The High Priest of Nature

Ben Kirschenbaum

History Honors Seminar, Georgetown University

Advisor: Kathryn Olesko

I grant permission for the publication of this thesis.
to

My Grandma, Esther, on whose shoulders I stand.
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At the beginning of the year, I knew that I wanted to write my senior thesis about the history of Western Science, but I did not know what specific subject to choose within such a broad category. So, following the suggestion of my advisor, I began my research in possibly the most obvious manner—I picked up a biography of Sir Isaac Newton. In his groundbreaking biography of Newton titled Never at Rest, science historian Richard Westfall illustrates Newton’s earliest experiments concerning light and colors:

As he became interested in light and vision, for which some forms of experimentation required no equipment beyond his own eyes, Newton plunged forward with little thought of the consequences. To test the power of fantasy, he looked at the sun with one eye until all pale bodies seen with it appeared red and dark ones blue. After “ye motion of ye sprits in my eye were almost decayed” so that things were beginning to appear normal, he closed his eye and “heightened [his] fantasie” of seeing the sun. Spots of various hues appeared to his eye, and when he opened it again pale bodies appeared red and dark ones blue as though he had been looking at the sun. He concluded that his fantasy was able to excite the spirits in his optic nerve quite as well as the sun. He also came close to ruining his eyes, and had to shut himself up in the dark for several days before he could rid himself of the fantasies of color. Newton left the sun alone after that but not his eyes. A year or so later when he was developing his theory of colors he slipped a bodkin “betwixt my eye & ye bone as neare to ye backside of my eye as I could” in order to alter the curvature of the retina and to observe the colored circles that appeared as he pressed. How did he fail to blind himself? In the grip of discovery, Newton did not pause to reckon the cost. (See Figure 1).\

I immediately reached two conclusions after reading these two brief anecdotes—1) Newton was insane 2) I had to write my thesis about him. As I began to read more on the thinker, the former declaration became less clear. Can we explain Newton’s willingness to sacrifice his eyesight by simply referencing the claim most often attributed to Aristotle that there was never a genius without a “tincture of madness” or should we attempt to dissect this “madness?”

When I started to read Newton’s religious and scientific writings, I realized that such extreme actions were manifestations of Newton’s faith—faith in the importance of his scientific mission and faith in a God who created and preserved the universe. Soon after the first

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1 Richard Westfall, Never at Rest (Cambridge; New York: Cambridge University Press, 1980), 94.
publication of his magnum opus, *The Principia*, in 1687 and up until the present day, Newton has become the quintessential symbol of secular rational thought. Enlightenment thinkers such as Voltaire glorified Newton’s ingenious discoveries and his stalwart dedication to a strictly mathematical and experimental mode of analysis. Often times, the figure of Newton came to symbolize an outlook of the universe that placed rational scientific discovery and method over Christian faith and belief in the Divine as the highest means towards truth. Newton’s discoveries, methods, and public image became the foundation of some of the strongest arguments against a Christian God.

The following pages underscore the irony of Newton’s ultimate legacy. Newton was not only a religious man who strongly believed in a Christian God, but he also pursued his science, the science that would ultimately be used against religious dogma, primarily for theological reasons. The great Newton historian Betty Jo Teeter Dobbs, whose work I am greatly indebted to in the construction of this thesis, writes, “There may be some historical value in evaluating Newton in a different way: not as one of history’s all-time winners, not as the First Mover of modern science, not as the Final Cause of the Scientific Revolution, but as one of history’s great losers, a loser in a titanic battle between the forces of religion and the forces of irreligion.”

My thesis explores the theological foundation of Newton’s scientific pursuits without directly addressing the “Newtonian legacy” following his death. However, when juxtaposed with the popular view of Newton and his works in later years, the following pages do indeed tell the story of “one of history’s great losers.” It is the story of a man who was willing to sacrifice his own eyesight defending a vision that he unintentionally helped to destroy.

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Figure 1

Newton’s description and sketch of his “bodkin” experiment. From: Westfall, Never at Rest, 95.
Acknowledgements

I wish to acknowledge several individuals who helped me greatly during this project. First and foremost I would like to thank my thesis advisor, Professor Kathryn Olesko for directing me towards such a fascinating subject matter and guiding me and my writing throughout this entire process; Professor Howard Spendelow for running an incredibly educational, efficient, and enjoyable albeit stressful Honors Seminar Class; all of my classmates in the Seminar, many of whom provided me with comprehensive and helpful feedback on my writing during both semesters.

I also want to acknowledge my high school physics teachers Dr. Jeffrey Weitz and Dr. Stephen Palfrey for patiently and energetically introducing me to the world of Newtonian mechanics; my high school religion teacher Mr. Pasquale Devito for teaching me that passionate pursuits towards spiritual truth can often be found in unexpected places; all of the remarkable twentieth and twenty-first century Newton historians who completely revolutionized the modern understanding of Newton and his times including Stephen Snobelen who coined the phrase “the high priest of nature”; the Georgetown History Department for providing me with such a unique and instructive opportunity; and finally my parents for their never-ending love, support, and of course, edits.
A Brief Biography of Newton

Before analyzing the various aspects of Newton’s works, it is essential to gain a firm although very abbreviated grasp on the facts of his life. Isaac Newton was born in the manor house of Woolsthorpe just south of Grantham in Lincolnshire on December 25, 1642. His father died before he was born, and he was raised at different times by his maternal grandmother and by his mother. In 1661, Newton attended Trinity College, Cambridge where he would for the most part remain first as a student and then as a Fellow until 1696. In that year, Newton moved to London to become Warden of the Royal Mint and then was appointed Master of the Mint in 1700. In the last few decades of his life, Newton received the highest honors bestowed upon an English scientist. He was elected President of the esteemed Royal Society in 1703 and became the only scientist other than Francis Bacon to be knighted in 1705. He died at the age of 84 in March of 1727.

Newton’s first major breakthroughs came in mathematics. In the second half of the 1660’s and into the 1670’s, he made stunning discoveries in almost every known branch of mathematics ranging from the study of power series and logarithms to geometry and classic number theory. He is best known in mathematics for his discovery of the “Calculus” generally dated during his unmatched anni mirabilis or “wonderful years” from 1664 to 1666. Building on the ideas of other influential mathematicians such as Isaac Barrow, René Descartes, and John Wallis to name only a few, Newton employed previously abstract concepts such as “infinitesimals” and “limits” to find methods for computing various properties of curves— e.g. the slope (derivative), the area underneath it (integral), and its highest and lowest points on a graph (maxima and minima respectively). Newton failed to publicize many of his most important mathematical discoveries,
but he still gained considerable recognition amongst his peers at Cambridge as a young man, and in 1669 he succeeded Isaac Barrow as the Lucasian Professor of Mathematics, a position he would hold until 1701.

