theology to cohere with other knowledge.

A fair-minded skeptic like Drees could ask whether there is anything overtly compelling enough in Pannenberg's method to subvert his critiques. Drees, also a theologian, is asking whether there is anything compelling enough in any of the similar methods to cause a nonbelieving scientist to believe—or even to take the theological aspects of the apparent coherence seriously, without the additional aid of something like divine revelation or a religious experience. One could argue that such good-natured skepticism might especially apply to Pannenberg's creation account, since he not only argues for coherence with scientific ideas, but does so to a very close degree, while pressing concepts like the ancient “Logos” and the idea of Trinity. If one were to agree with Drees and include Pannenberg in the critique, this would not necessarily include dismissing ideas like Logos or the Trinity as unimportant. They still appear widely as theological and philosophical concerns. One might simply admit the abiding, difficult state of affairs for theology in the larger context of the world of the atheistic secular sciences, even with increasing “science and religion” scholarship featuring scientists with theological interests.

Not many would question this state of affairs—including Pannenberg. His method of dividing theology into “fundamental” and “systematic” categories illustrates his agreement. Pannenberg begins *ST*, II, in which his scientifically coherent creation doctrine is expounded, by writing, “It is by no means self-evident today that the truth claims of Christian doctrine may even be regarded as open. Many champions of the public culture of secularism have long since answered the question in the negative.”⁶⁴

Steven Weinberg helps to illustrate the point further. Weinberg, a self-described “old friend” of Polkinghorne, exemplifies well the argument that secular scientists may take the science of a “science and religion” scholar seriously while disregarding his or her religion entirely. Weinberg recounts in *Facing Up: Science and Its Cultural Adversaries* (2001) how he “almost fell off my chair” when Polkinghorne, whom he had long known and admired as a scientist, announced his plans of entering the Anglican priesthood.⁶⁵ Weinberg expresses a later happiness that Polkinghorne had at least “wound

up as president of Queen's College, Cambridge, with a KBE," rather than "preaching to the indigenes in one of the less comfortable parts of the world."⁶⁶ But he remains careful to point out that "John had written several books on the relation between science and religion, with which I heartily disagreed."⁶⁷

Such examples fit Pannenberg's own commentary on a "public culture of secularism." One might conclude that Drees' critiques, as a self-confessed "naturalistic" theologian and scientist, are replete with related prejudices.⁶⁸ Still, this does not dismiss as invalid Drees' view, based on the common public understanding of theology and the natural sciences that "the intellectual standing of both human endeavors is quite dissimilar."⁶⁹

If that is true, one might also make a further logical point to which I have alluded. That is, without something like "revelation" in operation to accompany displays of coherence between theology and the sciences, however compelling to some they may appear, they remain for now intrinsically limited. Pannenberg's method of showing coherence, being similar to efforts by other scholars, has not overcome this state of affairs by introducing anything sufficiently compelling. This is so even given his attempts at demonstrating coherence in greater detail, as in how Logos might be understood to function like "laws of nature" or how the Trinity could be seen as responsible for a world at once both unified and plural. If theologically committed scientists like Drees are skeptical of such coherence, would scientists who count theology as completely irrelevant to their work not also be? And if so, one would think this more likely if the coherence is argued of particular or obscure theological concepts closely connected to scientific ideas, or claiming to be the plausible explanations for given phenomena.

B. Plausibility

Drees' next significant area of critique after "coherence" deals with "explanatory plausibility." His principal criticisms relate directly to natural theology. I have shown that Pannenberg's displays of coherence are meant to lead a reader to consider theological hypotheses as plausible explanations, often of what one finds in the natural world, but which may not be explainable without the presence of the "All-determining Reality." Following Pannenberg's example, the displays of coherence between his theology and the dialectic of physicists and philosophers are meant to posit, and begin to test, his theology as a kind of synthesis. A key question put now in Drees' terms is whether Pannenberg's understanding of creation can address quandaries raised by that dialectic where the sciences and philosophy of science must "leave off" in a way similar to how natural theology was used in past generations.

Drees indicates his view to be that whenever theology seeks to insert God where the sciences "leave off" in the way that Pannenberg does, this is a feature of natural theology:

“In natural theology the argument is in general from science to theology; theology is expected to provide an additional explanation where science leaves off. However, such projects run into various problems.”⁷⁰

Among the problems are the changeable nature of the scientific hypotheses on which theology is sometimes based, and the variability of “reliability” attached to different scientific hypotheses. The Periodic Table, for instance, he argues is “knowledge as solid as one may ever expect to have.” It is to be differentiated from the highly speculative, like “ideas regarding superstrings.”⁷¹ “Science and religion” methodology also often employs explanations “based on claims about that which science is unable to explain.”⁷²

But is Pannenberg’s creation thought an exercise in natural theology? How subversive to Pannenberg’s methodological aims are Drees’ critiques that essentially such natural theology is in the end implausible, underestimating the powers of the sciences?

PANNENBERG AND NATURAL THEOLOGY

There are two answers to whether or not Pannenberg’s creation thought fits Drees’ critiques of a plausibility sought through a type of natural theology. These are both “yes” and “not exactly.” A skeptic or theological outsider, unfamiliar with insular self-definitions in theology, might say “yes.” Pannenberg or a similarly inclined theologian might say “not exactly.” How much difference the “not exactly” makes then becomes the crucial focus. Illustrating these statements requires a closer look at Drees’ view, as well as a clarification of Pannenberg’s. Drees has written on natural theology in more detail elsewhere, as in his book *Religion, Science and Naturalism*.⁷³ There he distinguishes between “natural theology” and a “theology of nature”:

Natural theology (sic) has two distinctive connotations in the tradition of European theology. It is associated with the English tradition of arguments from design; the intricacies of the natural world would lead one to conclude to its creator. Natural theology is theology based on experience and reason, without appeal to revelation, Scripture, or similar source of authority. I will follow this usage. . . . *Theology of nature* is used for theologically based reflection on the natural world. It has become “politically correct” in theological circles to present oneself as doing theology of nature rather than natural theology. Thus, belief in divine action is not itself taken to follow from scientific knowledge, though divine action may be described in a model drawn from the natural sciences. The style of “natural theology” is more explicitly present when scientists or philosophers are finding meaning or mystery through their scientific knowledge. John Polkinghorne also presents himself as reviving natural theology, which he sees as “the completion of the task,

instinctive to the scientist, of seeking the deepest possible explanation of what is going on, the most comprehensive available account of the one world of experience" (Polkinghorne 1990, 87). Whereas he sometimes argues from science to claims about God, for instance when considering the intelligibility of the universe or the anthropic coincidences, Polkinghorne's treatment of divine action and of natural evil (above) is more in the tradition of theology of nature.⁷⁴

Drees' description of the differences between "natural theology" and "theology of nature" and his disagreement with Polkinghorne's self-definition are both telling. Drees posits that "it has become 'politically correct' to *present oneself as doing* theology of nature. . . ." ⁷⁵ He insists, on the other hand, that although Polkinghorne *presents himself* to be doing "natural theology," he can just as easily be seen to be doing "theology of nature." What each case indicates is that any distinction between "natural theology" and "theology of nature" requires first of all a faith in theology as a valid "starting point" for doing a "theology of nature." Theology as the starting point is the key difference in doing a "theology of nature."⁷⁶

To anyone skeptical of theological content, any difference starting with "God" or "nature" might make must become increasingly incredible in proportion to this skepticism.⁷⁷ To the mind of a *completely* secular physicist like Weinberg, who has none of Drees' sympathies, one could presume that the theological content is nonsense. Pannenberg himself argues that the term "nature" arose as an effort in the natural sciences at emancipation from theological ideas like "creation." He admits realization that the feasibility of a "theology of nature" is confronted both by theological suspicion and natural scientific skepticism.⁷⁸ Hence a problem of some measure still stands despite using a natural science term like "nature" as opposed to "creation," the latter being now a predominantly theological term,⁷⁹ or whether one starts or ends with theology.

In effect, beginning with God or the natural world to argue a theological point might make no difference to plausibility. Neither might it make much difference to a blunt definition of "natural theology." Theologians like Polkinghorne or Pannenberg could still be viewed by a skeptic as engaging in searches for divine design, and in offering evidences for it by drawing analogies, locating connections, or finding a proper "fit" between the natural world of the sciences and a designer God from theology. So at least in this first sense, Pannenberg's activity in doing his theology of creation might well be understood to fit Drees' characterizations of "natural theology," even if not exactly.

John Brooke and Geoffrey Cantor, writing as historians of science, have defined natural theology more broadly than Drees. They have shown that varied uses of the term, like the terms "science" or "religion," have been "not monolithic but fulfilled many different functions" covering "many modalities" for at least two centuries and maybe longer.⁸⁰ The uses have included supporting as well as attacking theology whenever "arguments

from design” of some kind have been employed to indicate a Creator.⁸¹ There could actually be any number of ways in which a skeptic might say that Pannenberg is doing natural theology—especially if one is uninformed of theology’s self-descriptions (e.g., “natural theology” or “theology of nature”), or puts no faith in those proposed differences.

Perhaps most obvious among possible charges is that Pannenberg is employing a “God of the gaps,” which is often associated with natural theology. Employing the idea of a God of the gaps (or “god-of-the-gaps”) is what Brooke has called “the *constitutive* role of religious beliefs.”⁸² That constitutive role is one of using an idea of God to fill apparent “gaps” in scientific knowledge. It is this type of thinking indicated in Drees’ talk of theology being “expected to provide an additional explanation where science leaves off.”

The idea of God used to fill gaps in scientific knowledge, if described in Drees’ terms, does sound similar to the account of Pannenberg’s work given early in Chapter 3 of this volume. There we saw how Pannenberg has talked consistently of theology having the necessary task of indicating to other disciplines that all systems of truth must include God in order to be complete.⁸³ Jacqui A. Stewart has referred to this idea in Pannenberg’s thought, commenting,

Theology should not, indeed, it cannot, retreat from the question of the universality of the truth of the Christian message. He continues to make these points throughout his published works. Further, he argues for the deficiency of any knowledge obtained without acknowledgement of the presence and action of God in the world. *Hence theology has to show other disciplines the areas that are missing.*⁸⁴

Stewart’s explanation that Pannenberg desires to see theology showing other disciplines “areas that are missing” is certainly a valid way to appreciate one of his principal aims. While Pannenberg is clear that there exists now a great dissonance between the claims of theology and the scientific world, he argues consistently that this does not dull the responsibilities of theology to test and prove itself “necessary,” by plausibly cohering with other knowledge, for instance. He has written,

If the God of the Bible is the creator of the universe, then it is not possible to understand fully or even appropriately the processes of nature without any reference to that God. If, on the contrary, nature can be appropriately understood without reference to the God of the Bible, then that God cannot be the creator of the universe, and consequently he cannot be truly God and be trusted as a source of moral teaching either.⁸⁵

While Stewart is clear on Pannenberg’s intention to show theology addressing gaps in other disciplines, her treatment of Pannenberg is also helpful

for illustrating the subtleties of his thought on natural theology. These subtleties can give the impression of ambiguities, and can be entirely misleading of Pannenberg's view if his overall method is not grasped. Stewart reckons, for instance, that while Pannenberg "is resolutely opposed to any hint of supernaturalism," conversely he "repudiates natural theology."⁸⁶ Each pole is close to being correct, yet neither is completely true of Pannenberg's argument. Stewart grasps that Pannenberg's position is somewhere between the poles, which are commonly held as antitheses. For Pannenberg, being human always implies a religious element, "grounded in the human experience of orientation to an external world."⁸⁷ But the terms of Stewart's description of the limits between which his position lies are not in themselves quite accurate. Her statement, especially if each element is taken alone, might only be made by considering restricted references in Pannenberg's writings, garnering a misunderstanding of his position. With regard to a human knowledge of God, Pannenberg does not *quite* reject all hints of supernaturalism, nor does he *quite* repudiate all natural theology. If someone were to say, however, that Stewart had produced only a caricature of Pannenberg's position on natural theology, in her case by flatly stating that he "repudiates" it, she would not be alone in having done so.

