



ORDER: GOD'S, MAN'S AND NATURE'S

God and Methodological Naturalism in the Scientific Revolution and Beyond

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Introduction

Not only do Christians tend to not recognize the role played by methodological naturalism (MN) in natural philosophy in the ancient and medieval periods, we also tend to miss MN's role in the Scientific Revolution. There are several strands to this story, but I will start by highlighting four theological strands that contributed to the ground breaking natural philosophy of the 17th century that feed directly into MN.¹

The Doctrine of Creation: Ontological Homogeneity

Early Christian thinkers struggled with their Greek philosophical and cultural context to formulate the doctrine of creation (DoC).² Natural philosophers in ancient Greece and Rome conceived the celestial realm as being of a qualitatively different order of being (divine, infinite, perfect) from the terrestrial (mundane, finite, imperfect, changeable). Under such a conception, the celestial and terrestrial realms were treated as being distinctly different from each other. In particular, being viewed as divine and perfect, the celestial was not investigated in same manner as the mundane.

Furthermore, early Christian thinkers had to struggle with biblical revelation proclaiming that all things were created through and for Christ (John 1:1-3, Colossians 1:16), and their Greek cultural inheritance that taught an eternal universe with a qualitatively distinct celestial and terrestrial realms. Eventually the Patristic fathers came to the recognition that if everything was created by and for Christ, then the entire universe was not eternal but a creation *ex nihilo*. This element of the DoC was wrung from deep reflection on the contrast between the prevailing Greek philosophical views and special revelation.³ Part and parcel with creation *ex nihilo* is the Creator/creature distinction, the qualitative distinction between the Creator and that which is created. These central tenants of the DoC led early Christian thinkers to the realization that as a created thing the celestial realm could not be divine.⁴

Still, the power of Greek thought—particularly in Plato and Aristotle—exerted a tremendous pull on early Christian thought as many Patristics continued to maintain a qualitative distinction between the celestial and terrestrial realms. The former was still considered a realm of changeless perfection and made of a different element (quintessence) than the latter which was made of the elements earth, water, air and fire, was imperfect and changeable and, consequently, of a lower grade of being. However, some Patristic thinkers—Irenaeus, Basil and Philoponus—were able to recognize that the thrust of biblical revelation was that the only distinction in being was that between Creator and created. They argued that the DoC led to the

conclusion that the being of everything created—terrestrial and celestial—is *homogenous*. Instead of a great chain of being, there was no distinction of being between celestial and terrestrial realms. Everything created had the same status, that of creature. “The creation is homogeneous in the sense that everything has the same ontological status before God, as the object of his creating will and love. All is ‘very good’ because he created it, mind and matter alike.”⁵

Philoponus traced the consequences of ontological homogeneity to the conclusion that creation has a genuine nature or order. “Philoponus insisted that nature could not be understood as the finite representation of infinite reality but as real in itself.”⁶ By implication all things in creation have genuine natures. In particular, the celestial and terrestrial realms were of the same order of being implying the same principles governed the two realms and they were made of the same matter. The nature of their distinction lay in difference, not order of being. This was the basis for Philoponus’ critique of Aristotelian natural philosophy, particularly Aristotle’s account of motion.⁷

The insights of ontological homogeneity were lost during much of the Middle Ages (though recaptured on rare occasions). They eventually reemerged in Duns Scotus, Jean Buridan and Galileo.⁸ Ontological homogeneity became the consensus view among natural philosophers in the 17th century, so that it was plausible to give an account of motion that was unified in its treatment of celestial and terrestrial motions (e.g., Newton’s theory of motion).

Divine Freedom

A second theological strand is divine freedom in creation. Although there were longstanding debates about whether God created freely or could only create out of necessity, the former view eventually won out.⁹ Bishop Tempier of Paris’ 1277 condemnation included, among its 219 prohibitions, a condemnation of teaching that any of God’s acts are done out of necessity. Although not the only theological development that led to an emphasis on divine freedom in creation, the condemnation played a role in motivating a shift to a more empirical approach to understanding the nature of God’s creation that was already underway in natural philosophy and renewed emphasis on divine freedom in creation often reinforced the need for an empirical approach to the study of creation.¹⁰

The link between God’s freedom in creation and natural philosophical inquiry is neither a necessary nor an inexorable one, and is illustrated in 17th century debates about laws of nature.¹¹ For example, if one believed that God created out of necessity, one tended to think that natural laws were discoverable by reason alone (e.g., Spinoza), whereas if one believed God was free to create any world He chose, one tended to think that natural laws were discoverable empirically (e.g., Bayle).¹² The view among many if not most natural philosophers of 17th century was that God as sovereign Creator could freely make any creation He saw fit.

One implication of divine freedom in *ex nihilo* creation, the Creator/creature distinction and the ontological homogeneity of creation was that the creation has *contingent rationality*. The sense of contingency, here, is twofold. First, creation is contingent in that it utterly depends upon God for its very existence (a creation out of nothing tends to fall back into nothing). Second, creation is contingent in that God could have made a wide variety of possible creations. In freedom and love He chose one in particular. Philoponus rightly saw that the contingency of creation implies that we have to investigate it to discover what kind of nature God had given to creation. Moreover, we can have confidence in such investigations because the rationality of God’s created order is intelligible (hence the biblical view is that creation’s nature is revelatory of

itself). By and large 17th century natural philosophers followed this line of thought emphasizing that empirical means were best suited to discovering the nature of creation (Cartesian natural philosophers being an important exception).

Two Books Metaphor

The two books metaphor—creation is a book revealing God as is Scripture—also has a long history going back at least as far as Origen of Alexandria. Although theologians tended to view the book of nature as a source of general revelation about God, natural philosophers tended to argue that the book of nature also revealed the workings of creation.¹³ Galileo is one of the most well known proponents of this view. He argued that the book of nature was written in the language of mathematics and revealed the nature of creation.¹⁴ Galileo gave voice to the growing application of mathematics to all areas of natural philosophy of the 16th and 17th centuries: To properly read or understand creation's processes, laws, and so forth, requires quantifying them so as to understand their created natures given by God as accurately as possible. Kepler, in letters to J.G. Herwart von Hohenburg,, March 26, 1598, put it like this:

as we astronomers are priests of the highest God in regard to the book of nature, we are bound to think of the praise of God and not of the glory of our own capacities...Those laws are within the grasp of the human mind; God wanted us to recognize them by creating us after his own image so that we could share in his own thoughts.¹⁵

Kepler believed that the language of mathematics was crucial to “thinking God’s thoughts” about the nature of creation, and took seriously the role of astronomers as priests articulating God’s book of nature.¹⁶

The Fall and Knowledge

Along with the infusion of new knowledge of mathematics and natural philosophy from the translation of Islamic texts, the ancient struggles with skepticism were rediscovered through either translation of Islamic texts or the discovery of long forgotten texts in monasteries. Space does not permit exploring how the renewal of that struggle in Renaissance thought contributed to the effort to develop a mitigated or constructive skepticism leading to a 17th-century epistemology of experiment.¹⁷ However, one important theological strand in this story is the explicit linkage of error and cognitive limitations, as sources of skepticism, with sin and the Fall.