In the late 1660’s and early 1670’s, Newton directed his attention towards the study of light and colors. Although Newton would publish many of his critical findings in this field years later, most notably with the first publication of *Opticks* in 1704, he disseminated his ideas to his contemporaries by delivering lectures on optics at Cambridge and through his correspondence with other natural philosophers decades before his seminal publication on light. He applied his optical findings in creating a reflecting telescope in the late 1660’s, which, once publicized in 1669, led to his election as a Fellow of the Royal Society in 1672. Newton posited that light was composed of infinitesimal building blocks or “corpuscles,” a concept of light, which he debated with many others, most heatedly with the English natural philosopher Robert Hooke. Through the study of light, Newton most clearly manifested his unparalleled abilities as an experimental philosopher. Through a series of ingenious experiments using prisms, which he detailed in both his early notebooks and in his later published works, Newton reasoned that white light is really a composition of every different color. “Rays” of light from one color refract off of a prism at different angles than the rays of another color producing a rainbow. Unlike white light, other colors (the colors of the rainbow) will yield the exact same color once put through a prism again, thus, confirming that only white light is a composition of different colored rays (See Figure 2).

Had Newton limited his studies to optics and mathematics, he would still be heralded as one of the greatest thinkers of the era and possibly the most influential mathematician and experimental scientist of all time; however, it is his work in mechanics that ultimately deified the figure of Newton as a scientist in both his lifetime and beyond. Most likely beginning with the
anni mirabilis and continuing at different times up until 1687, Newton gradually developed his seminal theories on forces and motion. With the aid (both financial and psychological) of Edmund Halley, Newton first published *The Mathematical Principles of Natural Philosophy* (better known simply as *Principles or Principia*) in Latin in July of 1687. Divided into three Books, *The Principia* lays out Newton’s comprehensive mathematical understanding of motion beginning with his famous “three laws” and principles of circular motion and then examining the consequences of these principles in everyday interactions. The final book introduces “the inverse square law” of gravitational force, which guided the mathematical understanding of gravity (the force two bodies exert on one another) up until Einstein’s General Theory of Relativity in 1915.

While we rarely picture Newton as anything other than a mathematician and scientist, both his published and particularly his unpublished writings reveal that he dedicated the majority of his time to other endeavors. He wrote hundreds of pages on religious topics, ranging from general accounts of his own religious virtues and history of sins, to meticulous scriptural analysis of both the New and Old Testament, to comprehensive histories of the Church and its earliest members. Newton was born into an Anglican family, and he never publically disobeyed or diverted from the teachings of the Church of England. However, Newton expressed many significant disagreements with the Anglican Church in his private writings; in particular, his unpublished religious works reveal that he did not hold an Anglican understanding of the Holy Trinity, but rather believed in Arianism, the doctrine developed in the first few centuries after Christ that dismissed the concept of a “three-pronged” God (the Father, the Son, and the Holy Spirit) in favor of one supreme God (just the Father) who must be placed above rather than equal to both the Son and the Holy Spirit. In addition to his religious interests, Newton, like many of his English contemporaries including the chemist Robert Boyle, practiced alchemy; he examined the occult
qualities of matter in order to gain further insight into the workings of God’s universe. Unlike his science, essentially all of his scriptural and alchemical writings were kept private during his lifetime.

Figure 2
Newton’s diagram of the two-prism experiment, which Newton deemed an “Experimentum Crucis” (or a “crucial experiment” that serves as the ultimate arbiter for what scientific theory to trust). White light from the window passes through the circular prism causing it to separate into rays of different colors. These different colors do not change when passing through the second triangular prism demonstrating that white light is a composition of different colors while the individual colors of the rainbow are pure. From: James Gleick, *Isaac Newton* (New York: Pantheon Books, 2003), 80.
Defining Key Terms—Science, Natural Philosophy, Religion, and Theology

In order to dissect the relationship between Newton’s “science,” “natural philosophy,” “religion,” and “theology,” all of these terms must be clearly defined. Newton, as well as the other preeminent figures of the “Scientific Revolution” such as Galileo Galilei, Johannes Kepler, and Robert Boyle viewed themselves as “natural philosophers” rather than the more modern designation of “scientists.” In fact, Newton named his most influential book *The Mathematical Principles of Natural Philosophy*. The term itself elucidates the inherent linkage of Newton’s various interests. A natural philosopher examines the “philosophy of nature” and while Newton may have followed a strictly “scientific” or as the title to his main work suggests, a “mathematical” approach in his investigations, he used the umbrella term “philosopher” to incorporate his wide range of pursuits. Historian Margaret J. Osler explains, “The early modern term ‘natural philosophy’ had a different extension than does the modern term ‘science,’ encompassing God’s creation of the world, his providential relationship with the creation, and the immortality of the soul, along with the chemistry, physics, anatomy, and physiology that we would expect. Natural philosophers did not establish criteria of demarcation between these issues and what we consider genuine scientific concerns, but regarded them as inseparable.”

Both Galileo and Kepler underscored God’s involvement in natural philosophy by adhering to

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3 “The Scientific Revolution” commonly refers to the European progress in science between the 1543 publication of Copernicus’ *On the Revolutions of the Heavenly Spheres*, in which he lays out the model for his heliocentric universe and the first publication of the *Principia* in 1687. I will also sometimes mention the “Copernican Revolution” referring to the early stages of the longer Scientific Revolution and centered on the shift from the growing Western belief in a Ptolemaic geocentric model of the heavens to a heliocentric system. Finally, the “New Science” signifies the natural philosophy of the “Scientific Revolution” based on a rigorous mathematical, rational, and experimental method. For more on the Scientific Revolution and whether or not the term itself is appropriate or useful see: Richard Westfall, “The Scientific Revolution Reasserted,” in *Rethinking the Scientific Revolution*; James E. Force, “The Nature of Newton’s ‘Holy Alliance,’” in *Rethinking the Scientific Revolution*; Dobbs, “Newton as Final Cause and First Mover.”

4 Margaret J. Osler, “Canonical Imperative,” in *Rethinking the Scientific Revolution*, 17.
the “Theory of Two Books”. God revealed himself to people through both the Book of Nature and the Book of Scripture. Natural philosophers investigated the former while priests and theologians examined the latter. Throughout this thesis, I often will use the terms “science” and “natural philosophy” interchangeably simply to stress the two concepts’ distinction with pure “theological” or “scriptural” studies. Nevertheless, it is critical to note, as Osler points out, that the self-assigned title of Newton’s vocation necessarily incorporates his underlying religious concerns.