Paul Molnar is also referenced in Stewart's volume, likewise on Pannenberg and natural theology. His criticisms indicate a similar, apparent Pannenbergian ambiguity. According to Stewart, Molnar understands "that Pannenberg's account rejects such natural theology, but argues that his philosophical presuppositions imply it."⁸⁸ This leads Molnar to conclude, because of Pannenberg's "philosophical framework" and "rationally centered method," that "Pannenberg's characterization of his primary agenda as theological is not secure."⁸⁹ Yet Molnar's conclusion does not fit Pannenberg's intention, for example, of producing a systematic theology that according to him was to be "more thoroughly Trinitarian than any example I know of."⁹⁰ This is exactly what Pannenberg eventually did to the extent his work appears "audacious and difficult," precisely because he insists on relating creation not so much to philosophy or reason as to the unseen interior life of the Trinitarian God.⁹¹

PANNENBERG MEDIATES BETWEEN PHILOSOPHICAL AND REVEALED THEOLOGY

Carl Braaten and Timothy Bradshaw have been able to grasp Pannenberg's subtle moves regarding natural theology accurately. They each bring to light complementary aspects of his view, in which he seeks to mediate between philosophical (or natural) and revealed theology. Braaten noted in the early 1980s,

The special subject matter of theology as a science of God is *reality as a whole*—the totality of reality. This whole implied in the experience

of meaning and in hermeneutical reflection provides anthropological grounding for the idea of God. Discourse about God as the “all-determining reality” corresponds to the theme of the whole. The old enterprise of natural theology is thus given new foundations in contemporary hermeneutical theory.⁹²

Bradshaw posits a similar argument, showing how someone might contend that Pannenberg sees “old style natural theology” as no longer viable. Stewart could have said something to this effect accurately. However, it is also true that Pannenberg engages, nevertheless, in what might still be called “natural theology,” but of a new type. Bradshaw first writes of Pannenberg rejecting any system pitting “revelation” against “natural knowledge,” stating,

He emphasizes that there is one God and that this God is the Trinitarian deity who revealed himself in the resurrection of the man Jesus. This God is the all determining reality, the creator. McKenzie is right to say that Pannenberg radically rejects the dualism of revelation as against “natural knowledge.”⁹³

Bradshaw then adds,

The fundamentally idealist character of his system is also relevant when assessing criticisms of Pannenberg as being a rationalist theologian. . . . Just as Pannenberg has rejected the “double book-keeping” of philosophical monotheism and revelational trinitarianism, so he rejects the two-tier type of procedure whereby man can, philosophically, raise arguments for God’s existence, then look at the realm of revelation. Like John Macquarrie Pannenberg finds “old style natural theology” damaged beyond repair by modern criticism. But Pannenberg, it is arguable, has much in common with Macquarrie’s venture at a “new style natural theology” which “would be more fundamental than the old style natural theology, in so far as it would press back beyond the traditional arguments to examine the conviction that lay behind them. *It would also have a different method, for it would be descriptive instead of deductive.* . . . [T]his approach is existential rather than rationalistic.”⁹⁴

Pannenberg’s treatment of natural theology has been about the location of a coherent understanding of God *achieved through uniting philosophical and revealed theology “in a way that transforms both”*⁹⁵ rather than leaving them as antitheses. Understanding what Pannenberg does with these traditionally contrasting categories is vital to understanding his overall method, and his taking up, changing, and using a renewed kind of natural theology. Christoph Schwöbel condenses Pannenberg’s moves effectively, stating:

Pannenberg thinks that such a solution can be found, if we hold fast to the underlying conviction of natural theology that God has to be conceived as the ground of the possibility of the existence of the world and humanity. Although this does not offer firm ground for developing a *natural theology* by means of reason alone, it nevertheless indicates the possibility of conceiving of *natural knowledge* of God, not as a human capacity, but as a factual characteristic of human life. Pannenberg thereby shifts the ground of the discussion from the *cognitio Dei naturalis acquisita*, the acquired natural knowledge of God that forms the basis of the formal theistic proofs, to the *cognitio Dei naturalis insita*, the innate knowledge of God.⁹⁶

Pannenberg writes most recently of these ideas in *ST*, I, when laying the groundwork for a Christian exposition of God by first considering “the concept of God and the question of its truth.”⁹⁷ He dedicates several sections in the second chapter specifically to “natural theology” and the “natural knowledge of God,” with most of the chapter touching on these themes either directly or indirectly. Subsections of the chapter include matters relating to “The Word ‘God,’” “Natural Knowledge of God and Natural Theology,” “The Proofs of God and Philosophical Criticism of Natural Theology,” and “Theological Criticism of Natural Theology.”⁹⁸ He argues toward the end, having covered several preliminary matters,

All talk about God must validate itself by being able to make the world of experience a proof of its power, showing what it is in everyday experience. This applies also to the extension of the radius of experience by the sciences and to reflection on this in philosophy. Every religious message must demonstrate its truth claims by philosophical reflection on the relation of humanity and religion. Philosophical reflection on the anthropological necessity of elevation to the thought of the infinite and absolute can no longer offer a theoretical proof of the existence of God, but it still retains the critical function of the natural theology of antiquity relative to every form of religious tradition, i.e., that of imposing minimal conditions for talk about God that wants to be taken seriously as such. In this sense it is possible to have a philosophical concept which acts as a framework for what deserves to be called God. Without recognition of this possibility Christian talk about God cannot advance any solid claim to universality. . . . An independent knowledge of the existence and nature of God—independent of the reflection of the philosophy of religion on the truth claims of the positive religions—is no longer to be expected from philosophical theology today. Hence we should no longer call it natural theology. To do so is simply to erase important distinctions. But the impossibility of a theology that is based on pure reason does not answer the question as to the possibility and actuality of a natural knowledge of God in the sense of a factual knowledge of the God whom the Christian message proclaims.⁹⁹

FROM UNTHEMATIC KNOWLEDGE TO CREATION WITH A TRINITARIAN CHARACTER

Pannenberg's progression from an unthematic knowledge of God to Jesus Christ, and then on to a creation marked by the unity and plurality of a Trinitarian God, can seem a great leap. Yet one can recount quite easily from his *ST* the methodological steps taken leading from the unthematic starting point to the Trinitarian creation theology from which his work has here been related to the dialectic between the unifying physicists and diversifying philosophers. One sees first, as Schwöbel explains, how Pannenberg labors to reconcile his exposition of unthematic knowledge, to the point of discussing the Christian message. He does this by echoing St. Paul's claim that our common experience of "an unknown God" ("unknown" thus "unthematic," meaning not specific) is of the Christian God:

By nature, i.e., from creation, God, the God of the apostolic gospel (Rom. 1.19–20), is known to all people. This is not a statement of natural theology. It is a statement that is made about us in the light of the revelation of God in Jesus Christ. We do not find it immediately confirmed in ourselves or our experience of the world, though in Paul, in Rom. 1.18ff. and 2.15, there are echoes of the Stoic theology of the cosmos and doctrine of natural law. It is a statement which claims validity even where people do not want to know anything at all about God, at least about the one true God whom the Christian message proclaims. . . . The idea of an inborn knowledge of God in the soul has been common to the theology of the Christian West from the time of Tertullian.¹⁰⁰

Even while proclaiming up front that this "unthematic knowledge" is of the temporarily veiled Christian "God of the apostolic gospel," Pannenberg carefully sets forth an explanation showing his understanding of all points leading from one to the other. In doing so, he engages in the familiar moving between categories of unity and plurality common to his later creation thought.

Beginning with the unthematic knowledge, Pannenberg first argues that one must locate claims to a universal understanding of reality in the major world religions.¹⁰¹ This is an initial step toward uncovering and concretizing what is hidden behind the "unthematic." The history of the religions is seen as a history of the revelation of God's unity. Pannenberg's argument is that Israel had a similar understanding of history as the locus of the appearance of God's unity long ago. This understanding now provides a key for interpreting the problem of the gradual appearance and meaning of plural religions.¹⁰² Pannenberg asserts that there is but one God, gradually being revealed through the to and fro of the universality and particularity of religions in human history. The obvious ambivalence of this plurality is cured through the particularity and apex of revelation in Jesus Christ. This is another instance of the mediation between universality and particularity,

in this case with regard to religions, which Pannenberg sees as a chief characteristic of God's divine self-demonstration.¹⁰³

The concept of divine revelation itself is Pannenberg's next focus.¹⁰⁴ God's indirect revelation and its outworking in history, which Christians historically believe to be ultimately revealed in Jesus of Nazareth, is open to eventual confirmation, eschatologically. Revelation, although common to the claims of many world religions, provides for Pannenberg the very turning point in the discussion for explicit focus upon Christian doctrine. He argues that a provisional confirmation of the truth of Christian doctrine will lie for the time being not only in the daily lives of believers, but importantly,

in the form of a systematic reconstruction of Christian doctrine, beginning with the understanding of God which is contained in the event of his revelation to which the scriptures bear witness and which was the express theme in the theological discussions that led to the formation of the doctrine of the Trinity.¹⁰⁵

Therefore the next major step in the systematic presentation of his theology becomes a focus on the doctrine of the Trinitarian God.¹⁰⁶ Pannenberg labors to show how everything else in human experience, including the world investigated by the sciences, might reasonably be understood to be the creation of this God.¹⁰⁷ He reverses the traditional order of discussing first the attributes and being of God before attending to the idea of Trinity by beginning with the Trinity as an assertion of truth. He then discusses God's attributes and internal self-relations. Pannenberg next introduces God's Trinitarian relations with creation, including humanity, and the church.¹⁰⁸ It is in his attempt to show the Trinity as responsible for creation that he argues the created order to have a Trinitarian structure, marked by the interplay of universalities and particularities, revealing "marks of the divine." These moves and characteristics have provided the basis for the proposition of synthesis above in Chapter 3, where Pannenberg's God and creation are investigated in relation to the dialectic in Chapters 1 and 2, and for the deeper investigations and critiques in Chapter 4, and here in Chapter 5.

"NOT EXACTLY" NATURAL THEOLOGY AND PLAUSIBILITY

The foregoing appraisal, showing the progression in Pannenberg's methodology throughout *ST*, has now brought the investigation full circle, back to the Trinitarian creation of *ST*, II. That creation thought was the reason and event of entering his work into the dialectic between unifying physics and diversifying philosophy. Surveying the progression has been important not only for distinguishing how someone might see Pannenberg as doing a natural theology, thus fitting Drees' critiques, but also for revealing the subtleties of why Pannenberg argues that he is not doing one, at least not in

the usual terms. Coming back methodologically to the creation thought with which we started has added a deeper understanding of what Pannenberg is doing there. He is building on a supposed human “natural knowledge” of the divine, arguing it to be Christian Trinitarian. He is then working to show at least provisionally how the world investigated by the sciences might reasonably be understood to be this God’s creation.