As Peter Harrison argues, many 17th-century discussions of error and limitations on human reason were deeply colored by a biblical understanding of sin and the Augustinian conception of the Fall.¹⁸ Although there was disagreement on how thoroughly the Fall affected the mind and its capacities for knowledge, there was general agreement that instruments and/or procedures had to be developed to overcome the epistemic consequences of the Fall to the degree possible.¹⁹ One of the goals of these mitigation attempts was to restore as much as possible of the human capacities to know the nature of creation genuinely. This epistemological project was daunting, however. Although there was theological grounding in the DoC for thinking creation was orderly and intelligible, coming to understand creation’s nature was generally considered to be a difficult and arduous task. Natural philosophers of the 17th century knew that creation did not yield her secrets easily and was not fully knowable or understandable to finite minds. Still, the epistemic goal was to understand the nature of God’s creation—the laws, parts, properties and processes—to the fullest extent humanly possible. The birth of modern science—its experimental and mathematical methods—was not a byproduct of a renewed confidence in reason, as we are often told, but a healthy appraisal of the deficiencies and limitations of human

capacities for knowing.²⁰

Pulling the Strands Together

The DoC's emphasis on *ex nihilo* creation and ontological homogeneity, the impact of divine freedom in creation, the idea that creation could be read as a book, and the skeptical attitude towards human capacities to know—along with other strands I have not mentioned—fed into the same conclusion: To understand creation requires taking the nature of created things on their own terms. Hence, methods and approaches to knowing had to be constructed that enabled natural philosophers to be in the best position to discover and explore the objects and phenomena of creation. To put the point in terms popular in the 17th century, natural philosophers realized that they needed modes of inquiry that could focus on making the nature of the secondary causes through which God worked in creation known. This was not a set of tasks that could be carried out by reading the book of Scripture, but by learning how to read the book of nature accurately.

This focus on secondary causes rather than the Bible—what we would recognize as MN—was for 17th century natural philosophers the guiding focus for studying created natures on their own terms to understand them as accurately as possible. In other words for these natural philosophers, MN was a commitment to particular methods of inquiry *for a particular limited purpose*: To understand the nature of the matter, forces and laws that God had made. Many of the scientific revolutionaries thought that to fulfill this purpose required a quantifiable, empirical approach to studying nature in contrast to a purely rationalistic approach or one that tried to read the nature of creation out of the Bible. However, 17th century natural philosophers—whether empiricists or not—were united in their conviction that the ultimate goal was understanding what kind of creation God had made and how God was at work in and through creation. Focusing on so-called natural causes for them in no way implied that God was absent from creation nor even that God was somehow excluded from explanations of how creation worked.

As Spradley (this issue) has traced, this “naturalistic” focus has been part and parcel of natural philosophy from ancient times. For Christians engaged in natural philosophy during the Medieval and into the early modern period, the commitment of many to MN is articulated well in David Lindberg's summary of Albert Magnus. In the 13th century, Magnus proposed distinguishing

between philosophy and theology on methodological grounds and to find out what philosophy alone, without any help from theology, could demonstrate about reality. Moreover, Albert did nothing to diminish or conceal the “naturalistic” tendencies of the Aristotelian tradition. He acknowledged (with every other medieval thinker) that God is ultimately the cause of everything, but he argued that God customarily works through natural causes and that the natural philosopher's obligation was to take the latter to their limit...Albert pointed out that God employs natural causes to accomplish his purposes; and the philosopher's task is not to investigate the causes of God's will, but to inquire into the natural causes by which God's will produces its effect. To introduce divine causality into a philosophical discussion...would be a violation of the proper boundaries between philosophy and theology.²¹

Examples from the Scientific Revolution

Tycho Brahe, Johann Kepler, Galileo Galilee, Robert Boyle, and Isaac Newton are just some of the names associated with the Scientific Revolution.²² Here, I will focus on Boyle and Newton as practitioners of MN in the spirit of Magnus.

Boyle

Much recent scholarship clearly demonstrates that theological motivations lay behind Boyle's approach to natural philosophy and informed his approach to studying creation.²³ While he believed God could intervene in the natural course of things, Boyle thought the task of natural philosophy was to study and understand creation on its own terms. As he puts it in *The Christian Virtuoso*, "For [natural philosophers] consult experience both frequently and heedfully; and...they are careful to *conform their opinions to it*; or if there be just causes, *reform their opinions by it*."²⁴ This is one of many places where he makes clear natural philosophy's task is to explain phenomena of creation in terms of natural processes.

For Boyle, then,

Nature is a 'book' written by an omniscient and omniscient author...One cannot reason on purely a priori grounds about such a divinely created product, because God's reason and power extend far beyond human faculties. Rather, one must look at nature—read the text—in order to determine what was actually done. The world is like a text. It is a coherent, albeit extremely complex, whole. To understand any part of the great cosmic mechanism, the relations that hold between that part and the rest of the whole have to be known...For Boyle, the experimental method was a means by which one could 'interpret' the book of nature...the experimental philosophy was designed as a method of interpretation.²⁵

Boyle believed that God's two books were distinct, though related: "He was opposed to any 'unwholesome mixture' of the two disciplines [study of Scripture, study of nature]. The two books could be used to shed light on each other, but care was required so as not to confound them."²⁶ In the book of nature was to be found detailed knowledge of the creatures mentioned in the Bible. The DoC, drawn from special revelation, could teach us that all the details of nature have a purpose in God's plan and that explanatory frameworks such as atomism cannot be understood atheistically on pain of adopting an incoherent foundation. Boyle defended the idea that biblical studies were superior to natural theology for learning about God and His activity.²⁷ In contrast, the study of creation was superior to biblical studies for learning about the particulars of creatures and natural principles.²⁸