Just as “science” can be viewed as a subset of “natural philosophy,” “religion” is a distinct subgroup of “theology.” “Religion” or “religious studies” refers to a specific organized religion, which in Newton’s case is Anglicanism. Thus, when we speak of Newton’s “religion” we may be speaking of his adherence to Scripture, his anti-Trinitarian views, or his detailed accounts of Christ’s Second Coming. “Theology” relates to the more general study of God or the Divine. Thus, while the previous list of subjects could also fall within Newton’s “theology,” this term refers to Newton’s overall outlook on God and His role in the universe. This thesis will concentrate on theology rather than Newton’s specific religious outlooks. Clearly, Newton’s understanding of the Divine is largely based on the Judeo-Christian religion and seventeenth century English Anglicanism, but while we will always recognize and refer to Newton’s particular religious convictions, the focus remains on his theology.
Chapter 1

Introduction

Nature and Nature’s Laws lay hid in the Night./ God said, Let Newton be! and all was Light.\(^5\)

-Alexander Pope

Newton was not the first of the age of reason. He was the last of the magicians.\(^6\)

- John Maynard Keynes

Over the past several decades, historians of Western science including Betty Jo Teeter Dobbs, James Force, and J.E. McGuire have begun dissecting the full range of Isaac Newton’s work in order to construct a more complete picture of the seventeenth and eighteenth century figure. Before this new wave of historical perspectives, the majority of Newton scholars rarely integrated Newton’s groundbreaking discoveries in math and science with his religious and metaphysical endeavors. Instead, these historians divided Newton’s writings into disjoint categories, which historian Ayval Ramati calls “the scientific and the esoteric” or as can be seen from the quotations above, Pope’s Newton and Keynes’ Newton.\(^7\) Newton is seen as the central modern thinker of pre-Enlightenment Europe whose developments in science marked the culmination of the Scientific Revolution. Newton’s writings, particularly the private writings that were first published centuries after his death, reveal the alternative thinker who enmeshed himself in alchemy, anti-Trinitarian Christian philosophies, scripture, obscure metaphysics, examinations of the Ancients, and other subjects deemed “backwards” and “esoteric” with respect to a more modern worldview.


The aforementioned historians along with a series of others abandon this “theory of two Newtons.”8 In her seminal work on Newton’s alchemy, The Janus Faces of Genius: The Role of Alchemy in Newton’s Thought Dobbs writes, “Newton’s mind was equipped with a certain fundamental assumption, common to his age, from which his various lines of investigation flowed naturally: the assumption of the unity of truth.”9 Writers such as Ramati and Lawrence M. Principe echo Dobbs’ point of view: the scientific and the esoteric Newton were truly one man using any means at his disposal to gain a higher understanding of God’s universe.

After acknowledging the like purposes in Newton’s scientific and non-scientific studies, many historians have attempted to pinpoint more concrete similarities in Newton’s religious and scientific thinking. Historian Stephen Snobelen distinguishes between two categories of connections that recent scholars have made between Newton’s theology and science. Many historians, particularly during the middle of the twentieth century, including one of Newton’s most influential biographers, Richard Westfall, have suggested “weak” arguments linking Newton’s theology and science.10 Snobelen defines an argument as “weak” if it centers on a “similarity of style and coincidence of method” between his science and theology.11 For instance, Newton stressed collecting and organizing as much “data” as possible in both his experimental philosophy and his scriptural analysis. Thus, throughout his life, he filled his notebooks pertaining to experimental philosophy with hundreds of pages listing different

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10 It should be noted that in his huge collection of studies on Newton including his biography Never at Rest, Westfall proposed what Snobelen would deem “strong” as well as “weak” arguments linking Newton’s natural philosophy and theology. I mention him here as a prime representative of the “weak” argument historians because he also dedicates a significant portion of his writings pointing out more “coincidental” parallels in method such as the example described above.
experimental observations just as his theological notebooks consist chiefly of catalogs of bible quotations. Although such a resemblance in method helps reveal Newton’s consistent approach to his studies, it, at least on the surface, tells us little about the underlying connection between his theological and scientific endeavors. In contrast, numerous historians in the past few decades, including Snobelen himself, have articulated “strong” arguments suggesting that “interpenetration existed at a fundamental level between the cognitive content of the theological and natural philosophical features of Newton's grand study.” These strong arguments have taken many different forms, but they all reaffirm Dobbs’ statement, positing that Newton had one uniform goal and philosophy.

This thesis focuses less on the intersection of “cognitive content” between Newton’s science and religion and instead builds upon Dobbs’ link between Newton’s science and his theological motivations. In her introduction to *The Janus Faces of Genius*, Dobbs states, “This book is predicated upon the conviction that to Newton himself all his diverse studies constituted a unified plan for obtaining Truth, and it is organized around a religious interpretation of Newton’s alchemy, but more than that, a religious interpretation of all his work. It is in Newton’s belief in the unity of Truth, guaranteed by the unity and majesty of God, that one may find a way to reunite his many brilliant facets, which however well-polished, now remain incomplete fragments.” While Dobbs searches for the theological stimuli behind Newton’s alchemical studies, this thesis will investigate his theological goals in his writing of *The Principia*.

Newton wrote his most prestigious book, in part, to satisfy his personal theological aims.

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Like his contemporary natural philosophers, such as Robert Boyle in England and Gottfried Wilhelm Leibniz on the continent, Newton consistently attempted to reconcile his scientific discoveries with his firmly planted religious beliefs. While he rarely addresses theological issues in *The Principia* directly, particularly in the first edition of 1687, theology remains as one of the driving forces of his grand endeavor. He studied Nature through scientific analysis partially in order to gain a greater understanding of God as an omnipotent creator who continues to intervene in His Creation, to get closer to God, and to complete his God-given responsibilities to both the Divine and to others.

Those who study the interplay between Newton’s science and theology immediately notice Newton’s complicated views on the relationship between these two areas of thought. In his “Seven Statements on Religion” written within fifteen years of his death, Newton’s first “rule” is “That religion & Philosophy are to be preserved distinct. We are not to introduce divine revelations into Philosophy, nor philosophical opinions into religion.”\(^{14}\) Such a remark seems directly opposed to his outlook in the “General Scholium” of *The Principia*, first published in the second edition of *The Principia* in 1713. In this brief and highly influential reflection on both natural philosophy and theology, Newton writes, “to treat of God from phenomena is certainly a part of natural philosophy.”\(^{15}\) Which of these two statements reflect Newton’s actual opinion on the matter?

Those who have argued that Newton’s motivations to pursue natural philosophy were in part theological, naturally point to the General Scholium to defend their case. Along with the concluding “Queries” to *Opticks*, this approximately five page long meditation is the premiere


piece of published writing in which Newton tackled the relationship between his new discoveries and God. This thesis, drawing from the work of numerous Newton historians over the past century, contends that the General Scholium provides some of the most explicit evidence that Newton wrote his *Principia*, to a certain extent, for theological reasons.\(^\text{16}\) Although the General Scholium is informative in this respect, it cannot stand as the only evidence of Newton’s theological motivations. Firstly, Newton initially published *The Principia* in 1687, and if we intend to prove that he originally wrote the book, to some degree, in order to satisfy theological aims, it is insufficient to examine only a document written over twenty years later. Like any thinker who is fortunate enough to work over the course of several decades, Newton constantly evolved and changed many aspects of his scientific and theological thinking. Moreover, he publicly directed his attention to different pursuits over the course of his life, writing many of his main religious pieces in the last few decades of his life, and the majority of his original mathematical and scientific works in his younger years.