This entire subsection on “plausibility” began by asking whether Pannenberg’s work fits Drees’ descriptions and critiques of natural theology. We have seen how one might understand Pannenberg’s work to fit Drees’ definition of natural theology. But we have also seen that Pannenberg’s work does “not exactly” fit Drees’ categorization. Pannenberg is not simply attempting to offer proofs of the truthfulness of belief in the Trinitarian God, for instance, if he might be said to be doing that at all. He is offering a provisional description of how what the sciences say about the natural world can be shown to fit what a traditionally rich view of Christianity says about God. He is, in effect, attempting to show that it is *reasonable* to believe in this God. His view of God seeks coherence with other truths believed about the world, scientific and otherwise, and might therefore be seen as plausible, hypothetically, by virtue of this reasonableness and fit.

Pannenberg does vaguely fit Drees’ understandings that natural theology picks up “where the sciences leave off,” as well as his view that “in natural theology the ambition is mostly to be in line with current knowledge.” Yet Pannenberg’s claim of an “All-determining Reality” is not a “god of the gaps,” simply filling areas of lack. He avoids conjecture on well-worn speculative ideas about unity like string theory, focusing instead on well-accepted ideas like laws of nature and fields of force. Although Cartwright has shown that even these apparently foundational ideas may not be so secure after all, Pannenberg has not engaged directly with her work, nor with any Stanford School philosopher.

So, Pannenberg only vaguely fits Drees’ definitions. Perhaps for this reason Drees does not mention him in the *Zygon* critiques when covering either “natural theology” or “theology of nature,” nor in his *Religion, Science and Naturalism* when examining the same. He does mention Pannenberg once in the latter book as being “eclectic” in a way suspicious to scientists. That is with regard to picking and choosing which scientific information to focus on, while ignoring information that a scientist would consider relevant.¹⁰⁹ In truth, the care and subtlety with which Pannenberg has crafted his work is not so easy to categorize and then dismiss on Drees’ terms. If the plausibility of Pannenberg’s Trinitarian creation is dependent on the ideas that Drees critiques, whether standing alone or proposed as a synthesis for the unifier/pluralist dialectic, then the answer cannot be a straightforward one.

C. Acceptability (and Symmetry)

Neither the unifying physicists nor Nancy Cartwright have directly critiqued Pannenberg’s vision of a Trinitarian creation with its coexistent unities and

pluralities, created by a God who might be seen as both a Unifier and Pluralist. Yet Drees, as a physicist, philosopher, and theologian, has provided a focused way of assessing what one can reasonably conjecture to be approximate, indirect criticisms, from a principally naturalistic scientific viewpoint. The question of how significantly Drees' critiques, and any indirect or imagined ones like them, might be understood to undermine Pannenberg's aims and methods remains to be summarized. Commentary from Drees' foundational area of criticism on "symmetry" provides an occasion for each step.¹¹⁰

"Symmetry" in Drees' thought corresponds to the final goal of Pannenberg's methodology, which I have called "acceptability." Acceptability in the secular world, to the degree Pannenberg believes one may achieve it before the consummation of human history in God, lies at the heart of his method. It is this that Pannenberg seeks to achieve via his method of coherence toward plausibility. The idea of symmetry is for Drees the large umbrella category in relations between religion and science, under which the matters of coherence and plausibility are situated.

Drees' opening comments in his essay, "Some in religion and science see their ambition as building a bridge between theology and science,"¹¹¹ relate indirectly to Pannenberg. But Drees' argument, reasserted through the sections of his essay on consonance and plausibility, is that "the intellectual standing of both human endeavors is quite dissimilar."¹¹² It is in the context of such a widespread view that Pannenberg's work must converse with the secular world of the sciences and philosophies of sciences.

Drees makes two initial statements before launching into the sections on consonance and plausibility, each using terms intent on showing why theology "in contrast" to the sciences is "dissimilar" in intellectual standing. He first argues that the natural sciences

have expanded the domain covered from human size ranges to minute details within atoms as well as to galaxies and even larger structures. They have shown an impressive increase in coherence across disciplines, as witnessed by the emergence of disciplines such as molecular biology. They have shown an enormous trend toward unification in ideas and explanatory schemes with respect to fundamental theories in physics as well as in the life sciences. They have proven to be eminently applicable, delivering us the power to manipulate individual atoms and genes.¹¹³

But as for theology, "In contrast, neither at the level of ideas nor at the level of practices is there a similar record of specific convergence and fruitfulness for the religious traditions."¹¹⁴

Second, he doubts the modesty of theology, particularly when presuming to enquire into scientific topics. The sciences have been marked by modesty in ambition, he claims:

The success of the sciences has been paid for, to some extent, by modesty in ambitions. In the present context, two kinds of modesty are especially

important to consider. The sciences have sought to abstain from moral and other evaluatory judgments regarding reality. And, they have focused on aspects of reality that were open to effective treatment, with operational definitions of concepts such as “energy” or “life,” while abstaining from metaphysical, essentialist questions about such notions.¹¹⁵

And yet again, as for theology—which sounds remarkably like Pannenberg’s:

In contrast, religious thinkers of various kinds have sought to articulate ideas about ultimate reality and the inner essences of things, transcendent explanations and the like, as well as on the meaningfulness of life or on absolute values. . . . Thus by scope and by success (science being more successful) the enterprises of science and religion are quite different. To this can be added differences in function (explanatory?) and differences in relation to reality and evil, to which we will return below.¹¹⁶

Drees admits that “not all scientists or all religious thinkers have kept clear to their side of this divide.”¹¹⁷ But he argues still that his portrayal of matters is a publicly understood reality.

Yet Drees’ arguments for scientific modesty and efficacy could be considered overstated, if one asks Cartwright. She has argued for decades precisely that science does not always function with modesty in mind, that it does not always achieve success or exhibit great explanatory power. Her essays on the disunity of nature consist not just of positive theses, but of attacks on what she has argued to be immodesties of nomological unification in physics. Cartwright argues precisely that science often overreaches itself.

Pannenberg may be understood to hypothesize that professionally atheistic science makes the same mistake that Drees accuses theology of making, but in reverse. Natural scientists who know little or nothing about the “science of God” decide that theology is irrelevant, having nothing to say to the natural sciences.¹¹⁸ Contrarily, Pannenberg has argued that the natural sciences have explanatory lack exactly from deciding negatively about things of which they have little or no knowledge. Similarly, scientists besides Drees who work also in theology, like Polkinghorne and McGrath, have shown a trend of vigorously arguing in a direction opposite Drees’ views, even if not about the matters pertaining to those views. Pannenberg’s method has been partly about illustrating areas of explanatory lack caused by scientific ignorance or avoidance of God. But his work is better characterized in Drees’ terms overall as building hypothetical bridges between theology and the sciences, with the testing of his theological hypotheses part of that process.

This chapter has been about showing step by step Pannenberg’s method of building bridges, and then attempting to test the boundaries of the worth of his methodology for application to the dialectic shown between physics and philosophy. The logic and conclusions of the demonstration and testing have been as follows. Using Pannenberg’s own arguments, we have identified his method as working to show coherence between theology and natural

scientific explanations toward the plausibility of the theological claims. We have mined the development of this method from the beginning of his career through to his creation theology of *ST*, II, so crucial to the notion of synthesis expounded in Chapter 3. We have seen in detail how Pannenberg has developed his method so thoughtfully and to such an extent, and that it is so replete in all that he has written that one might even be tempted to reduce his work by calling it a “theology of plausibility,” of “coherence and plausibility,” or even of “coherence, plausibility, and acceptability.” This might satisfy many Pannenberg scholars to date who have sought to locate such a single principle by which to describe his theology.

But I have also worked to show, in the testing phase of weighing Pannenberg’s method against Drees’ critiques, that even such a well-developed method must fall short of satisfying universally all involved, whether secularly or theologically oriented. The persistent necessity of a concept of divine revelation, argued for by Karl Barth and his disciples, and from which Pannenberg has sought a degree of professional disassociation, has not been completely overcome by Pannenberg’s methodology, however well developed it may be. This is not to mention more mundane matters like simple human viewpoints that tend to vary between individuals and disciplines, or the well-entrenched and documented secular disassociation from theology in the modern period of history from which theology still suffers.

Nancy Cartwright’s essay “No God, No Laws” is applicable once again here. While it might be assumed to support Pannenberg by underscoring a necessary connection between God and laws, it could also be understood otherwise. Cartwright reasserts there her arguments from *DW* with such a clever twist that they could threaten to *undermine* several matters debated throughout all of the preceding chapters.¹¹⁹ Both secular physics and theology would be affected. Her arguments have possible atheistic connotations, and can be so construed that both the unifying project of physics, and any theology like Pannenberg’s seeking to argue for God as the creator of a unified natural order, are both undercut.

Cartwright contends that physics cannot deny God while arguing for laws of nature, since none of the basic contemporary accounts of laws makes sense without God.¹²⁰ Conversely, she also argues again that evidence for most of the regularities called laws, and therefore for nomological unity, is sparse anyway. The regularities might be explained just as easily with her refashioned “Aristotelian natures” hypothesis. A God like Pannenberg’s is not absolutely necessary to arguing law-like regularity, therefore, if Cartwright is correct, even if it is true that the notion of laws must include the idea of God. The very dialectic investigated in this book, “God as Unifier or Pluralist,” indicates that not all concepts of God, even if ostensibly Christian, are unambiguously Trinitarian. The project of showing theology to cohere with science in order to demonstrate theological plausibility could also become derailed with respect to laws of nature, given the “Aristotelian natures” hypothesis.

This chapter began with the argument that when relating traditional theological ideas to scientific concepts, subtle differences should be understood to exist between categories of coherence, plausibility, and acceptability even in the best of all possible scenarios. We have seen that Pannenberg has sought by his methods to accomplish each category, and that all three tend to be methodological goals in theologies seeking to relate positively to the sciences, as Drees has argued. Through mapping Pannenberg's work onto Drees' critiques, we have also seen that Pannenberg's effort is subtle, such that it is neither easy to characterize nor to dismiss outright.

Still, measuring the effectiveness and acceptability of Pannenberg's search to show theological coherence with the sciences toward plausibility is complex. Like seeing the world as "One" or "Many," or in theistic or atheistic terms, so much depends on one's viewpoint as determined by a variety of complex factors that these could be impossible completely to trace. What is clear is that coherence cannot be shown incontrovertibly to exist between theological and scientific ideas to all readers, as Drees' study indicates. The same limitations hold for attempting to show coherence between a dialectic of unifying physics and pluralizing philosophy of science and Pannenberg's creation thought. And with all of that being so, the idea of synthesis from Pannenberg's material or methodology—while intriguing with the many apparent points of coherence indicated—is limited. Any such "coherence" cannot therefore automatically lead to "plausibility." Neither category can lead to certain "acceptability." Despite these factors and provisional conclusions, if one is going to place value in theology *at all* then there is great merit in Pannenberg's offering. After all, he admits to working only hypothetically.