Boyle thought the process of coming to understand creation was very similar to that of coming to understand a text. "The goal of understanding nature, as God's production,...[required] the same type of hermeneutic principles that were employed for an actual text, as constraints upon the theories that we construct for the 'explanations' of nature's processes...Boyle's choice of method was guided by his ontological view of nature as a divine text."²⁹ Hence, Boyle's experimental approach to inquiry was a means for gathering as much information as possible about creation's processes to enable the construction of "the most coherent interpretation of how the particulars of nature are connected into one grand cosmic mechanism."³⁰

With respect to MN, then, Boyle argued that it was illegitimate to explain the operations of natural phenomena in terms of the actions of spiritual beings because such explanations gave us no insight into the physical nature of the phenomena and the principles by which they operated.³¹ Without denying God was the creator, sustainer and governor of the entirety of creation, Boyle sought to study and understand natural phenomena without “intermeddling with supernatural mysteries.”³² It was inappropriate to invoke God or other spiritual entities in the explanations of the detailed workings of creation *if the task was to understand those workings on their own terms*. For Boyle, rational and practical engagement with creation was the only means for us to increase our knowledge of the phenomena of creation on their own terms.³³

Ultimately, for Boyle, the better we understood things of nature on their own terms, the better positioned we are to think theologically about creation and see God’s purposes in these things. Boyle’s “epistemological conception of the progressive nature of knowledge entailed the belief that it could only be achieved through a complex process of interpretation and the reconciliation of truths from all areas of learning.”³⁴ His pattern for relating natural philosophy to biblical knowledge and theology was to treat these domains as distinct but related, working out the nature of matter and secondary causes, then turning to think biblically and theologically about those discoveries.³⁵

Of course Boyle was not working in a vacuum, but following a well-established tradition. For example, Tycho Brahe had articulated a multi-pronged approach to understanding the cosmos that involved mathematical astronomy, natural philosophy and biblical/theological study as three distinct fields of knowledge that had a complex set of overlaps.³⁶ However, it was Kepler who combined a resolute commitment to discovering the truth about the universe as God made it with a view of mathematical astronomy as having a genuine correspondence with the causes of the motions of the planets. He also distinguished the disciplines of theology from natural philosophy and astronomy. For instance, in his *Astronomia Nova* Kepler writes that “while in theology it is authority that carries the most weight, in philosophy it is reason.”³⁷ It was not uncommon in 16th and 17th century Europe for theology and natural philosophy to be treated as distinct domains of knowledge—having some partial overlap—that drew on distinct methods. But it was Kepler who brings realism into theorizing the nature of the heavens (e.g., hypotheses about planetary motion should involve genuine causes of that motion rather than merely being mathematical constructs that accurately reproduce observations). In this way, Kepler saw himself as an “exegete of the Book of Nature.”³⁸

Newton

One of Newton’s great contributions to natural philosophy was to marry mathematical modeling and experimental observations in a form we are roughly used to seeing in contemporary physical science. He used thought experiments involving simplifications and idealizations of realistic situations; developed mathematical models for these idealized situations; applied idealized models to real situations comparing results with observations; and systematically refined the simplifications and idealizations until the models achieved experimental agreement. In this way he was able to work out the mathematical form of gravity and other forces.³⁹

Newton’s methodology was an attempt to understand forces on their own terms, i.e., as secondary causes through which God works in creation, with the ultimate aim being to “know by natural philosophy what is the first Cause.”⁴⁰ Newton, though doubting that Christ was co-

eternal and equal to the Father, nevertheless viewed Jesus as a key mediator through whom creation was made.⁴¹ Christ served a vice-regent role as not only the creator of all things but also overseeing and directing the forces causing the motion of material bodies while God the Father worked through gravity as an expression of His omnipresence.⁴²

Hence, for Newton MN in the form of experiment and mathematical modeling is in service of revealing God's wisdom and glory in creation, through demonstrating its uniformity and intelligibility, rather than expunging God from natural philosophy. Similar to Magnus and Boyle, Newton recognized, "That religion & Philosophy are to be preserved distinct. We are not to introduce divine revelations into Philosophy, nor philosophical opinions into religion."⁴³ Hence, he also endorsed MN as the appropriate way to study the secondary causes of creation. For instance, in a letter to Richard Bentley, Newton maintained that if God chose to produce gravity mechanically, then a mechanical cause should be sought. However, if God chose some other means the phenomenon of gravity was still genuine and law-like. "Gravity must be caused by an agent acting constantly according to certain laws, but whether this agent be material or immaterial is a question I have left to the consideration of my readers" of the *Principia*.⁴⁴ In other words, gravity has God as its primary cause even if Newton was unable to discover the nature of its secondary cause.

God caused gravitational attraction by his omnipresent activity according to principles that he had established, called by Newton "active principles" or "laws of motion."

Working in accord with these principles, God animated nature, providing life to a world of dead matter.⁴⁵

Although the idea that God's activity in creation was always mediated was steadily declining in the 17th century⁴⁶, Newton seems to have continued maintaining that God accomplishes His purposes in creation through means. Newton's universe was far from the clockwork machine with God as a distant supervisor.⁴⁷

Furthermore, as with Magnus, Kepler and Boyle, Newton viewed biblical studies, theology and natural philosophy as distinct enterprises, yet as interacting fields of knowledge relating to one another under the broader domain of theology.⁴⁸

The Turn to Metaphysical Naturalism

If the scientific revolutionaries were theists who deployed MN in the service of discovering the nature of God's creation, what happened in the intervening centuries such that science and its methodologies now are routinely disassociated from God? I will start by briefly tracing four trends in the transformation of religion in the 18th century that set much of the scene for this dissociation. While many parishioners in the pew may not have gone very far in the direction of these trends, many natural philosophers, theologians, pastors and writers of the 18th century did.