We also need to look beyond the General Scholium because of Newton’s clear political intentions in the essay. Newton published the second edition of *The Principia* at the height of the “Calculus Wars” between him and Gottfried Wilhelm Leibniz. Leibniz was a German mathematician, philosopher, and theologian widely regarded along with Newton as one of the greatest minds of the age. From around 1700 to Leibniz’ death in 1717, Newton, Leibnitz, and particularly the two men’s friends and supporters argued bitterly about which of the two natural philosophers deserved the bulk of the credit for creating calculus. As noted in the short biography, Newton likely made his major breakthroughs in calculus in the mid 1660’s (particularly between 1664 and 1666) and his *On the Method of Series and Fluxions* is most

\(^{16}\)For example: Snobelen, “‘God of Gods, and Lord of Lords’: The Theology of Isaac Newton’s General Scholium to the Principia.”
often dated at 1671 even though it was not published until after his death. He avoids incorporating calculus in *The Principia* and instead defends his mechanics with Euclidean geometry and mathematical techniques that had been well known for centuries. Beginning with *A New Method for Maxima and Minima* from 1684, Leibniz began publishing his developments on the Calculus, although, like Newton, he began making his most important discoveries several years before organizing it into major works. In the years surrounding Newton’s writing of the General Scholium, Newton’s supporters accused Leibniz of stealing Newton’s ideas and for decades following both men’s deaths, arguers on both sides attempted to establish one man’s primacy of discovery.\(^\text{17}\)

This bitter quarrel between the two thinkers permeated beyond their respective mathematical works. In his 1710 book *Theodicy*, Leibniz opposed Newton’s concept of gravity because he could not accept the notion of “action at a distance.” Leibniz did not think that one body could exert a force on another body without some sort of medium or contact between the two entities.\(^\text{18}\) Around the same time, Leibniz pinpointed many other areas of Newton’s science and philosophy, on which the two men differed, and he often used religious arguments to defend his stances. For example, Newton believed that God must occasionally intervene directly in the world in order to preserve His Creation. Leibniz disagreed, retorting that God would only need to interfere in the world if He had created an imperfect universe.\(^\text{19}\) As a result, Leibniz calls into question Newton’s belief in a perfect God. It is in this tumultuous atmosphere, where Newton’s most fundamental theological beliefs were being called into question, that he decided to compose his General Scholium. Along with English mathematician Roger Cotes’ preface to the second

\(^{17}\) For more on the “Calculus Wars” see: Westfall, *Never at Rest*, Chapter 14.

\(^{18}\) We will discuss this concept in greater detail in Chapter 4: Divine Intervention with respect to Newton’s outlook versus that of Descartes.

The edition of *The Principia*, Newton’s General Scholium distinguished the new edition from that of 1687 by addressing the works’ wide range of criticisms led by Leibniz. Westfall comments, “Placed at the front and rear, like symbolic covers, they [Cotes’ preface and Newton’s General Scholium respectively] gave to the new edition a polemic tone.” Since the General Scholium stemmed from Newton’s personal conflicts and it was written decades after 1687, it must be supplemented with other writings in order to get a complete picture of his motivations.

In addition to the General Scholium, we will investigate many of Newton’s theological and scientific writings along with his personal correspondence composed throughout his life. While focusing on the different elements of Newton’s theological aims, we may begin by referencing works like the General Scholium and the Queries to the *Opticks* and then move back in time to works written closer to the 1687 publication. Essentially all of these writings, even those that were not originally published, have been known and read by Newton scholars for many generations. However, in recent years, thanks to Internet collections such as the Newton Sussex Project, both Newton’s private and public works are now readily available for the general public and neatly organized in one place. The Newton Sussex Project website, from which I gathered the majority of my primary sources states, “the publication of all his writings presents an opportunity to understand the interrelations of different aspects of his work, and to see more accurately how his attitudes changed over long periods of time.” Along with having many of Newton’s diverse writings in the same location, current Newton scholars benefit from using I. Bernard Cohen and Anne Whitman’s 1999 English translation of *The Principia*, which coupled

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20 Westfall, *Never at Rest*, 744.
with Cohen’s extensive introduction to the work provides a strong tool for the exploration of Newton’s premiere achievement.

Before investigating Newton’s theological objectives in writing *The Principia*, we must review the obvious scientific purpose of his major work. This thesis aims to reveal Newton’s underlying theological motivations in writing *The Principia*, but on the surface, Newton’s work is purely scientific. From this vantage point, *The Principia* should be viewed primarily as an examination of the cosmos.

**The Principia as a Cosmological Work**

The first edition of *The Principia* was published in 1687, then republished in 1713 and again in 1726 shortly before his death. The core of all these editions are divided into three books, the first two concerning “the motion of the bodies” and the third on “the system of the world.” Book 1 investigates the motion of bodies not subject to any sort of resistance, Book 2 discusses motion through different sorts of resisting mediums, and Book 3 applies these findings to the workings of the heavens and unveils his theory of universal gravitation. In an unpublished draft of a preface for *The Principia* written after the publication of its second edition, Newton lays out the central objectives of his magnum opus:

> The aim of the Book of Principles was not to give detailed explanations of the mathematical methods, nor to provide exhaustive solutions to all difficulties therein relating to magnitudes, motions, forces, but to deal only with those things which relate to natural philosophy and especially to the motions of the heavens; and thus what contributed little toward this end I have either entirely omitted or only lightly touched on, omitting the demonstrations.22

He emphasizes his exclusion of detailed mathematical explanations in the first edition in order to reinforce his argument that he developed calculus well before writing *The Principia*. Newton

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wrote this draft in the midst of the heated “Calculus Wars” during which he and Leibniz competed over who first discovered calculus. As a result, many of Newton’s revisions to his later editions of *The Principia* are direct responses to Leibniz and his supporters.

Despite Newton’s underlying practical motivations in his writing of this preface, he still seems to concisely and candidly articulate the basic purpose of the work. Newton underscores the importance of the “motions of the heavens” addressed in the third book. Although Newton dedicates only a third of his book to cosmology, it is apparent that he found his examination of the heavens to be at the core of his overall investigation. A year before *The Principia*’s first publication, Newton threatened to remove the third book regarding universal gravitation after Robert Hooke’s insistence that he deserved credit for developing the inverse square law of gravity. In a letter to Halley, Newton stated that if the third book were eliminated he would no longer consider it appropriate to title the work “Philosophiae naturalis Principia Mathematica” but would instead name the book “De Motu corporum libri duo” or “On the Motion of two bodies.”

The proposed change of title reveals the centrality of the third book to Newton’s overall project. The title *Philosophiae Naturalis Principia Mathematica* is a direct reference to Descartes’ groundbreaking treatise *Principia Philosophiae* of 1644. Much of Newton’s book may be understood as a straightforward response to Cartesian philosophy as presented in works like *Principia Philosophiae* and especially *Treatise on the Light* written in the early 1630’s. As the difference in Descartes’ 1644 and Newton’s 1687 titles imply, Newton viewed his strictly mathematical approach to questions of natural philosophy to be the major distinction between the two authors’ works. In the published preface to the first edition of *The Principia*, Newton states,

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“Our present work sets forth mathematical principles of natural philosophy.”\textsuperscript{25} This mathematical approach pertains as much to the first two books as it does to the third, but by suggesting to change the title of the work if the third book were removed, Newton insinuates that he can truly produce his own “Principia” that belongs next to or in front of one of Descartes’ major works only if it includes his theories of the heavens.