This book likewise is in part a hypothetical testing of Pannenberg's hypothetical argumentation and testing. Even Drees states later in his essay that there is much room, and indeed a need, for such efforts. Drees' eventual allowances, like his critiques, fit Pannenberg well. Drees admits in the end, for example, that "when we want to use religious language that has some plausibility, we cannot bypass what we have learned in the natural sciences."¹²¹ There is a great deal that physics, chemistry, and other sciences cannot yet explain even about human beings, much less about the entirety of creation, whether of its origins or essences. This, too, is a widely accepted fact, just like the official, professional separation of science from religion. For Drees, admitting the "non-transparent nature of human nature" means that "religious narratives may be considered valuable communicators of wisdom."¹²²

There are limits, then, to the reaches of Pannenberg's methodology, which Pannenberg admits. But there are still also "limit questions" arising at the "speculative boundary" of the sciences. As Drees writes, "explanations within a framework do not explain the framework itself."¹²³ Drees does not believe, whether as a physicist, philosopher, or theologian, that humanity will ever be free from these questions, even in light of a possible scientific explanation of "everything." Drees' own science-inspired naturalism is in the end an admitted "incomplete position," even as both the sciences and

theology have largely admitted the limits of their powers.¹²⁴ McGrath indirectly points out that proposals like Pannenberg's have gained plausibility in proportion to the implausibility of believing there to be one necessarily right rationality for viewing the natural world. That was the modern project of the Enlightenment, which is widely now seen to have collapsed in failure.¹²⁵ If Shults is correct, Pannenberg's offerings are in a much better position than even those characterized by postmodernity. If Pannenberg is a "post-foundationalist," as Shults has contended, his work will incorporate both modern and postmodern elements,¹²⁶ appealing to an even wider audience than many other "science and religion" offerings could.

On all of these grounds there is space for what Pannenberg's work provides both scientist and theologian. There must then be room for testing hypothetically what the subtlety of his creation theology offers, whether as a supposed synthesis for our problematic, or just as an interesting gloss on the long-standing problem of "the One or the Many," if that is all that can be accepted. It is on such audacious foundations and possibilities that the academic world has experienced a continuing surge in the field of "science and religion" (or "theology and science"), whatever its eventual fate, through the opening decades of a new millennium.

NOTES

1. Cf. Willem Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," in *Theology and Science*, 1.1 (2003): 113–128. Willem Drees has similarly claimed that problems arise in "religion and science" due to assumptions of "symmetry," of "explanatory plausibility," and of "goodness," by which he means intended displays of "consonance." Drees does not consider Pannenberg in his essay, but similarities in Drees' argument provide a framework for the critiques considered here.
2. Pannenberg, "Theology Examines Its Status and Methodology," delivered at the University of Oxford, 7 August 2003. Used by permission of Wolfhart Pannenberg.
3. I am calling this "acceptability" in the same way in which Nancey Murphy has written of "Acceptability Criteria for Work in Theology and Science," in *Zygon* 22.3 (September 1987): 279–297. Murphy's point was to use the philosophy of Imre Lakatos to suggest criteria for acceptable theses in interdisciplinary "theology and science" work.
4. While Pannenberg does not regularly use "coherence," "plausibility," and "acceptability" to describe his method, he is nevertheless commonly working toward these particular ends.
5. Pannenberg has discussed coherence and truth in relation to theology and other disciplines most prominently in *ST*, I, chap. 1. There he systematically covers internal coherence between complementary theological views, and external coherence between those views and that considered to be true from other disciplines.
6. Thomas Aquinas, question 1, article 2: "Whether Sacred Doctrine Is a Science?," in *Summa Theologica* (Westminster, MD: Fathers of the English Dominican Province, 1981), 2.
7. *Ibid.*, question 32, "The Knowledge of the Divine Persons," 168–169.

8. Ibid., question 2, "The Existence of God," 11–12.
9. Friedrich Schleiermacher, "First Speech," *On Religion: Speeches to Its Cultured Despisers*, trans. John Oman (New York: Harper Torchbooks, 1958 [1799]), 1–25.
10. Christoph Schwöbel, "Wolfhart Pannenberg," in *The Modern Theologians*, ed. David Ford (Oxford: Blackwell, 1997), 181.
11. Pannenberg, "An Autobiographical Statement," in *The Theology of Wolfhart Pannenberg*, ed. Carl E. Braaten and Philip Clayton (Minneapolis, MN: Augsburg, 1988), 14.
12. Ibid., 16.
13. Ibid.
14. Pannenberg, in a published letter to Bradshaw, *Trinity and Ontology*, 402. Bracketed clarification mine.
15. See the discussion of *RAH* in chap. 3 of this volume.
16. Pannenberg, "Theology Examines Its Status and Methodology," 2.
17. Ibid.
18. Pannenberg, "Speaking about God in the Face of Atheist Criticism," in *BQT*, vol. 3 (London: SCM Press, 1973), 99–115. First published in *Evangelische Kommentare* 2 (1969): 442–226.
19. Ibid., 104–105.
20. Pannenberg, "Theology Examines Its Status and Methodology," 5. Emphasis mine.
21. In a private interview with Pannenberg at Oxford University, he confirmed the judgment of many that he has a penchant for mediating between what are often seen as contrary viewpoints (like "One or Many"). He qualified this in good humor, noting that he has only attempted to do so "as long as they are both true."
22. Pannenberg, "Theology Examines Its Status and Methodology," 3–4.
23. Pannenberg, "The Truth of Christian Doctrine as the Theme of Systematic Theology," §5 of chap. 1 in *ST*, I, 48–61, provides a specific discussion of the terms. The first several chapters of *ST*, I, consider these matters broadly. These include chap. 1, "The Truth of Christian Doctrine as the Theme of Systematic Theology" (1–48); chap. 2, "The Concept of God and the Question of Its Truth" (63–118); chap. 3, "The Reality of God and the Gods in the Experience of Religion" (119–187); and chap. 4, "The Revelation of God" (189–257).
24. *ST*, I, 49–50.
25. Pannenberg, "An Autobiographical Sketch," 17. Pannenberg writes, "Nor is there much need to explain why I focused on Christology, anthropology, and theological method as topics of three voluminous books. In my mind, they were necessary stages before I could produce a systematic theology."
26. Roger E. Olson, review of Pannenberg, *ST*, II, *Themelios*, 21.3 (1996): 28.
27. F. LeRon Shults, "Theology, Science, and Relationality: Interdisciplinary Reciprocity in the Work of Wolfhart Pannenberg," *Zygon* 36.4 (December 2001): 809–825.
28. Shults, *The Postfoundationalist Task of Theology*, 84–110.
29. I have both interviewed in person and corresponded with Shults. He has covered the matter of a *Grundprinzip* thoroughly. While he does not say so in his book, and despite his own efforts, he has agreed with me several years after the release of his research that the pursuit of a single Pannenbergian *Grundprinzip* is not a good idea, after all.
30. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 113–128.
31. Ibid., 113.

32. Ibid., 114. Bridge imagery is used by the Center for Theology and the Natural Sciences, Berkeley, California (www.ctns.org), in explanations of its self-concept and work.
33. Ibid., 115.
34. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 117.
35. Sybil Wolfram, "Coherence Theory of Truth," in *The Oxford Companion to Philosophy* (Oxford: Oxford University Press, 1995), 140.
36. Shults, *The Postfoundationalist Task of Theology*, 112–121, provides an in-depth discussion of these terms.
37. Ibid., 115–116.
38. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 117. He does not say exactly which theological ideas he means.
39. Ernan McMullin, "How Should Cosmology Relate to Theology?," in *The Sciences and Theology in the Twentieth Century*, ed. Arthur Peacocke (Stocksfield, UK: Oriel Press, 1981), 17–57.
40. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 117.
41. Ibid.
42. McMullin, 51.
43. Ibid. McMullin does recant this possibility about Pannenberg in the very same section of the essay. He appears to have been working in the early 1980s to understand Pannenberg's position.
44. Ibid., 51.
45. Ibid., 52. McMullin, like Pannenberg, intermingles "coherence" and "consonance."
46. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 117.
47. Ted Peters, *Cosmos as Creation: Theology and Science in Consonance* (Nashville, TN: Abingdon Press, 1989), and more recently, *Science and Theology: The New Consonance* (Boulder, CO: Westview Press, 1998).
48. Peters, *Science and Theology: The New Consonance*, 12. The methodological approaches included by Peters are scientism, scientific imperialism, ecclesiastical authoritarianism, scientific creationism, the two-language theory, hypothetical consonance, ethical overlap, and New Age spirituality.
49. Ibid.
50. Ibid., 1.
51. Ibid.
52. Ibid.
53. Ibid.
54. Ibid.
55. Polkinghorne, *Science and the Trinity* (New Haven, CT: Yale University Press, 2004), 171. Polkinghorne admits, for example, that among scientists "[a] distaste for particularity is an obstacle to serious engagement with religious understanding."
56. Peters, *Science and Theology: The New Consonance*, 10. Pannenberg's contribution to the book is a brief chapter on "Human Life: Creation versus Evolution?," 137–148.
57. Keith Ward, *The Turn of the Tide* (London: BBC Publications, 1986).
58. Arthur Peacocke, *Theology for a Scientific Age: Being and Becoming—Natural, Divine and Human* (Minneapolis, MN: Fortress Press, 1993), 91.
59. Nancy Murphy, *Theology in the Age of Scientific Reasoning* (Ithaca, NY: Cornell University Press, 1990).

60. See Nancey Murphy and George F. R. Ellis, *On the Moral Nature of the Universe: Theology, Cosmology, and Ethics* (Minneapolis, MN: Fortress Press, 1996), and especially her *Anglo-American Postmodernity* (Boulder, CO and Oxford: Westview Press, 1997) for a full explanation of how she sees postmodernity as paving a way for a coherence between theology and the sciences to have become acceptable by the mid-twentieth century.
61. John Polkinghorne, *Scientists as Theologians: A Comparison of the Writings of Ian Barbour, Arthur Peacocke, and John Polkinghorne* (London: SPCK, 1996), 6–7.
62. Alister McGrath, *A Scientific Theology: Nature, Reality, Theory*, 3 vols. (Edinburgh: T&T Clark, 2001–2003). McGrath posits the natural sciences as dialogue partners with Christian theology, seeking especially to preserve the fidelity of Christian doctrine.
63. John Polkinghorne, *Science and the Trinity*, 9–10. Polkinghorne names all three thinkers and references Niels Henrik Gregersen and J. Wentzel van Huyssteen, *Rethinking Theology and Science: Six Models for the Current Dialogue* (Cambridge: Eerdmans, 1998).
64. *ST*, II, xiii.
65. Steven Weinberg, *Facing Up: Science and Its Cultural Adversaries* (London: Harvard University Press, 2001), 230–232.
66. *Ibid.*, 230.
67. *Ibid.*
68. Drees, *Religion, Science, and Naturalism* (Cambridge: Cambridge University Press, 1996).
69. Drees, “‘Religion and Science’ without Symmetry, Plausibility, and Harmony,” 114.
70. *Ibid.*, 115.
71. *Ibid.*
72. *Ibid.*, 116.
73. Drees, *Religion, Science and Naturalism* (Cambridge: Cambridge University Press, 1996).
74. *Ibid.*, 122–123. Drees is quoting Polkinghorne, “A revived natural theology,” in *Science and Religion: One World—Changing Perspectives on Reality*, ed. J. Fennema and I. Paul (Dordrecht and Boston: Kluwer Academic Publishers, 1990).
75. *Ibid.* Emphasis mine.
76. Ted Peters, “Natural Theology versus Theology of Nature,” *Theology and Science* 3.1 (March 2005): 1–2.
77. Peters claims that starting with theology “might be comforting to a scientist,” and thus is a better option than natural theology. This seems illogical, however, since most scientists could not possibly give official credence to a religious hypothesis. Peters appears to be thinking in terms of “science and religion” scholarship, where many scientists have faith commitments, and not with a view to wider secular opinions, which is the greater state of affairs.
78. Pannenberg, *TTN*, 72–76.
79. Pannenberg advocates that using “nature” as opposed to “creation” might be helpful in appealing to the natural sciences. This idea has been critiqued by Alister McGrath for underestimating the “profound ambivalence” of the term “nature,” since nature itself is a concept mediated by various factors. McGrath, *A Scientific Theology*, vol. I, 135–137.
80. Brooke and Cantor, *Reconstructing Nature*, 176.
81. Brooke, *Science and Religion*, 193.
82. *Ibid.*, 29.
83. Pannenberg makes these claims implicitly and explicitly throughout *TPS*, *TTN*, and *ST*.