1. Even in the 17th century, the rich biblical picture of divine action in creation as mediated—taking place through or being shaped by divine command, Jesus and the Spirit, and ministerially through creation itself—had largely been reduced to just mediation through divine command. Increasingly, laws of nature became the key mediators of everything that happened in creation. Although Newton managed to maintain a richer sense of divine mediated action in creation, the

generation of Newtonians after him did not.⁴⁹

2. Following Augustine Medieval philosophy and theology stressed God's will and power in creation. As a consequence, God's ultimate relationship to creation as one of covenantal love often fell out of the grasp of Western thinkers. Hence, voluntarism usually sounded notes about God's will in creation being arbitrary. Under the growing conception of creation as a machine designed by a Master Engineer, by early in 18th century the very idea of God arbitrarily and unpredictably intervening in creation became psychologically jarring to the majority of theists.⁵⁰ A mechanical picture of creation absent a rich DoC seemed to imply deism, but there was psychological pressure in this direction, too. Deism sprang to full flower in the 18th century with the laws of nature mediating all that happened in creation and secondary causes as mechanical vice-regent (instead of Jesus in this role as Newton had emphasized). The culmination of this line of development was *providential deism*, the idea that "God's beneficence" consisted solely "in constructing the world so that it conduced to good."⁵¹ The Master Engineer was so gracious and wise that from its beginning creation had been given all the resources it needed to achieve the good God had set for it. No interventions in the natural order were needed. Providential deism of the 18th century did have one crucial advantage over older understandings of providence with respect to the temper of the times: Instead of invoking mysterious actions of God in creation, everything was accomplished through natural laws and processes, which were accessible to reason and observation.

3. Natural theology underwent a shift in the 17th century that had significant influence in the 18th (though this is not to say that all natural theology fell into this one pattern). Whereas Newton still maintained that God's existence, wisdom and power were best demonstrated by the total order exhibited by the system of the world, most theists followed the lead of Boyle and John Ray's *The Wisdom of God Manifested in the Works of the Creation* (1691) in looking to particular features of creation (e.g., organs such as the eye and hand, and organisms exquisitely suited to their environments) for evidence of God's existence, wisdom and power.⁵² Early in the 18th century every area of natural philosophy was marshaled for natural theology. By the end of the 18th century, most natural philosophers and theists admitted that the details of astronomy, physics, chemistry and geology were ambiguous at best regarding evidence for a Deity other than the natural laws which still pointed to a wise Creator.⁵³ Only what would become biology—the study of organisms and their relations to their environments—was generally acknowledge to be replete with exquisite examples of the Master Engineer's hand.

4. Closely related to this shift in natural theology was a shift in the appraisal of or relationship between reason and revelation. Already by the mid 17th century, the Socinians had elevated human reason to a high role in faith and biblical interpretation. As the 17th century progressed, both theologians and natural philosophers had a tendency to promote natural revelation—God's book of nature—to being on par with the Bible. As belief was being transformed into rationally verified propositions—a transformation begun in the 16th century and completed in the 18th⁵⁴—the Bible and faith were being torn in two directions: intellectual assent based on demonstrated propositions vs. arational trust and love. In the 18th century, "Deism professed to be a religion founded on reason alone, composed solely of truths about God evident in the order of nature, subjecting all beliefs to the test of reason and experience." For some theists early in the 18th century, Scripture became optional because they believed that whatever revealed truths there were in the Bible could be ascertained from reason and experience alone. It did not take long for

a number of theists to conclude that the Bible was suspicious because reason and experience could not demonstrate many things found in Scripture such as the Trinity, the incarnation and resurrection, and miracles. Whether because the Bible was viewed as redundant or suspicious, as the 18th century rolled on, a large number of theists discarded Scripture and formulated their beliefs about God based solely on reason and experience. Human reason had been elevated above revelation for many theists. Still, deism “rested squarely on the rational necessity of God,” a conviction that even Voltaire could not rationally deny.”⁵⁵

Despite all these religious changes, at the end of the 18th century, MN was still the rule of the day among natural philosophers, still the appropriate way to understand the nature of God's creation even if for most of them God was a distant spectator. A sharp distinction was maintained between theological proofs for God based on science and scientific conclusions about the nature of creation. The latter were “held to be strictly confined to the naturalistic subject matter of the individual science.” And so things continued well into the 19th century. Yet, what a difference from the 17th! By the 1830s, “Scientists with the large exception of biologists, needed God now only as a First Cause, the Author of natural laws. The laws themselves explained what actually happened.”⁵⁶ Rationalism in religion ran strong and not only among natural philosophers and scientists.

“The great wave of rationalizing that had gathered theological force since Newton's day found ardent disciples among nineteenth-century churchmen. The most striking religious minds of the century—such as Schleiermacher in Germany, Coleridge in England, Emerson in America—distinguished themselves by swimming against this tide. But more representative theologians dove into quasi-scientific natural theology with a zeal that would have done credit to any Enlightenment rationalizer.”⁵⁷

Trends dating back to before the early modern period are key to understanding the significant shift represented in the 19th-century narrowing of all forms of knowledge down to one. This complicated set of mutually shaping and reinforcing intellectual trends involved the rise of ever narrowing models of rationality and knowledge, the drive for quantification, capitalism, bureaucratization, secularization, changes in the conception of persons (e.g., individualism) and society, and the stunning successes of the natural sciences.⁵⁸ By mid-19th century, to count as knowledge was to be a concrete proposition about tangible reality that is demonstrable via logic or experience. This was the positivist ideal of knowledge where the exemplars were (1) tangible facts, material objects, demonstrable truths, laws and principles, (2) exact in the sense of logically or mathematically precise, and (3) verifiable through logic, observation and experiment. This ideal held for all knowledge (e.g., scientific, mercantile as well as theological). The religious implications of this model of knowledge were disastrous. First, faith was now viewed as an altogether different category from knowledge and truth. Second, God was treated as an object of natural knowledge in parallel with balance sheets and chemical compounds.⁵⁹ Clergy in the 19th century were at least as much to blame—if not the scientists for religious knowledge being reduced to this ideal.⁶⁰

By 1859 the intellectual space making agnosticism and atheism sustainable ways of life was fully constructed just in time for the publication of Darwin's *The Origin of Species*.⁶¹ In 1869 Thomas Huxley coined the term agnosticism to describe “a permanent suspension of belief in God. This settled inability to accept the reality of God, rather than positive atheism, became the

distinctively modern unbelief.”⁶² The intellectual trends surveyed so far continued their development leading to the importation of metaphysical naturalism into science. Against this backdrop, some key developments were:

1. To those theists who had built their natural theology on reason and experience alone, the publication of *The Origin* in 1859 delivered a psychological blow to the argument for design. Darwin was able to offer an account of how organs and species might become well-suited to their environments through evolutionary mechanisms such as natural selection.⁶³ Biology had been one of the last scientific domains which seemed to offer direct evidence of God’s creative activity in nature and to many people Darwin appeared to have knocked that line of evidence out. Explanations for organs and organisms in terms of natural processes seemed much more credible to many. The possible exception was the origin of life itself where God might still be necessary. But God’s role as First Cause “dissipated into mist. Most scientists, qua scientists, simply stopped talking about such metaphysical questions. Many of the amateurs of science, taking their cue from Herbert Spencer, solemnly if vaguely invoked Force as the primal creative power inherent in the universe” leaving the idea of a purposive Creator aside. “Those who invoked Force as a creative power believed themselves to be speaking science. That they were, for the most part, speaking hokum only underlines again the enormous appeal of scientific explanations.”⁶⁴

2. Darwin’s emphasis on natural processes for scientific explanations followed a pattern already set in explicit discussions of scientific methodology in the first half of the 19th century (e.g., Herschel and Lyell).⁶⁵ These 19th-century discussions—conducted by Christians and other theists—are continuous with the methodological traditions of the 17th century (and even earlier as in Magnus). Darwin’s constant complaint about appeals to divine creation of species was that they are not scientific explanations because they did not tell us how secondary causes were involved in the natural history of organisms (his explanatory complaints have nothing to do with questions about God’s existence). Even in the aftermath of Darwin’s publications, Congregational minister and geologist George Fredrick Wright defended MN on Christian grounds in an 1876 issue of *Bibliotheca Sacra*

It is not in accordance with what we specially value in the modern habits of thought, to cut the Gordian knot with the simple assertion, “so God has made it,”...Such a course would be suicidal to all scientific thought, and would endanger the rational foundation upon which our proof of revelation rests. It is superstition and not reverence, which leads us to avoid the questions concerning the order and mode of the divine operations...We are to press on known secondary causes as far as they will go in explanation of facts. We are not to resort to an unknown cause for explanation of phenomena until the power of known causes has been exhausted. If we cease to observe this rule there is an end to all science and of all sound sense.⁶⁶

Wright goes on to invoke Newton’s example of forces as the scientific explanation for God’s activity in the heavens. Hence, many Christians still viewed science as revealing God’s laws in creation, whereas many theists and all agnostics and atheists viewed science as silent on God.⁶⁷ In the last third of the 19th century, some who adopted the latter view veered into scientism—the philosophy that only scientific methods deliver knowledge and only scientific knowledge counts. This camp was composed of some scientists who were bent on undermining

and marginalizing the Anglican church in England, and several nonscientists who were completely enchanted by science but hardly understood what it was.⁶⁸ Scientism was the logical endpoint of the overly narrowed model of knowledge described above. Unfortunately, this minority late 19th-century view became quite influential seeping into all manner of intellectual cracks and crevasses in contemporary culture.⁶⁹

3. In the wake of *The Origin*, anthropological explanations for the origin and development of religion gained much greater plausibility in intellectual circles. In 1873, Robert Ingersoll summarized the trend of these anthropological explanations, “Every new religion has a little less superstition than the old, so that the religion of science is but a question of time.”⁷⁰ If God and religion could be accounted for by natural sociological developments, so the thinking went, supernatural explanations were superfluous and dubious.

4. The uniqueness of human beings as being distinct from the rest of the animals became highly questionable in the second half of the 19th century. It is in special revelation where we are told that humans are made in God’s image, and that image was interpreted over the centuries as various forms of distinctness from the rest of creation. Yet by this period “biblical evidence” held no sway over many thinkers. Instead, under the reigning model for knowledge, human distinctiveness had to be “scientifically discernible.” Since 19th-century developments in neurophysiology were progressively demonstrating that human consciousness and cognition were crucially linked to our brains and that our brains were very similar to those of the great apes, evidence for human distinctiveness appeared to be lacking. Humanity was becoming more naturalized in the minds of many, while our ability to know supernatural things such as God, immortality and the soul appeared outside the reach of knowledge. Ingersoll articulated the sense of the age for many thinkers: “Beyond nature man cannot go even in thought—above nature he cannot rise—below nature he cannot fall.”⁷¹

All of the preceding trends developed within a DoC so atrophied that a pernicious false dilemma was solidly in place by the end of the 18th century:

Events in creation either happen due to God’s unmediated intervention or due to natural processes without any divine influence whatsoever.⁷²

Outside of Christian circles, few thinkers believed that natural processes were God’s ordinary ways of working in creation (even many Christians fell sway to viewing God as absent from natural processes). So the second branch of the false dilemma pictured the world of distant deism, completely cut off from God. It is not surprising, then, that between widespread rising skepticism about whether knowledge of God was possible and widespread focus on natural processes, 19th-century science largely dispensed with invoking God in its explanations. Metaphysical naturalism—the philosophical belief that material reality was the only reality there was—was fast becoming the norm in educated circles (save largely for Christian thinkers). Turner summarizes the 1860s-1880s this way: “Although many scientists clung to the faith that their work pointed to God, God no longer formed a necessary part of the scientific understanding of reality.”⁷³

The rise of metaphysical naturalism was complete by the 1880s. What was called natural philosophy through the 1850s still shared many metaphysical interests that were inviting

towards theism. But the new post-1850s discipline known as “science” had a much narrower non-metaphysical focus:

a narrowing of the range of valid scientific knowledge so as to exclude all inferences about supposed nonphysical realities. The older idea of [natural philosophy], prevalent through the early decades of the [19th] century, envisioned a spacious and rather laxly policed territory of [natural philosophic] knowledge. [Natural philosophy] meant something like “orderly and methodically digested and arranged” knowledge of nature. No fortified frontiers prevented [natural philosophy] from exploring metaphysical as well as physical questions about the natural world [witness Boyle and Newton]...In effect, science by fiat redefined its meaning of “natural” so as to preclude the traditional necessity of a supernatural on which nature depended. It did this defacto, not by denying the supernatural, but by refusing to consider as within the bounds of scientific knowledge anything but the physical. This was at root why scientific laws had to be reconceived as merely observed regularities rather than manifestations of divine will...The prodigious American physicist Joseph Henry defined as essential to a “scientific truth” its enabling “us to explain, to predict, and in some cases to control the phenomena of nature.” But what could be accurately predicted was inherently limited to what could be carefully and precisely observed; that is, to physical reality. Thus, this predictive drive demanded ever more rigorous verification by physical evidence of scientific hypotheses. *Hypotheses projected beyond human experience of the natural world—even if formed by it—are worthless...because we have no way of testing them. The very purpose of modern science forced it gradually but inexorably to narrow its focus to physical reality alone.*⁷⁴