Newton further highlights the primacy of his cosmology amongst the other topics addressed in \textit{The Principia} through his instructions for reading the book. In the preface to Book 3 Newton writes,

> Since in books 1 and 2 a great number of propositions occur which might be too time-consuming even for readers who are proficient in mathematics, I am unwilling to advise anyone to study every one of these propositions. It will be sufficient to read with care the Definitions, the Laws of Motion, and the first three sections of book 1, and then turn to this book on the system of the world, consulting at will the other propositions of books 1 and 2 which are referred here.\textsuperscript{26}

It may be argued that Newton suggested such an approach because he lacked confidence in the common readers’ mathematical aptitude, and thus sought to distinguish between the more advanced scholars who could parse through the difficult mathematics of the first two books and those who could understand only the theoretical proclamations of the final book. It is indeed true that some of \textit{The Principia’s} most capable readers found the mathematics of the first two books indecipherable. The English political theorist John Locke asked the Dutch natural philosopher Christian Huygens to confirm that the mathematical proofs of \textit{The Principia} were sound because of his inadequate knowledge of geometry.\textsuperscript{27} Moreover, in many of his other private writings on both theological and scientific matters Newton makes a crucial and sharp distinction between the

\textsuperscript{25} Newton, \textit{Principia}, 382.
\textsuperscript{26} Newton, \textit{Principia}, 793.
majority of individuals who could only scratch the surface of meaningful knowledge and the elite minority including himself who had intellectual access to higher truths.\textsuperscript{28}

Although Newton’s advice to bypass the middle portion may stem partially from his low esteem of the common reader, he provides these directions also to accentuate the importance of the final chapter. Immediately following the preface to the third book, he includes four short “rules for the study of natural philosophy.”\textsuperscript{29} These are general guidelines for the reader to keep in mind while reading the final book such as “No more causes of natural things should be admitted than are both true and sufficient to explain their phenomena.”\textsuperscript{30} In principal, these overarching precepts pertain as much to the methods of investigation in the first two books as they do to the model of the third book. Nevertheless, he inserts this valuable base before the third book again supporting the conclusion that he viewed the third book as the heart of the entire endeavor. His carefully chosen title exhibits that Newton is first and foremost concerned with natural philosophy and its mathematical principles, and although he provided numerous examples of such mathematical techniques before the beginning of the third book, he does not find it necessary to lay down the theoretical groundwork for natural philosophy before his study of the cosmos.

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\textsuperscript{28} We will discuss this understanding with respect to Newton’s theology in Chapter 5: His God-Given Mission.
\textsuperscript{29} The rules are organized differently in each of the three editions and vary slightly in content. The “four rule” organization mentioned here refers to the 1726 edition. In all three editions, the rules immediately precede the content of the third book.
\textsuperscript{30} Newton, \textit{Principia}, 794.
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Chapter 2

Background Information: An Overview of Cosmology and Theology in the West

If I have seen further it is by standing on ye shoulders of Giants.\textsuperscript{31}

-Isaac Newton in a letter to Robert Hooke (1676)

Accepting that Newton pictured \textit{The Principia} as most importantly a cosmological study, we see that he follows the work of a long line of scientific and religious thinkers who studied the heavens for underlying theological reasons. Thinkers dating back to the ancient Greeks endorsed and practiced natural theology—the ideology that we can learn about God’s existence and nature as well as our expected relationship with the Divine through the study of Nature. This line of thinking may be divided into four basic categories, which although not completely distinct or all encompassing effectively organize the disparate theological motivations for examining the cosmos. Natural theologians studied the heavens to a) gain insight regarding God as the creator of the universe; b) learn more about God’s continual role in controlling or intervening in the universe; c) become closer to God; d) and fulfill what they viewed as their God-given responsibilities. While natural theology is in no way unique to the history of Western thought, we will center our discussion on the thinkers dating back to Plato who most likely had the strongest influence on Newton’s thinking. Cambridge librarian John Harrison first published \textit{The Library of Isaac Newton} in 1978, which provides the most detailed available catalog of the books Newton possessed and most likely read at different points during his life.\textsuperscript{32} We may utilize Harrison’s index as well as Newton’s direct references to other individuals in his own


writings as a guide to identify many of the key thinkers who examined one or more of the four branches of natural theology listed above.

Students of Nature have often studied the heavens in order to learn more about God as the creator. Since Plato’s *Timaeus*, individuals leading up to Newton’s time viewed the existence, vastness, intricacies, and order of the cosmos as a clear reflection of an intelligent designer. Building off of the ideas of earlier philosophers including Aristotle, Cicero articulated an early version of the argument from design:

> When we see something moved by machinery, like an orrery clock…, we do not doubt that these contrivances are the work of reason; when therefore, we behold the whole compass of heaven moving with revolutions of marvelous velocity and executing with perfect regularity the annual changes of the seasons with absolute safety and security for all things, how can we doubt that all this is effected not merely by reason, but by a reason that is transcendent and divine?

Early church fathers including Origen, Ambrose, and Augustine repeated and refined such teleological arguments, putting them in the specific context of a Christian God. In the thirteenth century, scholastic theologians such as St. Thomas Aquinas and St. Bonaventure meticulously amalgamated Ancient Greek philosophy with Christian theology as professed by the early church fathers. Aquinas famously included his version of the design argument as the fifth rational proof of God’s existence in the *Summa Theologica*.

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33 The “argument from design” (also known as the “teleological argument” or simply the “design argument”) is an a posteriori explanation of God’s existence. One defending an argument from design assumes that the universe contains a certain order, which he or she then reasons must be attributed to a divine Creator. It is critical to note that natural theologians such as Augustine and Aquinas as well as philosophers such as Cicero and Plato are often using design arguments not only to learn more about God as the divine creator but also to construct a “proof” that God formed the universe. In this thesis, we are investigating Newton’s natural theology, which may be connected to the former but not the latter function of teleological arguments.


36 Aquinas’ fifth proposition incorporates both God’s role as the creator of the universe as well as his ongoing involvement in the world. He writes, “The fifth way [philosophers have proven God’s existence] is taken from the...
Although scientific thinking began to shift significantly between the publication of Copernicus’ model of a heliocentric universe in 1543 and Newton’s time, natural philosophers of the period continued to propound comparable design arguments. In the wake of the Copernican Revolution, supporters of a heliocentric universe such as Kepler and Galileo attempted to reconcile the contradictions between the Holy Scriptures and the new understanding of Nature. These thinkers generally bridged the gap by affirming that God presents himself to humans through the Book of Nature as well as the Book of Scripture, and if certain details of the Book of Scripture are interpreted correctly and often metaphorically there should be no conflict between the two. Keeping this distinction in mind, these scientific giants repeated the sentiments of both the Ancients and Christian scholars before them by linking their conception of the cosmos to an intelligent creator. Kepler asks,

> Why has God chosen the distinction between curved and straight lines, and the nobility of the former, as fundamental to the creation of the world? For what other reason than that it was absolutely necessary for the most perfect Creator to produce the most perfect creation. It is not fitting (as Cicero, in imitation of Plato’s *Timaeus*, had said in *De Universitate*) and never has been for the best to bring forth something that is not the most beautiful of all.\(^{37}\)

We thus see a seamless transition from medieval design arguments to those of Early Modern Europe. Kepler and his contemporaries utilized their new rational and mathematical understandings as further support for the teleological argument and like their predecessors pointed to the order and wonders of the universe as God’s work.