84. Stewart, *Reconstructing Science and Theology in Postmodernity*, 24. Emphasis mine.
85. Pannenberg, "Theological Questions to Scientists," in Albright and Haugen, eds., 38. Previously published in *Zygon* 16.1 (March 1981): 65–76; *CTNS Bulletin* 7.2 (Spring 1987); and in Pannenberg, *TTN*, 15–28.
86. Stewart, *Reconstructing Science and Theology in Postmodernity*, 23.
87. *Ibid.*, 15.
88. *Ibid.*, 145.
89. *Ibid.*, 145–146.
90. Pannenberg, "God's Presence in History," *The Christian Century* (11 March 1981), 263.
91. Hefner, "Pannenberg's Fundamental Challenges to Theology and Science," *Zygon*, 36.4 (December 2001): 801–808.
92. Carl E. Braaten, "Wolfhart Pannenberg," in *A Handbook of Christian Theologians*, ed. Martin E. Marty and Dean G. Peerman (Nashville, TN: Abingdon Press, 1984 [1965]), 653.
93. Bradshaw, *Trinity and Ontology*, 179. Bradshaw refers to David McKenzie, *Wolfhart Pannenberg and Religious Philosophy* (Washington, DC: University Press of America, 1980).
94. *Ibid.*, 257–258.
95. Galloway, *Wolfhart Pannenberg*, 91.
96. Christoph Schwöbel, "Wolfhart Pannenberg," in David F. Ford, ed., 189.
97. *ST*, I, 63–118. "The Concept of God and the Question of Its Truth" is the title of chap. 2. Cf. Pannenberg's exposition of the religious dimension in human existence in Pannenberg, *Anthropology in Theological Perspective* (Edinburgh: T&T Clark, 1985), 72.
98. *ST*, I, 63–73, 73–82, 82–95, and 95–107, respectively.
99. *ST*, I, 106–107.
100. *ST*, I, 107–108.
101. *ST*, I, 119–187, which is chap. 3, "The Reality of God and the Gods in the Experience of the Religions."
102. *ST*, I, 169–171. Pannenberg writes of "the concept of the history of religion as criticism of religions and as a history of the manifestation of the divine mystery that is concealed in them, i.e., of the true reality of God. . . ."
103. *ST*, I, §4 "The Religious Relation," 172ff.
104. *ST*, I, 189–257, which is chap. 4, "The Revelation of God."
105. *ST*, I, 257.
106. *ST*, I, 259–336, which is chap. 5, "The Trinitarian God."
107. *ST*, II, xv.
108. *ST*, II, covers creation (1–174) and anthropology (175–464); *ST*, III, covers the church (1–526) and the *eschaton*—at the end of which all truth should be confirmed, Pannenberg argues (527–646).
109. Drees, *Religion, Science and Naturalism*, 126. When Drees criticizes Pannenberg as a theologian using scientific information eclectically for his arguments, he references Pannenberg, "Theological Appropriation of Scientific Understanding: Response to Hefner, Wicken, Eaves, and Tipler," *Zygon* 24 (September 1989): 255–271.
110. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 114–115.
111. *Ibid.*, 114.
112. *Ibid.*
113. *Ibid.*
114. *Ibid.* Emphasis mine.
115. *Ibid.*
116. *Ibid.* Emphasis mine.

117. Ibid.
118. Pannenberg, "Theological Questions to Scientists," in *TTN*, 15–28, and generally shown in the material and methodological trends illustrated above in chaps. 3, 4, and 5 in this volume.
119. Cartwright's "No God, No Laws" was discussed in chap. 4 of this volume.
120. Ibid. Cf. Lydia Jaeger, *Lois de la Nature et Raisons du Coeur* (Bern: Peter Lang, 2007).
121. Drees, "'Religion and Science' without Symmetry, Plausibility, and Harmony," 121.
122. Ibid., 122.
123. Ibid., 123.
124. Ibid.
125. McGrath, *The Science of God*, 90–91, 105–106, 158–159.
126. Shults, *The Postfoundationalist Task of Theology*, 237ff. This is among Shults' main theses throughout the book.

6 Conclusions

In the preceding five chapters a real debate between unifying physics and pluralizing philosophy of science, characterized by significant metaphysical and theological elements, has been investigated. The principal aim has been to examine, hypothetically, the extent to which Pannenberg's Trinitarian creation thought might be seen to synthesize relevant aspects of that problematic. While Pannenberg has not himself engaged with the debate investigated here, we have seen, nevertheless, how several prominent characteristics in his material and methodology suggest an intriguing notion of synthesis for key components of the dispute. His work does directly address matters relevant to the issues dividing unifying physics and the thought of Nancy Cartwright. He does argue positions that, if the physicists and Cartwright were to adopt them, could become limited mediations for some of the metaphysical, philosophical, and theological aspects of their disagreements. And for both parties, these are not insignificant factors in their respective worldviews. Rather, these undercurrents have at least indirectly informed their science and philosophy. Clear residual echoes of a strong Christian theological heritage abound, even where early ideas of God have now been jettisoned.

We can now draw together the various conclusions of the study toward final observations, including what one may take to be implications for Pannenberg's entire program, and for similar ongoing scholarship. Throughout, five areas of significance that have arisen in the course of the chapters will be highlighted. These include conclusions regarding Pannenberg's answers to the problems of (1) "God as Unifier or Pluralist" and (2) "the One and the Many" in human thought, and (3) the plausibility of theology in a world marked by natural science. We shall finish by reflecting on (4) Pannenberg's developing positions, and (5) possible implications for the field of "science and religion" studies.

Chapters 1 and 2 together granted the primary problem for consideration with Pannenberg's theology. Following Pannenberg's own Hegelian manner of thinking, a dialectic between unifying physics and Cartwright's diversifying philosophy of science was demonstrated as a thesis and antithesis. The thesis derives from physicists with theories of ultimate unification, and a metaphysics supported by a recurring "Unifier" concept of God. The

antithesis comes from Cartwright, with her perspective on diversity via a “metaphysical nomological pluralism” and a “Metaphysical Pluralist” God. The dialectic between these sets of views was shown to be richly multifaceted, extending across scientific, philosophical, and theological boundaries. A philosophical framework was suggested in which the conflict might be understood as an updated scientific version of pre-Socratic arguments between unifying Parmenideans with their wholism of “One,” and diversifying Heracliteans championing “Many.” This framework implies that human perspectives and theory choices are strong factors in seeing either “one” or “many” with regard to a variety of problems.

Each side in the current, actual, scientific debate, as in those ancient contests, possesses age-old sympathies and differing sets of evidences for emphasizing either “unity” or “plurality” as a grand narrative for ordering nature. Acknowledging human theory choice helps to explain the millennia-long character and reinvigoration of such arguments, including this recent scientific guise. The background for the opening chapter in this volume lies in scientific historical fact, even as the chapter on Cartwright following it represents a real and current response. The conclusions of those first two chapters, as matter-of-fact aspects of an actual argument, speak for themselves. That is, the labors and conclusions there have served mostly to highlight what might otherwise have been overlooked: the significant metaphysical and theological character of the debate.

In Chapter 1, we saw from history the ways in which monotheistic theology has for several centuries found alliance with scientific evidences for uniformly ordering nature, in the context of a unity of physical laws. Scientific projects seeking support for concepts of physical and nomological unification have likewise often looked to monotheistic concepts of God. We have seen how the very idea of a law of nature has a strong basis in Christian monotheism, even if alongside other factors. It is simply true that in some cases theological views have driven scientific unifying projects and that a monotheistic Creator has functioned to ratify a “unified nature,” and vice versa.

Einstein, a principal inspiration for current unifying physics who often referred to “God,” observed that a drive for intelligibility, not infrequently akin to the quests of religious seekers, was the reason behind all scientific investigations. While ideas of God have continued gradually since the Enlightenment to vanish as aspects of acceptable professional discourse in physical science, figures like Einstein have still drawn strong connections between their scientific and religious impulses. And as Jammer (1999) has shown, Einstein’s “God,” although an unconventional concept, was more like the God of Jewish and Christian monotheism than might otherwise be supposed by an unwitting public informed by a twenty-first century professional scientific atheism. Even so, a turning point in the intellectual history of these science and religion interactions did come around mid-century approximately following Einstein’s death. Those continuing to work toward

unity in the form of a quantum theory of gravitational interactions, whether through conventional particle physics or more esoteric notions like string theory, do not consider God officially.

God still makes the occasional appearance, however—even if as the uninvited guest from whose philosophical implications unifying physics and broader cosmological considerations cannot seem to escape, try though they do. Unifying physicists after Einstein, despite atheistic scientific trends generally, seem to find it quite difficult to reconcile the philosophical implications of their work with an idea of a universe *without* a “designer.” This is so whether seen as a traditional personal deity, an impersonal God at least understandable in anthropomorphic terms, or as a mysterious cosmic principle that could one day make complete sense to physics, but for now may be called “God” for lack of a better term. The factors in physics connoting this God include not only an apparent unity of reality at its deepest levels, but also natural beauty, symmetry, and a rather knife-edged, life-sustaining “fine tuning” of the cosmological constants, allowing human life to exist and think existentially at all. Even where none of this is assumed, God still appears as a concept being openly and directly negated.

Physicists like Hawking, who have led the charge for a theory of everything in recent decades, are among those finding it still helpful when arguing their grand theories to mention God. Particularly telling of the metaphysical character of the business of theories of everything is when Weinberg, perhaps the most ardently atheistic of unifying physicists, finds it impossible not to include an entire chapter (11) of his *Dreams of a Final Theory* discussing, “What about God?” Weinberg alludes to traditional monotheism when he begins that chapter by quoting Psalm 19: “The heavens declare the glory of God; and the firmament showeth his handiwork.”¹ Earlier conclusions above have pointed to the fact that traditional monotheism has influenced unifying physics profoundly, such that physics finds it difficult to escape entirely from these monotheistic roots. Wherever these connections between scientific unity and theology have existed in history to this day, the concept is necessarily one of a God who unifies the natural order.