Most American scientists in this period were Christians or at least theists, though they perhaps did not notice how metaphysical naturalism came to replace MN in scientific practice for so many of their non-Christian colleagues.⁷⁵

Conclusions

Historically, metaphysical naturalism arises much later than MN, coming to flower in the latter half of the 19th century.⁷⁶ Hence, metaphysical naturalism is not a necessary presupposition for MN. While it is tempting to see the rise of metaphysical naturalism as the ontologizing of methodological naturalism—and there is some truth to this diagnosis—metaphysical naturalism is not explainable without a host of other mutually reinforcing intellectual trends indicated above.⁷⁷ Review XV, no. 4 (1986): 389

Moreover, as the DoC slowly atrophied over the course of the 17th century while taking a nosedive in the 18th century, natural philosophic explanations—what we would now call scientific explanations—gradually began to be viewed as replacements for God’s active involvement in creation rather than being viewed as possible explanations for *how* God worked in creation (hence the false dilemma regarding understanding how events in nature happen mentioned above).

Methodological naturalism presupposes no such competition with or replacement of God’s working in creation. In the 17th century context, MN functioned as an injunction to understand nature on its own terms implying natural philosophers did not invoke God’s unmediated action in creation to explain events and patterns in creation. The ultimate purpose of MN was to glorify

God through understanding secondary causes much in the spirit of Magnus.⁷⁸

Unfortunately, since the end of the 19th century, MN has often been confused with metaphysical naturalism. For instance, Brad Gregory describes MN as “the methodological postulate of metaphysical naturalism, which entails that for science to be science, by definition it can pursue, identify, and entertain only natural causes as plausible explanations of natural phenomena, with the universe as a whole regarded as if it were a closed system of natural causes.” And Bruce Gordon says that MN “maintains that for the purposes of science one cannot appeal to transcendent causes, and therefore scientific research must be pursued as if metaphysical naturalism were true.”⁷⁹ Since MN has nothing to do with metaphysical naturalism, to formulate MN in terms of such naturalism betrays a serious lack of historical understanding of the concept as well as a lack of clear thinking about the distinction between methodological and metaphysical naturalisms.

It is also important to note an insidious side effect flowing out of the 17th century emphasis on God’s rule of creation through laws for thinking about creation: While God as ruler through laws came to central stage in books and pamphlets written by natural philosophers, God as redeemer receded into the shadows. This theological shift in emphasis corresponds to a focus on God’s will, wisdom and power in relation to creation at the expense of His covenantal love for creation and plan of salvation. Although often ignored in historical accounts, this theological shift was an important strand contributing to the 18th century idea that a perfectly wise Creator would make a creation that requires no divine interventions whatsoever. The intuition was that it would be demeaning to the grandeur of a Creator if He had to do anything in creation after its origin (an intuition that is alive and well in contemporary atheist writings such as Dawkins’ *The God Delusion*). This intuition was crucial to the rise of providential deism in the 18th century which in turn accelerated the separation of natural philosophy from faith/theology.

Nevertheless, natural philosophers involved in the Scientific Revolution uniformly believed that their efforts to understand the universe were efforts aimed at understanding God’s creation—understanding the characteristics of things *He had made*. The pursuit of observational, experimental and mathematical methods of investigation as means of understanding the nature of God’s creation that were distinct from theological means was fully justified in their minds by their commitment to (some robust version of) the DoC—nature was a creation of God. As such, they saw MN was the appropriate theistic stance to take towards the study of nature.

References

1. Some, such as Bruce Gordon (this volume), question the applicability or projectability of MN as a characterization of scientific work prior to the late 19th century because they see its contemporary usage as inextricably intertwined with metaphysical naturalism.
2. As Colin Gunton points out, “[T]here could be no doctrine of creation without the setting in which it was hammered out.” *The Triune Creation: A Historical and Systematic Study* (Grand Rapids: Eerdmans, 1998)
3. For example, in his unfinished *Literal Commentary of Genesis*, Augustine noted that the “plain reading” of Genesis 1:1-2 was that God began His work of creation with (probably eternally) pre-existent matter (a reading of Genesis 1:1-2 that his Manichean opponents favored).

In contrast, Augustine argued that these verses pointed to the deeper meaning that God had created *ex nihilo* because we know from the New Testament that God is the author and founder of all things and this implies that matter has a beginning in God (hence, cannot pre-exist God's founding creative acts). So Genesis 1:1-2 must mean—contrary to the “plain sense”—that God initially created matter.

4. For a fuller treatment of the DoC, see Gunton, *The Triune Creator*, and Robert C. Bishop, “Recovering the Doctrine of Creation: A Theological View of Science,”

<http://biologos.org/projects/scholar-essays>, (31 January 2011).

5. Gunton, *The Triune Creator*, 72.

6. Harold Nebelsick, *The Renaissance, the Reformation and the Rise of Science* (Edinburgh: T & T Clark, 1992), 13.

7. Joseph L. Spradley, *Visions that Shaped the Universe: A History of Scientific Ideas about the Universe*. (New York: McGraw-Hill, 1994), 51-56.

8. Nebelsick, *The Renaissance*; Spradley, *Visions*; Gunton, *The Triune Creator*.

9. Gunton, *The Triune Creator*.

10. R. Hooykaas, “The Rise of Modern Science: When and Why?,” *The British Journal for the History of Science* 20 (1987): 453-473; T. E. Huff, *The Rise of Early Modern Science: Islam, China and the West* (Cambridge: Cambridge University Press, 1993), 104-106, 179-189, 339-342; Edward Grant, *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional and Intellectual Contexts* (Cambridge: Cambridge University Press, 1996), chs. 5-8; Gunton, *The Triune Creator*, 106-107; Edward B. Davis, “Christianity and Early Modern Science: The Foster Thesis Reconsidered,” in *Evangelicals and Science in Historical Perspective*, ed. David N. Livingstone et al. (New York: Oxford University Press, 1999); David D. Lindberg, *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, Prehistory to AD 1450*, 2nd rev. ed. (Chicago: University of Chicago Press, 2007), 233-253, ch. 12.