While the majority of prominent natural philosophers leading up to Newton adhered to a relatively traditional Christian view of God as creator, other longstanding theological ideas posed ordered tendencies of nature. A direction of actions to an end is detected in all bodies following natural laws even when they are without awareness, for their action scarcely ever varies and nearly always succeeds; this indicates that they do tend toward a goal, not merely succeeding by accident. Anything, however, without awareness, tends to a goal only under the guidance of someone who is aware and knows; the arrow, for instance, needs an archer. Everything in nature, consequently, is guided to its goal by someone with knowledge, and this one we call ‘God.’”


a potential threat to design arguments. For example, for well over a thousand years adherers of the widespread religious ideology Gnosticism believed that although God is the ultimate controller of the cosmos and world, some intermediary agent is the direct cause of the material universe. Certain groups of Gnostics viewed the universe as imperfect and often evil, and thus strongly objected to the notion that examining the cosmos lead to an awareness of the Divine. Natural philosophers like Kepler and Newton expounded on age-old design arguments in order to combat such alternate views.

Both scientific and religious thinkers have gained insight into God’s role not only as the universe’s creator but also as its sustainer by contemplating the cosmos. Beginning with the early Church Fathers, members of the Church emphasized divine providence in addition to God’s creation of the world from nothing. As with the doctrines of creation, biblical scholars like Augustine in City of God asserted that God is constantly guiding the universe towards an ultimate purpose even if this divine control is often imperceptible to human senses. The majority of religious leaders during the Reformation altered certain accepted interpretations of divine providence but still adhered to the doctrine that God always remains in charge of his creation. For example, in the sixteenth century, John Calvin emphasized that every individual is responsible for his or her sins, but at the same time, God has the permanent power to control our fates and the cosmos. For both early Christians and the reformers following the Middle Ages, God manifested his continuous authority most clearly through revelation as described in both the Old and New Testaments. Before the scientific breakthroughs of the fifteenth and sixteenth centuries, cosmology would most often be used as a defense of providence in the absence of

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38 Here we use “divine providence” or just “providence” as an umbrella term referring to God’s continuing role in the universe. As we will see below, especially in Chapter 4, divine providence can describe both God’s consistent sustainment of the universe (sometimes referred as “general providence” or God’s potentia ordinata) or to God’s direct and often supernatural intervention in the universe (also known as “special providence” or potentia absoluta).

greater scientific understanding. For instance, rather than attributing the motion of the stars, planets, and comets to the mathematical principles of universal gravitation, these occurrences could be viewed as an effect of God’s constant interaction with the universe.

While those immediately preceding Newton revolutionized such outlooks on divine providence, they inserted their own novel explanations of how an interventionist God dictates the daily workings of the universe. In his *Principia Philosophiae*, Descartes writes his theories of inertia and the conservation of motion or momentum in the earthly and heavenly realms. He states,

> It is obvious that when God first created the world, He not only moved its parts in various ways, but also simultaneously caused some of the parts to push others and to transfer their motion to these others. So in now maintaining the world by the same action and with the same laws with which He created it, He conserves motion; not always contained in the same parts of matter, but transferred from some parts to others depending on the ways in which they come in contact.  

He soon after extends the theory of God’s continual involvement to the cosmos. Like Kepler, Descartes attempts to adapt traditional natural theology with his more sophisticated natural philosophy. He views the preservation of quantities such as motion as evidence for God’s constant interaction in the world.

As can be seen by juxtaposing Descartes and Kepler’s statements, the issue of consistent divine intervention rather than intelligent design is a far more problematic theory to defend in the wake of scientific discoveries. In order to adapt the creation argument to the new science, individuals like Kepler rarely needed to do more than accept less literal interpretations of certain scriptural passages. In contrast, if seventeenth century thinkers began to believe that such laws as inertia and the conservation of motion preserved the daily workings of the world and the heavens, it became natural to question whether divine intervention was ever truly necessary.

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Individuals like the English political philosopher Thomas Hobbes began to underline God’s identity as the creator while his continued presence appeared less likely. Scholars like Hobbes built their theories on earlier Neoplatonic and post-medieval ideas.\textsuperscript{41} Although Plato argues for an intelligent creator in the \textit{Timaeus}, he also introduces the concept of an \textit{anima mundi} or “world soul” which could conceivably reject the possibility of God’s continued action in the universe. Plato writes, “It is necessary to call the world an animal, endued with intellect, and generated through the providence of Divinity.”\textsuperscript{42} Later thinkers including the highly influential German-Swiss alchemist Paracelsus of the sixteenth century proposed similar conceptions of the universe’s animated nature. As a result, many later Neoplatonists and Paracelsans took the natural logical leap concluding that if God endowed Nature with a self-sufficient soul, God no longer needed to interact with His creation. As the Western science progressed, especially after the first publication of \textit{The Principia}, these reservations on God’s continuing work intensified and began to reach fruition in the late seventeenth and early eighteenth century with the spread of deism. Although deism is often used an umbrella term encompassing a wide range of religious outlooks, all deists hold the belief that supposed divine works following creation such as scriptural revelation are logically impossible.\textsuperscript{43} For natural philosophers like Newton, who held a firm belief in revelation, prophecy, and God’s sustained guidance of the universe, it was essential to learn more about God’s continuing presence in order to refute growing trends.

\textsuperscript{41} Neoplatonism is the branch of philosophy based mainly on Plato’s metaphysical works such as the \textit{Timaeus}, where he discusses the relationship between the cosmos, theology, and mystical philosophy. Plotinus, a Western philosopher from the third century CE is often viewed as the founder of this wide-ranging school of thought, which continued to make a strong impact on Western philosophy and theology for centuries. For a brief introduction to Neoplatonist thought see: Pauliina Remes, \textit{Neoplatonism} (Berkeley: University of California Press, 2008).