Chapter 2 showed how an entire school of recent philosophers of science, most notably Cartwright, have challenged the notion in physics that nature is reducible to singular mathematical formulations like a theory of everything. Cartwright has done so not by ridiculing what might be viewed as a questionable theological basis for such a theory, although she could have done that. Instead, she has posited an alternative grand metaphysics with its own theological implications, which she has found worthy to hypothesize. She is best known among what I am calling conjointly the “metaphysical pluralist” philosophers for questioning both the philosophical and scientific assumptions, and the methods, leading to conclusions that our world, by virtue of physical laws, is somehow metaphysically One or unified, and that it is therefore theoretically unifiable. The expensive, imperialistic unifying projects in physics proceed initially from a faulty metaphysics of unity, she

has contended for two decades, for which there is little real evidence and too few verifiable success stories. Nevertheless, these unifying projects continue to be attempted. Cartwright names this intrepid advance, which disregards its own paucity of evidence (not to mention philosophical arguments like hers) a “scientific fundamentalism.” The main theological point to be taken from Cartwright has been to illustrate, and conclude with, the challenge for Christian theology that Pannenberg might be seen to answer. That is, from the metaphysical pluralists, namely Cartwright, comes consideration that the same Christian God, should this God exist, might be not a “Unifier,” but a guarantor of the diversity Cartwright and others proclaim.

Chapter 3 described the characteristics of Pannenberg’s scientifically informed Trinitarian creation, which I have argued to show the Christian God of Pannenberg to be a synthesis, to some extent, for the thesis Unifier and antithesis Pluralist. In the second installment of his three-volume *ST*, Pannenberg has presented a scientifically informed Trinitarian vision of creation, which having certain material and methodological characteristics, offers what can seem plausible resolutions for aspects of the God as Unifier or Pluralist debate. This promise is suggested by virtue of Pannenberg’s highly detailed Trinitarian view of God showing attributes of a divine being uniquely both One and Three since its theological inception in early Church history. God, according to Pannenberg, has birthed a creation marked by similar unities and pluralities, centering largely on laws of nature, reminiscent of God’s Trinitarian character and activities.

We have seen how Pannenberg bases this entire systematic offering on a conceived divine Trinitarian “inner life” of relations between Father, Son, and Holy Spirit. Undergirding the whole scheme is Pannenberg’s idea that God is the All-determining Reality of the world, such that gaps appear in any discipline, scientific or otherwise, when God is not taken into sufficient consideration. Commentator Ted Peters has called this Pannenbergian view one of theology as a field-encompassing field. This methodological view, along with the idea of a Trinitarian God as the All-determining Reality with extensive material demonstrations, has been applied—hypothetically—to the dialectic between unifying physics and Cartwright’s philosophy. The scenario has provided Pannenberg’s material and methodology with a fascinating opportunity: a current real-world test case for his claims.

Chapter 3, as the initial locus for that extended test case, immediately revealed both strengths and weaknesses in the idea of a potential Pannenbergian synthesis. Regarding strength of connections, we saw at length how Pannenberg’s conception of God as both a Unifier *and* Pluralist relates to his characterization of creation not simply as either unified or plural, by virtue of the activities of Father, Son, and Holy Spirit.

Pannenberg argues in *ST*, II, for intimate connections between God’s Trinitarian inner life of Persons and the character of a creation marked by unities and pluralities, stating,

The action of the one God in relation to the world is not wholly different from the action in his trinitarian life. In his action in relation to the world the trinitarian life turns outward, moves out of itself, and becomes the determinative basis of relations between the Creator and the creatures.²

This outward turning shows creation itself to have been a Trinitarian act, with the several Persons having a unity of creative purpose and a diversity of divine actions.

While Pannenberg has been careful to acknowledge that if the world is ever to understand the divine origins of its existence from the Triune God this will come “only in the light of the end of history,” he still boldly asserts, “The three persons of the Father, Son, and Spirit are primarily the subject of the divine action. By their cooperation the action takes form as that of the one God.”³ The cooperative divine action includes by implication creation being a unity, having come from the one God, which is sustained and continues creatively by virtue of a system of natural laws with contingent character. Chapter 3 indicated how Pannenberg mediates between positions of scientific fundamentalism on one side of the dialectic, and a notion of metaphysical nomological pluralism on the other, with his concept of divine natural laws and their outworking in creation dependent on the reign of a free and personally active God. The unity by natural laws, and the creative outworking of a plurality of forms of creatures, Pannenberg largely credits to the cooperation of Son and Spirit. He notes that in his theology, like that of Irenaeus, “the Son and the Spirit are the two hands of God by which he created all things.”⁴ Jesus as Logos becomes then for Pannenberg both the quintessence of the world’s order and unity by a system of natural laws, and of its distinctions and relations between parts as constituents of the whole of created systems. The Spirit provides the dynamic character and functioning of the natural world in its orderliness and differentiations, including the evolution and fulfillment of the multitude of all creaturely forms.⁵ Pannenberg’s mediating figure of Jesus as Logos, as author of both unity and plurality, coheres with the truth of the debate in pre-Socratic thought.

While Heraclitus and Parmenides and their followers did certainly argue the world to be “Many” and “One” respectively, Logos was at the center of both views. For Heraclitus the flux of reality was real, but also constitutive of an overall unity, while Parmenides considered flux a pure illusion, believing everything in existence to be in a state of unified stasis. Logos, broadly conceived as the fire of reason permeating all reality, developed from these early debates and was eventually to be adopted by Christians, who named Jesus to be the cosmic Principle itself.

Pannenberg does not openly discuss this progression, but brings it to a logical conclusion with Jesus as the mediator of a natural order consisting of both plurality and unity through natural laws. In so doing, Pannenberg is responsible for a reinvigoration of Logos philosophy in Christian thought,

not despite our current understanding of nature's laws but in tandem with it. These sorts of contributions show Pannenberg neither to be retreating within a theology hiding from the present scientific understanding of sciences like physics, nor cowering in their presence by jettisoning ideas like Logos, which have been constitutive of Christian theology from the start. He mediates between such extremes, like between a God who might otherwise be seen as either a Unifier or Pluralist, and between a creation understood principally as either One or Many.

Yet in the face of what anyone placing value in these theological and philosophical ideas might see as victorious lies also what one can see conversely as a great weakness. Why, for instance, must a God be Trinitarian in order to accomplish a creation marked by unities and pluralities? It is clear enough why a Christian theologian would seek to make such assertions and connections. But since God in the three great monotheistic faiths of Judaism, Christianity, and Islam is generally thought of as an all-powerful being, could not this God still decide so to create, even if best considered an undivided "One"? If God is all powerful, and if creation is truly both "free" and "created," and not some neo-Platonic emanation, then one would think the answer must be in the affirmative.

This weakness of argument is compounded by the detail with which Pannenberg makes the connections. I have argued, principally in Chapters 4 and 5, that Pannenberg's highly detailed connections, enacted to show theological coherence with the sciences, can actually derail plausibility. In effect, a reaction opposite that intended can be engendered. It may seem at first glance a positive thing to show the most intricate connections imaginable between a concept of God and a scientific understanding of reality. This must be true for those with Trinitarian commitments like Pannenberg. But such an approach also opens negative possibilities, and not simply just that scientific understandings may (and usually do) change, thus requiring any correlate theological claims made in relation to be altered. A theologian can make such intricate claims for which there is no evidence, like for a divine inner life of a Trinitarian God who is both One and Three, and then relate that to a created order marked by vaguely similar unities and pluralities, such that even other theologians can find it unpalatable. This is not so negative an observation as to deny the great merits of Pannenberg's systematic work. Again, as even Pannenberg enthusiasts like Hefner have admitted, "One reason Pannenberg's effort is so audacious and so difficult and, for some readers problematic, is that he insists that the creation must be related to the interior life of God."⁶

If a fellow Trinitarian theologian admits that, what might one expect a secular and generally atheistic physicist or philosopher of science, to whom one is wishing to appeal, to think? As far as this criticism may be appropriate, alternatives in the form of broadly theistic arguments in the light of the natural sciences could be more palatable. Works like those by Keith Ward, in *The Case for Religion*⁷ or *Pascal's Fire*,⁸ the latter of which includes

discussions on physics, laws of nature, and theories of everything, are good examples. My comparisons led at the end of the third chapter to the conclusion that both the apparently positive and negative factors press for further and deeper evaluation.

This led to the more pronounced focus in Chapter 4 on dialogue limits. The first three chapters highlighted similar foci between the three perspectives, albeit with differing opinions being expressed. Chapter 4 served to emphasize the clarification or uncovering of both obvious, and hidden, material limits in the dialogue. From the start two possible routes were noted, each dependent on one's sympathies toward or against a detailed Christian theological explanation such as Pannenberg offers, as related to the physics/philosophy dialectic in Chapter 3. One route would be instantly to dismiss any notion that Pannenberg's theology, however scientifically and philosophically adept, might offer any degree of viable synthesis for a serious, secular scientific and philosophical problem. A second option is to *suppose* provisionally Pannenberg's working assumptions, such as seeing theology as a field-encompassing field able to illuminate other disciplines—including matters arising between disciplines like those debated by the physicists and Cartwright.

In the spirit of Pannenberg's hypothetical stance for theology, the second option has been investigated. This synthesizing route has allowed for a more subtle comparison between the three sets of views, as well as the opportunity to test Pannenberg's most crucial underlying presupposition for interdisciplinary discussions. That presupposition, again, is that theology has information needed by the scientific disciplines in order to form a complete understanding of the world under investigation. But the close re-examination of the explanatory systems of the unifying physicists, Cartwright, and Pannenberg has revealed deep differences even in defining the very terms under investigation. Each party repeats words like "truth," "reality," "explanation," and "understanding" in their respective materials. Yet all mean quite different things by the terms, even given my conclusion that all three are realists—of different varieties—each claiming that truth is something to be had.

Regarding what is true and real, deep dissimilarities appear especially when comparing the respective ideas of "laws of nature" with their differing concepts of "God." While I have shown that each party discusses both ideas together in their written materials, with Cartwright and Pannenberg necessarily taking from the nomological accounts in physics, ironically, "God" and "laws" have also been the principal sources of variety between the three accounts. Specifically in Chapter 4, I revealed the way in which "God" and "laws" are simply not quite the same things when the three sets of uses are more closely compared. My conclusions included that the views expressed by each party are different enough to approximate to three principal, and generally contradictory, perspectives found in the history of science: Necessitarian, Regularist, and Prescriptivist accounts.

Each viewpoint fits approximately the respective sets of theological arguments represented, and also helps to reflect the variety of realist stances illustrated. The Prescriptivist Theory came first, chronologically. It dates far back to the time in the history of science discussed in Chapter 1 when natural philosophers came to the idea of laws of nature in the first place. The Necessitarian Theory Swartz criticizes as being “the latter-day successor to the Prescriptivist Theory, that is nothing but Prescriptivism-without-a-Prescriber.”⁹ This fits with my claim that two features of laws had survived the centuries, although both are now devoid of religious meaning: universality and necessity.