11. J. R. Milton, “Laws of Nature,” in *The Cambridge History of Seventeenth-Century Philosophy*, ed. D. Garber and M. Ayers (Cambridge: Cambridge University Press, 1998), 680-701.

12. There is a further distinction among natural philosophers regarding divine freedom. If one believed that God's freedom in creation was exercised in service of reasons accessible to human minds, then one tended to think that reason alone could arrive at the true laws of nature (e.g., Descartes).

13. Kenneth J. Howell, *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science* (Notre Dame: University of Notre Dame Press, 2002); Klaas van Berkel and Arjo Vanderjagt eds., *The Book of Nature in Early Modern and Modern History* (Leuven, Belgium: Peeters Publishers, 2006); M. VandenBerg, “What General Revelation Does [and Does Not] Tell Us,” *Perspectives on Science and Christian Faith* 62 (2010): 16-24.

14. For example, see Stillman Drake, *Discoveries and Opinions of Galileo* (New York: Anchor Books, 1957), 173-216.

15. C. Baumgardt, *Johannes Kepler: Life and Letters* (New York: Philosophical Library, 1951), 44, 50.

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16. For instance, see J. G. Holton, *Thematic origins of scientific thought: Kepler to Einstein*, Rev. ed. (Cambridge, MA: Harvard University Press 1988), 68-69. This momentum for mathematizing more and more of nature received its biggest impulse in the infusion of new mathematical learning and practice from the many Islamic texts that flowed back into Medieval and Renaissance Europe.
17. See R. Popkin, *The History of Skepticism from Erasmus to Spinoza*, (Berkeley: University of California Press, 1979), and *The History of Skepticism: From Savonarola to Bayle* (Oxford: Oxford University Press, 2003).
18. Peter Harrison, *The Fall of Man and the Foundations of Science*, (Cambridge: Cambridge University Press, 2007).
19. Descartes was something of an exception to these trends with respect to mitigating what he took to be the unreliability of sense experience.
20. Harrison, *Fall of Man*, As he sums it up, for many in the 17th century “The birth of modern experimental science was not attended with a new awareness of the powers and capacities of human reason, but rather the opposite—a consciousness of the manifold deficiencies of the intellect, of the misery of the human condition, and of the limited scope of scientific achievement” (258).
21. Lindberg, *Beginnings of Western Science*, 240-241.
22. The idea that there was a Scientific Revolution has come in for a great deal of criticism of late. For example, see Andrew Cunningham and Perry Williams, “De-Centering the ‘Big Picture’: ‘The Origins of Modern Science’ and the Modern Origins of Science,” *The British Journal for the History of Science*, 26, (1993): 407-432. Although there is reason to be cautious in using such a grand term, I think it still has merit for delineating an important period in the history of the development of modern science.
23. For instance, see Edward B. Davis and Michael Hunter eds., *Robert Boyle's A Free Enquiry into the Vulgarly Received Notion of Nature* (Cambridge: Cambridge University Press, 1996); Rose-Mary Sargent, *The Diffident Naturalist: Robert Boyle and the Philosophy of Experiment* (Chicago: University of Chicago Press, 1995); Jan W. Wojcik, *Robert Boyle and the Limits of Reason* (Cambridge: Cambridge University Press, 1997).
24. Robert Boyle, *The Works of the Honorable Robert Boyle*, ed. T. Birch (Hildersheim: Georg Olms, 1965 [1772]), vol 5, 513-14, emphasis added.
25. Sargent, *Diffident Naturalist*, 110-112.
26. *Ibid.*, 112.
27. Boyle, *Works*, vol 4, 7.
28. *Ibid.*, *Works*, vol 2, 19-20.
29. Sargent, *Diffident Naturalist*, 122.
30. *Ibid.*, 122.
31. Boyle, *Works* vol 4, 68, 78, and *Works* vol. 5, 165.
32. *Ibid.*, *Works* vol. 3, 7.
33. *Ibid.*, *Works* vol. 2, 61. Understanding phenomena on their own terms also means understanding them in context: “A body is not to be considered barely in itself, but as it is placed in, and is a portion of the universe” (*Works* vol. 3, 303). However, for Boyle MN did not extend

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- to the origin of matter, or living creatures; God created these immediately rather than mediated through natural processes (*Works* vol. 14, 157, Hunter-Davis edition).
34. Sargent, *Diffident Naturalist*, 115.
35. *Ibid.*, and Wojcik, *Robert Boyle*.
36. Howell, *God's Two Books*, ch. 3.
37. As quoted in *ibid.*, 120.
38. *Ibid.*, ch 4.
39. I. B. Cohen, *The Newtonian Revolution: With Illustrations of the Transformations of Scientific Ideas* (Cambridge: Cambridge University Press, 1980).
40. Isaac Newton, *The Correspondence of Isaac Newton*, vol. 3, ed. H. W. Turnbull (Cambridge: Cambridge University Press, 2008), 369; and Newton, *Optiks: or A Treatise of the Reflection, Refraction, Inflection & Colours of Light*, based on the 4th edn., eds. I. B. Cohen *et al.* (New York: Dover, 1979), 405. There is some ambiguity as to whether forces in Newton's view are physical or nonphysical—corporeal or noncorporeal in his terms. See, J. T. Dobbs, "Newton's Alchemy and His Theory of Matter," *Isis* 73 (1982): 511-528.
41. Isaac Newton, Keynes MS 3, fol. 12, King's College, Cambridge, <http://www.newtonproject.sussex.ac.uk/view/texts/normalized/THEM00003> (accessed 11 February 2012); and Isaac Newton, Yahuda MS 15, fols. 47v, 96v, Jewish National and University Library, Jerusalem, <http://www.newtonproject.sussex.ac.uk/view/texts/normalized/THEM00220> (accessed 11 February 2012).
42. Dobbs, "Newton's Alchemy," 526-528.
43. Isaac Newton, Keynes MS 6, fol. 1r, King's College, Cambridge, <http://www.newtonproject.sussex.ac.uk/view/texts/normalized/THEM00006> (accessed 11 February 2012).
44. Newton, Letter of 25 February 1693, *Correspondence*, vol. 3, 254.
45. G. B. Deason, "Reformation Theology and the Mechanistic Conception of Nature," in eds. David C. Lindberg and Ronald N. Numbers, *God & Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986), 167-191.
46. Gunton, *The Triune Creator*.
47. Dobbs, "Newton's Alchemy"; Davis, "Newton's Rejection."
48. Indeed, Newton believed this was the normal pattern in religion from ancient times forward: Theology, philosophy and astronomy were acknowledge to be distinct fields of study yet interacted to produce true knowledge with theology as the broadest, encompassing the others. See, Isaac Newton, Yahuda Ms. 41, fol. 4v, Jewish National and University Library, Jerusalem, <http://www.newtonproject.sussex.ac.uk/view/texts/normalized/THEM00077> (accessed 11 February 2012). In that belief he was surely right (Howell, *God's Two Books*).
49. Gunton, *The Triune Creator*; Bishop, *The Doctrine of Creation*; James Turner, *Without God, Without Creed: The Origins of Unbelief in America* (Baltimore: Johns Hopkins, 1985); Margaret Jacob, "Christianity and the Newtonian Worldview," in Lindberg and Numbers, *God & Nature*, 238-255.
50. Turner, *Without God*, ch. 2; Jacob, "Christianity and the Newtonian Worldview."