In addition to solidifying their belief in the divine Creator and Sustainer, thinkers before Newton’s time explored the sky seeking a stronger connection with the sacred. Plato and Aristotle in the *Timaeus* and *Metaphysics* respectively revered the cosmos deeming the heavens to be infallible and thus, a prime object of study for searching for sacred truths. The Early Church fathers lead by Augustine often downplayed the examination of the heavens as a route towards the Holy, instead emphasizing internal contemplation as the primary path towards God. In the thirteenth century, the influential scholastic theologian, St. Bonaventure harkened back to the Ancient Greeks and highlighted the divinity of the cosmos by placing it closer to God in his hierarchical depiction of the universe. He writes,

Concerning the existence of material nature the following points are to be held: the entire material world machine comprises a heavenly and an elementary nature. The heavenly nature is mainly divided into three heavens: the empyrean, the crystalline heaven, and the firmament. Within the firmament (the starry heaven) there are seven planets: Saturn, Jupiter, Mars, the Sun, Venus, Mercury, and the Moon. The elementary nature is divided into four spheres: fire, air, water, and earth. From the highest point in heaven to the center of the earth there are in all ten celestial and four elementary spheres. Thus, the whole material world machine is constructed in a distinct, perfect, and ordered manner.

Bonaventure’s organization of the universe establishes a clear theological hierarchy between studying the world and its four elementary spheres and exploring the planets and the stars. Since the visible cosmos make up one third of the heavens, Bonaventure insinuates that a close study of the heavens should literally put the believer in contact with a more sacred realm. Echoing Plato and Aristotle, Bonaventure understood “the celestial spheres to be imperishable and

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44 In the *Soliloquia*, Augustine writes, “I asked the heavens, the sun, moon stars: ‘Neither,’ say they, ‘are we the God whom thou seekest.’ And I answered… ‘Ye have told me concerning my God. That ye are not He; tell me something about Him,’ and with a loud voice they exclaimed ‘He made us.’…And I directed my thoughts to myself and said ‘Who art thou?’ And I answered ‘A man.’ And lo! In me there appear both body and soul…By which of these should I seek my God, whom I had sought through the body from earth to heaven, as far as I was able to send messengers—the beams of mine eyes? But the better part is that which is inner…By my soul itself will I mount up unto Him.” Augustine of Hippo, *The Soliloquies of St. Augustine*, trans. Rose Elizabeth Cleveland (Boston: Little, Brown, and Company, 1910), 135.

perfect. The earth, however, was the realm of imperfection and transience.\textsuperscript{46} Cosmology provided the believer with a chance to temporarily abandon the less perfect world and reach out towards the divine.

Similarly, early practitioners of the New Science on the European continent found an investigation of the wondrous and immaculate cosmos to be a means towards greater spiritual understanding. Kepler zealously proclaims his devotion to God and links knowledge of the cosmos with that of the Creator in his 1619 work \textit{The Harmony of the World}. After describing his third law of planetary motion Kepler writes, “O Thou who by the light of Nature movest in us the desire for the light of grace, so that by it thou mayest bring us over into the light of glory.”\textsuperscript{47} Those like Kepler who linked the cosmos to God began to find considerable opposition not only from groups like the Gnostics who often equated the material world with evil but also from early pantheists. Inspired by influential seventeenth century philosophers such as Baruch Spinoza\textsuperscript{48}, The Irish writer John Toland coined the term “pantheist” in the early 1700’s and described its fundamental outlook in a 1710 letter to Gottfried Leibniz. Toland writes that a pantheist, “was one of those persons, ‘who believe in no other eternal being but the universe.’”\textsuperscript{49} In other words, the concepts of God and Nature were identical. As a result, natural philosophers who equated an investigation of the cosmos with a greater understanding of God faced resistance from two

\textsuperscript{46} St. Bonaventure as quoted in: Wildiers, \textit{The Theologian and his Universe}, 44.
\textsuperscript{48} There is debate as to whether Spinoza himself was a pantheist. He insisted that he did not intend to fully integrate the Divine with Nature and in a letter to Henry Oldenburg stated, “The supposition of some, that I endeavor to prove in the Tractatus Theologico-Politicus the unity of God and Nature…is wholly erroneous.” Nevertheless, much of Spinoza’s theological writings illustrate a significant relationship between God and His creation and many self-proclaimed pantheists including Toland site Spinoza as a direct influence, thus implying that at least the roots of the ideology were planted well before the turn of the eighteenth century. For more on Spinoza’s relationship to pantheism see: Charles Huenemann, \textit{Interpreting Spinoza: Critical Essays} (Cambridge; New York: Cambridge University Press, 2008); Quote to Oldenburg from: Benedict de Spinoza, \textit{The Chief Works of Benedict de Spinoza}, trans. R. H. M. Elwes (New York: Dover, 1955), 298.
\textsuperscript{49} Paul Harrison, \textit{Elements of Pantheism} (Coral Springs, FL: Llumina Press, 2004), 29.
opposite ends of an ideological spectrum—Groups like the Gnostics denied the sacredness of the cosmos while a new line of pantheist thinkers looked to the heavens in order to connect with Nature itself rather than employing knowledge of the universe as a step towards God.

Finally, many Europeans in the centuries leading up to Copernicus believed that they had a God-given duty to examine the cosmos and to gain an accurate knowledge of its workings. Since God created and controlled the cosmos and made the heavens a particularly sacred realm of examination it was incumbent upon true Christians to understand God’s celestial work. Once again, the two principal scholastic writers of the thirteenth century, Aquinas and Bonaventure, integrated the writings of Christian and pagan predecessors in order to articulate this Christian responsibility. In the *Summa Theologica*, Aquinas states,

> Consideration [of God’s works] leads us to admire the sublime power of God and, consequently, begets in men’s hearts a reverence for God; for we must needs conclude that the power of the maker transcends the things made. Wherefore it is said (Wis. 13:4): “If they” (the philosophers to wit) “admired their power and their effects” (namely, of the heavens, stars, and elements of the world), “let them understand… that he that made them is mightier than they.”

Aquinas suggests that individuals not only have a personal incentive to study God’s creation and his divine realm, but also that such a close study of the cosmos is a prerequisite to having a full appreciation of the Sacred. As a result, studying the heavens is a concrete religious responsibility. In his book *The Theologian and his Universe*, which traces the connection between theology and cosmology since the time of the scholastics, N. Max Wildiers writes of Aquinas, Bonaventure, and the typical European medieval theologian: “What he had in view was a Christian interpretation of the cosmos as God’s creation and revelation, as a pathway to the knowledge of God and as a partner in salvation.”

By immersing oneself in a sacred realm, the believer inches closer to the Creator while simultaneously committing to his God-given mission.

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Natural philosophers following Copernicus often understood their studies of the heavens as their divine obligation. Kepler made the point most clearly in the section of the *The Harmony of the World* quoted previously. He goes on to state, “Lo, I have now brought to completion the work of my covenant, using all the power of the talents which Thou hast given me. I have made manifest the glory of Thy works to men who will read these demonstrations.” Kepler reasoned that the Divine endowed him with unique scientific and mathematical talents and that God intended him to employ these abilities to deliver greater knowledge of His creation to the masses. Practitioners of the New Science not only found it to be their duty to explore the skies but also to make accurate conclusions regarding the divine Book of Nature. By openly endorsing the heliocentric theory of the solar system, Galileo explained that certain segments of the Bible such as the temporary stoppage of the sun’s movement in the Book of Joshua could not be taken literally. Since Galileo viewed the Books of Scripture and Nature to be distinct yet wholly compatible, he held his heliocentric universe to be the only correct understanding of God’s creation. In a letter to Italian mathematician Benedetto Castelli from 1613, Galileo comments,

> Although Scripture can indeed not err, nevertheless some of its interpreters and expositors may sometimes err in various ways, one of which may be very serious and quite frequent, [that is] when they would base themselves always on the literal meaning of words. For in that way there would appear to be [in the Bible] not only various contradictions, but even grave heresies and blasphemies.