This residual “necessity” is one of the leftover ingredients from an earlier theologically rich view of laws that is no longer logically vital. It is akin to Weinberg’s lifelong search for a theory of everything without expecting that an end result, or any other level of understanding of nature’s laws, should indicate anything existentially meaningful. These drives remain in physics without their original content. The resulting apparent awkwardness is the product of the principal theological implications of Necessitarianism. The Regularity Theory, as Swartz explains it, being in direct odds with Necessitarianism, can be seen as a “negative theory.” Regularity “is the theory that there is no natural necessity, either *in re* or in physical laws.” It is a denial of “natural necessity in both its forms and under all its names.” Necessitarianism and Regularism both see laws as descriptions, but there the similarity ends. The unifying physicists are broadly Necessitarian, even as Cartwright is more like a Regularist, in the sense that van Fraassen argued the realism in physics to be not naïve in actuality—but that understanding it that way indicates the right flavor.

The right flavor with regard to Cartwright’s view lies in her claim that laws are in a much looser association than anything approaching unity or necessity. Pannenberg represents a reinvigoration of Prescriptivism, but in a subtle guise like his rehearsal of Logos philosophy, making God not simply a Prescriber in the manner that monotheism gave rise to the idea of laws and a Law Giver in the first place. Pannenberg’s God is a distinctly Trinitarian Prescriber, set within a highly specific scheme in *ST*, II. The Trinitarianism is supported reciprocally by exacting illustrations and schemes in God’s creation. In this way, occurring once again, theological specificity set in relation to particular theories in natural science might be understood to work *against* the more general goal of asserting the idea of God at all. God, or a god, who creates and uses laws, makes the best of contingency, introduces a scheme into creation featuring both unities and pluralities, and whose reality begs for reintroduction into a modern scientific worldview, need not be the Christian God at all. Of course it *could* be the Christian God. But nothing in Pannenberg’s material has of necessity—and by his admission—dictated that.¹⁰ Hence with regard to ideas of “truth” and “reality,” a Pannenbergian mediation appears as a true possibility here and there, but is not an unambiguous success.

Hope yet remains in the form of a proposal by Cartwright, depending on how one takes it. She has argued, noting strong historical and epistemological connections between the ideas of God and of laws of nature, that, epistemologically speaking, laws cannot be said to exist without God. "No God, no laws," she says, intending to remind physicists that their idea of laws was built on the idea of a divine lawgiver, God. Therefore they cannot now expect to have laws without God. Nevertheless, her alternative concept of a reinvigorated Aristotelian "natures," said to be resident in things, provides a complete substitute for the idea of natural laws. She indicates a preference for this latter option due to her view that the concept of Aristotelian natures has greater explanatory power than the idea of laws.

But would anyone at present expect physics and the sciences at large to accept her proposals, however brilliant, being mostly epistemological arguments in nature? Widespread acceptance of Cartwright's ideas seems unlikely, even though her proposals have birthed much healthy contemplation, and however much anyone excited by scientific atheism might find in her ideas a reason to hope. Therefore, while the sciences are at least equally unlikely to accept Pannenberg's proposals for a reinvigoration of Prescriptivism, some logical connection between laws and God, as Cartwright shows, must continue to exist, even if the theological underpinnings of nomological concepts are ignored by most working scientists.

Pannenberg's claims fared much better when ideas of "explanation" and "understanding" were compared between the three sets of thinkers. This is so even though the terms whereby Pannenberg offers his take on these ideas are couched in what can be quite opaque philosophical discussions. Just as even the occasional Trinitarian theologian might find Pannenberg's detailed machinations of an interior divine life a bit much, his interesting, arguably luminous, but at once also painstaking tracings of divergent emphases between "explanation" and "understanding" in the natural and human sciences, relating it all to problems in metaphysics, could be at least as difficult for a natural scientist patiently to abide. As I have worked to illustrate, however, ironically the same materials also contain among the most promising aspects of his thought for interdisciplinary discussions with any of the sciences or philosophies of sciences. Regarding "explanation" and "understanding," Pannenberg continues on from the way in which his Trinitarian creation might be seen to mediate between a Unifier and Pluralist concept of God, in an attempt at reconciling a problem like "the One and the Many" with his view of metaphysics. If his material were to be judged successful, he would have been able not only at least facily to reconcile the God concepts of the physicists and Cartwright, but perhaps also to help mend the ages-old tendencies in human metaphysical theories that have, insofar as human theory choice is a factor, given rise to the dialectic of the first two chapters in the first place.

Pannenberg ties categories of explanation and understanding to philosophical concepts of "part" and "whole," all toward a further concept of

“meaning.” He argues all “parts” and “wholes” in existence to have their ultimate “meaning” in the definitive possible whole beyond all wholes, which is God. I showed in Chapter 4 how all of reality has a “semantic structure” according to Pannenberg. That is, he argues through the lens of critical conversations with figures ranging from Aristotle in ancient philosophy to Wilhelm Dilthey in the nineteenth century that both the sciences and humanities must interpret any individual thing (a part) of a set of given things (a whole) in relation to a “semantic horizon.” A semantic horizon represents all that can be understood, interpreted, and discussed about a thing or a set of things using knowledge in an investigative field at a given time in history. Reality itself is “open”; the processes of all human and natural scientific investigations will continually push past their present “horizon” toward new understandings, interpretations, and discussions. I have related this to the way in which there is further geographical reality beyond the horizon of an actual physical plane. Looking beyond the plane is possible, but requires a continual and determined approach.

Pannenberg’s view of reality as having this semantic structure comes in *TPS* in the context of formulating an overall method for locating theology amidst the “multiplicity and unity of the sciences.” The proposed method relates to his emphasis on history and *prolepsis*; what we now know is “part,” while the “whole” of knowledge is to be revealed in the future of God, who already knows all things.¹¹ Reality, like a text, features wholes and parts reciprocally illuminating each other toward a meaning. In each regard, reality as a whole may be interpreted via a “hermeneutical” method, in the manner that a text can be approached. All scientific approaches to reality, whether in a natural science like physics, a human science like philosophy, or even theology, which Pannenberg argues to have equal footing with other scientific approaches to reality, can appropriate this concept.

Dialectics like that between the physicists and Cartwright, if stalemated as a thesis and antithesis, can in theory be moved toward a synthesis using this proposed method. I concluded the entire matter by observing that the required hurdle from reintroducing premodern metaphysical reflections from the likes of Aristotle, connecting these to nineteenth-century theories on hermeneutics, all toward successful theological apologetics, is vast. God, it seems by now in history, from the age of natural theology through the recent surge in “science and religion” studies, cannot be indisputably *proven* in any such way. This will remain the case however well Pannenberg’s explanations appear to fit a problematic like that disputed between physicists and Cartwright on whether the world is primarily best explained and understood as a whole, or as a system of variously disjointed parts.

Pannenberg’s idea that theology must engage once again with metaphysics by formulating grand ideas explaining reality as a whole is as fitting for our dialectic as his mediating view of God. After all, both the unifying physicists and Cartwright have boldly done so. Theology, I conclude, will likely only escape a “ghettoized” existence, if not some future relegation to a Dark

Age, not by avoiding metaphysics, as has been the fashion of some, but by seeking at least to address the metaphysics that twenty-first-century physics and philosophy of science dares to formulate. This must especially be true when these disciplines first mention God in varying degrees of seriousness while doing metaphysics.

Pannenberg, while engaging with physics, but not with Cartwright's work, has answered the dispute on whether God is a Unifier or Pluralist by offering a God who is both a Unifier and Pluralist at once. He has even posited related seeds for a hermeneutical method whereby one might interpret the world of wholes and parts created by this God. My judgment is that Pannenberg's expansive theories on explanation and understanding toward a grand metaphysic of meaning in God are at least a good starting place for what could become the material for further connections, however limited these apparent relations may eventually prove to be.

The issues considered in Chapter 5 had to do more pointedly with the matter of evaluating the overall ability of Pannenberg's theological system to relate constructively to secular scientific and philosophical concepts or debates. The comparisons of content and method in each of the chapters have indicated what I continue to reflect on here: that an ironic problem exists in which one can demonstrate "trade-offs" in theologies like Pannenberg's, which seek close relations and relevance to scientific knowledge. Pannenberg's problems are not uncommon, occurring not only by virtue of his work, but also in relation to the growing number of science and religion studies currently in abundant production.

In the fifth chapter, I made use of a widespread critique by physicist Willem Drees showing that common problems center on degrees of coherence (with scientific data), plausibility (to scientific or theological audiences), and acceptability (likewise to scientific or theological audiences). Not coincidentally, I also showed in the chapter that Pannenberg has recently discussed each of these explicitly as important aims in his overall program of seeking to formulate what one might call, as I have, a "theology of plausibility." I attempted to show, following both Pannenberg's efforts and Drees' critiques, that when relating scientific and theological viewpoints, one must carefully define and differentiate between these three categories. My main argument in the light of Pannenberg's method was that when relating traditional theological ideas to scientific concepts, subtle differences should be understood to exist between the three distinct categories of coherence, plausibility, and acceptability, and what may be achieved by pursuing them.

Pannenberg's work seeks coherence with scientific knowledge, and would be plausible to some in scientific and theological communities, but indicates these acceptability problems for secular and even theological audiences by virtue of an insistence on altering and using detailed theological traditions like Logos, and especially in this case hidden intratrinitarian relations, as constructive factors. A realistic appreciation of the differences between the categories covered in the preceding chapter offers food for thought on the

potential for increasing theological “acceptability” in a scientifically oriented world. Pannenberg has negotiated these problems by showing a willingness to alter, or even abandon, his theological positions if new evidences point to their demise. This is precisely what he has meant by couching his theology in terms of the hypothetical. Pannenberg’s theology is to be viewed in terms something like *ceteris paribus*—as hypothetically acceptable only as long as new information does not dislocate it from its position.

This may be wise and even true where theology is insularly considered by other theologians, or at least theists. But one of my conclusions, dictated by the obvious, is that in the reality of interdisciplinary discussions between theology and the sciences, one cannot consider theology in *ceteris paribus* terms, much less *simpliciter* ones. Physical theories of nature’s laws are accepted universally, allowing Cartwright to make an argument decreasing their vitality from *simpliciter* to at least *ceteris paribus*. Theological theories simply do not have the same currency. They may have once had such status in Anglo-European-American culture, but they decidedly no longer do. Couching them as hypotheses does at least help.

So, in so far as anyone puts credence to theological ideas, one might reasonably see a “theology as hypothetical” notion as true wisdom, although some would see an implicit danger in granting knowledge beyond the “revealed” so strong a position. While one might suppose that a theologian holding a view like “theology as hypothesis” could become more liberally minded regarding doctrine over time, Pannenberg has shown the opposite trend. His views on a metaphysical program based in ideas of whole and part, which reciprocally inform each other against a developing semantic horizon interpreted through a type of hermeneutics, became by the time of *ST* a method based ever more firmly in the idea of the Trinitarian God. A re-reading of the data I have provided on his positions in works like *TPS*, which he re-encapsulates in similar terms in *MIG*, become profoundly less apologetic by *ST*. A complete stranger to theology might have to consider quite carefully the degree to which the writer of *TPS*, which was published in 1973, was even a Trinitarian theologian. The signs are there, and at points are clearer than others, but Pannenberg’s Trinitarianism in *TPS* is far subtler than in his later works.