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51. Turner, *Without God*, 40.
52. Ibid.; J. H. Roberts, "Myth 18: That Darwin Destroyed Natural Theology," in ed. Ronald L. Numbers, *Galileo Goes to Jail and Other Myths about Science and Religion* (Cambridge, MA: Harvard University Press, 2009), 161-177. Although the argument from design appealing to the order and intelligibility of the world through laws made a comeback in the second half of the 19th century.
53. Turner, *Without God*, 55-57, 77; R. Hahn, "Laplace and the Mechanistic Universe," in Lindberg and Numbers, *God & Nature*, 264-271).
54. Turner, *Without God*.
55. Ibid., 51, 53.
56. Ibid., fn. 53, 283, 77.
57. Ibid., 96.
58. Ibid.; Charles Taylor, *A Secular Age* (Cambridge, MA: Belknap, 2007).
59. Turner, *Without God*, 132-140. Although we tend to associate these three features of knowledge with science, Turner points out that in the 19th century, "Empirical rationality fitted rather well the developing environment of commercial capitalism. A penchant for rational organization helped to bring success in an increasingly complicated and interwoven tangle of economic relationships. A sharp eye on specific concrete realities aided in taking advantage of rapidly changing markets" (132). In other words, the developing model of knowledge found reinforcement as much in merchant and commercial values as in science.
60. Ibid., chs. 3-4 and 6.
61. Hence, Richard Dawkins' oft repeated claim that Darwin made it possible to be an intellectually fulfilled atheist is historically inaccurate to say the least.
62. Ibid., 171.
63. Design arguments based on the overall order of nature were less disturbed (Roberts 2009).
64. Turner, *Without God*, 180.
65. Numbers, "Science without God: Natural Laws and Christian Beliefs," in Lindberg and Numbers, *When Science & Christianity Meet*, 277-279.
66. G. F. Wright, *Studies in Science and Religion* (Andover: Warren F. Draper 1882). Kepler said something very similar in 1606 in reference to explaining the origin of a newly discovered star: "However, we should consider all [other possibilities] before that of [special] creation as that is to end all discussion," *De Stella Nova*, Ch. 22, in Johannes Kepler, *Gesammelte Werke*, vol. 1, eds. Walther von Dyck and Max Caspar (Munich: C. H. Beck'sche Verlagsbuchhandlung, 1938), 257, ll. 23-4 (my translation).
67. Turner, *Without God*, 175-187; Numbers, "Science without God," 279-281; Matthew Stanley, "The Uniformity of Natural Laws in Victorian Britain: Naturalism, Theism, and Scientific Practice," *Zygon* 46, no. 3(2011): 537-560). Stanley points out Huxley's clever relabeling of theistic scientist's statements of MN as metaphysically naturalistic.
68. Turner, *Without God*, 189-202; Numbers, "Science without God," 281-282; Timothy Larsen, *Crisis of Doubt: Honest Faith in Nineteenth-Century England* (Oxford: Oxford University Press, 2009).
69. Ian Hutchinson, *Monopolizing Knowledge: A Scientist Refutes Religion-Denying, Reason-*

Destroying Scientism (Belmont, MA: Fias Publishing, 2011).

70.R. G. Ingersoll, *The Works of Robert G. Ingersoll*, vol.1, ed. R. Green (New York: Dresden Publishing Co., 1909),192.

71.Ibid, 27.

72.This false dilemma is still pervasive in the science-religion literature.

73. Turner, *Without God*, 180-182. The quotation is from pp. 181-182).

74.Ibid, 184-186, emphasis added.

75.Cunningham and Williams (1993) make the argument that modern science in a substantial sense began with this secularizing of science connected with replacing the term ‘natural philosophy’ with ‘science’ as we now understand the latter term.

76.“[S]cience by fiat redefined its meaning of ‘natural’ so as to preclude the traditional necessity of a supernatural on which nature depended...by refusing to consider as within the bounds of scientific knowledge anything but the physical,” ibid, 185-186.

77.Nor is the rise of metaphysical naturalism explainable apart from a host of moral commitments and ethical ideals (e.g., ibid, especially ch. 7;Taylor, *Secular Age*).

78.There are parallels in biblical interpretation from the Reformation. For instance, Luther recognized that the Moon’s light, say, could be described as a sign of divine providence while at the same time it was described by astronomers as a reflection of the Sun’s light. Similarly, Calvin taught that Moses and other biblical authors described heavenly phenomena as they appeared to observers in their day while astronomers would give technical descriptions for purposes that differed from those of Moses. As Gary Deason summarizes, “Recognizing the accommodation of the text to the general reader, the interpreter could avoid conflict with contemporary astronomy by claiming that the biblical author described the heavens as they appeared to the unlearned eye, not as they might be understood by the astronomer”

(“Reformation Theology,” 171). The astronomers’ descriptions are analogous to MN in that they did not replace religious descriptions, but served different purposes from the latter (c.f. Howell, *God’s Two Books*; Harrison, *Fall of Man*).

79. Brad S. Gregory, “No Room for God? History, Science, Metaphysics, and the Study of Religion,” *History and Theory* 47(2008): 495-519; Gordon, this issue.