Granted, the point of *TPS* was not to defend a notion of the Trinity, but rather theology amidst the multiplicity and unity of the natural and human sciences. Nevertheless, in *MIG*, appearing in 1988, some of the same arguments are made for a part and whole metaphysical hermeneutics, with clearer statements to the effect that,

The particular significance which the category of the whole holds for theology . . . is conditioned by the idea of God. Whoever uses the word “God,” particularly as a singular, makes a claim at the same time about the totality of what exists finitely. The Christian doctrine of God as the Creator of the world has this significance. Moreover, God’s sending

of Jesus Christ is concerned, at least according to its intention, with the reconciliation and redemption of the entire world. Without this reference to the totality of what exists finitely in the world, a reference that we find also within eschatology in the concept of the universal judgment and a new heaven and earth, talk about God—about the *one* God—would not be possible. Further, when the connection of theistic language with the totality of finite reality is not conceived in the light of these implications, talk of God becomes empty and thoughtless, reduced finally to an unnecessary and bothersome ballast from which we would prefer to free ourselves.¹²

By the time of *ST*, Pannenberg's classifications of part and whole had become ensconced in dogmatic categories of the doctrine of the Trinity and creation. This is, of course, while arguing at the same time at another level, the two levels being his systematic (dogmatic) and fundamental (apologetic) modes.

One might explain these gradual changes in a variety of ways, including the obvious matter of Pannenberg's differing aims in his various books. Yet there is a deeper, subtler possible explanation. On meeting Wolfhart Pannenberg to discuss this project with him, he admitted a change occurring in his thinking over the years in which he had gradually had to admit that the currency of theology in wider culture was not as he had imagined it to be when a younger man, writing his earlier books.¹³ He had supposed then that one *could* "prove," to use his term, certain things theologically. But over time he had to concede this to be impossible. In discussing the matter in a further interview with Pannenberg commentator F. LeRon Shults, I proposed whether or not one might say that Pannenberg has gradually drifted back in the direction of his erstwhile tutor Barth, from whose influence and way of doing theology he had sought escape from the time of his own first major book, *RAH*.¹⁴ Shults agrees that there is some truth in this idea, although the shift is so very subtle and gradual as to be scarcely noticeable. Shults does not think it possible to call the change a "Barthian" one, at any rate. But there is a sort of drifting back "full circle" toward a more dogmatic theological position. To use van Fraassen yet again, it is at least like his allusion to scientific realism being of "the right flavor" to be called naïve realism. I do conclude that throughout the course of his career, Pannenberg has come full circle with regard to certain dogmatic positions and ways of doing theology. While they may not be called Barthian, they seem not *entirely* removed from the flavor of his former mentor Barth, either.

Pannenberg's work does bear a family resemblance to much research in the current field of "science and religion." Many of Drees' critiques in the fifth chapter fitted Pannenberg to perfection, although Drees was not critiquing Pannenberg, but rather similar directions in science and religion projects. That being so, one can reasonably assume that the same possibilities and strengths and some of the same weaknesses seen of Pannenberg in

the course of this study will probably prove true of not dissimilar work in science and religion.

Conversely, the weaknesses show up in that while there is no one way to explain “the” relations between science and religion, as John Brooke has reminded us (as if there is a “the” to be explained), there are nevertheless divisions between scientific and theological modes of reasoning, whatever we may call them. This is true whether we describe the divisions as being between human “reason” and divine “revelation,” as Barth may have described matters, between the “human” and “natural” sciences, as Dilthey might have explained the situation, or between what C.P. Snow in his 1959 Rede Lecture¹⁵ argued to be “two cultures,” one of “the literary intellectuals” and the other of natural scientists. Pannenberg’s entire lifelong program of seeking to show theology to cohere with the natural sciences evidences the same divide.

While this project is properly only about one theologian, Pannenberg, in conversation with one dialectical scientific problem, it is tempting to draw parallels with enthusiastic science and religion scholarship more widely. If Pannenberg’s relations with the dialectical problem between unifying physics and the diversifying philosophy of Cartwright (for which one could almost imagine his theology to have been written, it is so close a fit) is shown to be limited, should we not expect more of the same with similar study programs?

We appear to live in a world in which, as Paul Fiddes explained in *The Creative Suffering of God* when recalling the “God is Dead” movement of the 1960s, God is no longer a “necessary” hypothesis in the world’s estimation—if God ever truly was.¹⁶ There will always be alternative explanations and understandings for what is found in the world than “God,” and any study relating the sciences to religion must realize this. This does not mean that God is actually “dead” in human discourse, or in reality, any more than Jesus Christ was finally dead in the story of his life, death, and resurrection, whether we interpret the story literally or not.

One way to view some of the conclusions of this study is to consider that the idea of divine resurrection, which along with the concept of revelation has always been important in Pannenberg’s work, seems to have a metaphorical vitality in relations between theology and the sciences. Physicists who have tried have not been able entirely to escape the notion of God, even though attempting to kill the concept in relation to their theories. Even Cartwright, an “enemy” of unifying physics in its present guise, argues such a disassociation to be impossible in her “no God, no laws” position. The fact of the existence of the field of science and religion, which is vital enough that the University of Oxford inaugurated a Professorship in Science and Religion in 1999, is proof enough that scientific and religious interactions have never been decided finally “one way or another.” The conversations are ongoing. They have life. And so far in history, whenever it has been assumed that they might soon no longer have it, we have seen these assumptions proven to be false. This is because connections continue to be seen,

however hypothetical and tenuous they may be, and whether they are only somehow the product of the creative human imagination or true reflections of the divine in the created order, as Pannenberg argues.

There is more that one can add regarding the seeming fit of Pannenberg's Trinitarian system with the problem of "the One and the Many," and the "God as Unifier or Pluralist" dialectic, toward further research projects. This is to acknowledge a plethora of purely scientific research projects, having in most cases nothing to do with science and religion, connoting a reality made up of sets of unities and pluralities, and not just either "One" or "Many" things. One can point to sound philosophical theses like that of mathematician Margaret Morrison in *Unifying Scientific Theories*, who argues neither for a metaphysics of unity or of disunity, but for something in between as being closer to the actual available evidences.¹⁷ Nobel Prize-winning physicist Murray Gell-Mann's explorations in *The Quark and the Jaguar* celebrated a world featuring intimate connections between the basic laws of nature and the complexity and diversity of the natural world.¹⁸ Stephen Hawking, with Thomas Hertog of the European Organization for Nuclear Research (CERN), has used Richard Feynman's "sum over histories" interpretation of quantum theory for a recent theory of the universe.¹⁹ Feynman had argued that one observes the strange results of the double-slit experiment, where a photon is fired at two slits, because the photon does not simply travel from point A to point B, but takes both paths simultaneously, interfering with itself. Hawking and Hertog have recently built on the implications of the idea to propose a further concept of one single universe with many possible histories, the entire multitude of which are somehow true at once. Related is multiverse theory, hypothesizing a potentially infinite number of universes including ours, which physicists like Max Tegmark, Brian Greene, and Bernard Carr have dedicated much energy to researching.²⁰ The popular multiverse idea Hawking has also championed of late, even as he has begun arguing a decisively atheistic stance while wielding the multiverse and related ideas as atheistic weapons.²¹

Andrei Linde, another physicist, is said to have been "unconvinced" at least by the earlier Hawking-Hertog notion.²² All the while Linde, an author of inflationary cosmology, is best known for a similarly based multiverse idea of one cosmos with many universes. Linde has explained his theories in books like *Inflation and Quantum Cosmology* and *Particle Physics and Inflationary Cosmology*.²³ His theory of a "self-reproducing inflationary universe" describes our universe as a single self-generating fractal that sprouts other universes.²⁴ Linde considers the possible religious implications of his views, assuming his theories to be "much closer to polytheism or to atheism than the picture of a uniform universe created at a single moment and governed by a single law in all of its parts, which had much more in common with monotheism."²⁵

Yet a theologian like Pannenberg, given his views on a Trinitarian reality of wholes and parts, would conclude no such atheistic viewpoint. Linde would only be making a potentially damning theological observation if

Christian monotheism were not Trinitarian. But as the Christian conception stands, a universe in any guise of “One” and “Many” serves as evidence, not refutation, of God.

Pannenberg may be proven completely wrong in all that he proposes if the *eschaton* for which his hypotheses await ever comes. And yet his views on a Trinitarian reality are hardly stranger than some of the scientific theories just described. There is to date no evidence for a multiverse. The concept is fascinating, but also speculative and ostensibly unprovable. As long as scientific theories like Hawking’s or Linde’s about a multiverse abound, or problems like the dialectic between unifying physics and Cartwright’s philosophy exist, Pannenberg’s thought, and science and religion projects similarly themed, will have life, however hypothetical that life may be.

NOTES

1. Psalm 19.1, King James Version.
2. *ST*, II, 5.
3. *ST*, I, 388.
4. *ST*, II, 109.
5. *ST*, II, 108–109.
6. Philip Hefner, “Pannenberg’s Fundamental Challenges to Theology and Science,” *Zygon* 36.4 (December 2001): 801–808.
7. Keith Ward, *The Case for Religion* (Oxford: Oneworld, 2004).
8. Keith Ward, *Pascal’s Fire: Scientific Faith and Religious Understanding* (Oxford: Oneworld, 2006).
9. Swartz, *The Concept of Physical Law*, 37–38.
10. *ST*, I, chap. 2, “The Concept of God and the Question of Its Truth” (63–118), and chap. 3, “The Reality of God and the Gods in the Experience of the Religions” (119–187).
11. *ST*, II, 75n, and Pannenberg, “Hermeneutic and Universal History,” in *BQT*, vol. 1 (London: SCM Press, 1970), 96–136.
12. *MIG*, 142.
13. In an interview with Wolfhart Pannenberg at the University of Oxford.
14. In an interview with F. LeRon Shults at the University of Oxford.
15. C. P. Snow, *The Two Cultures* (Cambridge: Cambridge University Press, 1998).
16. Paul Fiddes, “The Death of God,” chap. 7 in *The Creative Suffering of God* (Oxford: Oxford University Press, 1988), 174–206.
17. Morrison, *Unifying Scientific Theories* (Cambridge: Cambridge University Press, 2000).
18. Murray Gell-Mann, *The Quark and the Jaguar: Adventures in the Simple and the Complex* (London: Abacus, 1994). Gell-Mann won the Nobel Prize for Physics in 1969 for quark theory.
19. Amanda Geffer, “Mr. Hawking’s Flexiverse: The History of the Cosmos Has Yet to Be Decided. At Last, a Chance to Play God,” *New Scientist* 190 (22 April 2006): 28–32.
20. See Bernard Carr, ed., *Universe or Multiverse?* (Cambridge: Cambridge University Press, 2009), which also features an essay by Tegmark and Brian Greene, *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos* (New York: Alfred A. Knopf, 2011).

21. Stephen Hawking and Leonard Mlodinow, *The Grand Design: New Answers to the Ultimate Questions of Life* (London: Bantam Press, 2010).
22. Gefter, 32.
23. Andrei Linde, *Inflation and Quantum Cosmology* (Boston: Academic Press, 1990), and *Particle Physics and Inflationary Cosmology* (Chur, Switzerland: Harwood Academic Publishers, 1990).
24. Andrei Linde, "The Self-Reproducing Inflationary Universe," *Scientific American* 271.5 (November 1994): 48–55.
25. Andrei Linde, "Universe, Life, Consciousness," a paper delivered at the Physics and Cosmology Group of the "Science and the Spiritual Quest" program of the Center for Theology and the Natural Sciences (CTNS), Berkeley, California, 1998.

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