Galileo, thus introduces another reason why individuals must examine the heavens—since the Book of Nature is just as critical in understanding the Deity as the Book of Scripture, we must gain an accurate account of the cosmos to aid us in deciphering God’s words in the Bible. Galileo deems this to be an obligation of the highest priority because without an accurate scientific understanding we can completely misinterpret God’s message.

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While natural philosophers on the European continent combined their scientific findings with their theological convictions, England became the center of both scientific progress and natural theology in the seventeenth century. The rise of both British natural philosophy and theology can be traced to the reign of Elizabeth I and her policies of religious tolerance. Following the five-year reign of her Catholic half-sister Mary, Elizabeth reestablished the supremacy of the Anglican Church while simultaneously including other members of other religious denominations including Catholics in influential government positions. In response to growing resentment from the Puritans in the late sixteenth century, the Oxford-trained scholar Richard Hooker was assigned to write an official defense of Elizabeth’s Anglican-minded policies, which he titled *The Laws of Ecclesiastical Policy*. The first half of the book was published in 1593 while the second half was not released until the beginning of the seventeenth century. As a result of this delay in publication, Hooker’s book remained a cornerstone of British thought right up until the first publication of *The Principia* in 1687.

Hooker’s influential work reiterated the two Books theory of contemporary natural philosophers and laid down the foundation for the style and centrality of natural theology in seventeenth-century England. Hooker writes, “Nature and Scripture do serve in such full sort that they both jointly and not severally either of them be so complete that unto everlasting felicity we need not the knowledge of anything more than these two may easily furnish.” After establishing the importance of Nature in any theological undertaking, Hooker explicitly endorses natural theology. He concedes, “the mind of man desireth to know the truth according to the

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55 Olson, 87.
56 Richard Hooker as quoted in: Olson, 88.
most infallible certainty which the nature of things can yield.” In order to gain knowledge of God with the greatest possible degree of certainty (which thinkers like Hooker and John Locke believed would not be perfect certainty of God’s nature but very probable estimates that were true beyond any reasonable doubt) man ought to look towards Nature. Moreover, Hooker stressed that such an examination of God’s works would substantiate the claim that God both created and continued to act in the universe. He deemed God “both the Creator and Worker of all in all.” Hooker communicated the concrete theological framework for seventeenth-century English natural theology and the most prominent English natural philosophers of the sixteenth and seventeenth centuries supported such notions and put his principals into practice.

Many of the major English natural philosophers leading up to Newton reiterated Hooker’s ideas and solidified natural theology’s specific and noteworthy position in British thought. Of all late sixteenth century British natural philosophers, Francis Bacon is most often credited as the father of future British intellectual thought for his strong defense and creation of his own inductive methodology. Using direct quotations from his philosophical works, science historian Michael Ben-Chaim describes Bacon’s link between natural philosophy and theology. Ben-Chaim writes,

Genuine knowledge pertained to ‘the Ideas of the divine’ which were ‘impressed’ upon and ‘defined’ matter by ‘the creator.’ The ‘natural’ and the ‘created’ were synonymous terms that singled out the ultimate objective of natural philosophy, and at the same time set it apart from the practical pursuits by which people could discharge their duties to God as a benevolent ruler.

Thus, Bacon endorsed all four of the aforementioned branches of natural theology in his practice of natural theology. Investigations of nature and the cosmos illuminate God’s role as the creator since the “created” and the “natural” are one in the same. It sheds light on God’s ongoing

57 Hooker as quoted in: Olson, 90.
58 Hooker as quoted in: Olson, 91.
control of the universe and enhances spiritual connection since it ultimately brought the individual closer to the “benevolent ruler.” Finally, Bacon understood scientific investigation as a way to fulfill man’s “duties to God.”

Prominent English thinkers of the seventeenth century adhered to Baconian thought and further developed the British form of natural theology. One of the pioneers of modern chemistry, Robert Boyle established himself as possibly the most influential British natural philosopher between Bacon and Newton. By expanding and amending the theories of the French thinkers Descartes and Pierre Gassendi, Boyle became the chief spokesman for the mechanical philosophy of nature or “mechanism.” Historian Margaret Osler explains, “Mechanical philosophy was a philosophy of nature, popular in the seventeenth century, that sought to explain all natural phenomena in terms of matter and motion without recourse to any kind of action-at-a-distance.”

Mechanists could envision nature as a logical machine, created by God to function in a concrete and rational manner. By employing scientific methods like those put forth by Bacon, natural philosophers could understand, to a limited extent, the inner workings of the great machine. Like Descartes’ earlier propositions of inertia and conservation of motion, many aspects of the mechanical philosophy at first clashed with accepted theological beliefs. In his theological writings, Boyle went to great lengths to blend the mechanical philosophy with belief in an all powerful and ever present Creator. Boyle agreed with atomists such as Gassendi that all matter was composed of indivisible particles but made sure to distinguish his outlook on such a “corpuscular theory” of matter from similar materialist understandings of atoms dating back to ancient Greek thinkers like Epicurus. Osler explains, “Boyle...believed that God had created matter and had endowed it with motion. God had created laws of nature but could violate those

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Boyle was among the most vocal of the natural philosophers regarding the divine nature and implications of his investigations. Like Bacon, he understood the study of nature as a necessary form of worship. In his 1663 work the *Usefulness of Experimental Natural Philosophy* he states of the investigation of Nature: “It is the first act in religion and equally obliging in all religions; it is the duty of man as man, and the homage we pay for the privilege of reason.” Boyle would further underline and elaborate on the theological use of natural philosophy in his last major work titled *The Christian Virtuoso* published in 1690. He unveils the overarching purpose of the book in the full title to the first part: “The Christian Virtuoso: Showing that Being Addicted to Experimental Philosophy, a Man Is Rather Afflicted, Than Indisposed, to Be a Good Christian.”

Boyle’s highly instrumental works were largely representative of the common outlook amongst prominent seventeenth-century British natural philosophers and natural theologians. To cite just one of numerous examples, theologian Thomas Sprat reiterated Boyle’s belief that an understanding of Nature enhanced religious belief in the 1667 *History of the Royal Society*. Sprat comments, “The way to reduce a real and sober sense of religion is not by endeavoring to cast a veil of darkness again over the minds of men, but chiefly by allaying the violence of spiritual madness.” Sprat directed such comments at the Puritan community in England who often raised doubts regarding the smooth collaboration between theology and the New Science. Other seventeenth century English thinkers like John Wilkins and Walter Charleton advanced comparable positions often in response to Puritan “spiritual madness” arguing that the study of

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61 Osler, “Mechanical Philosophy,” 149.
Nature provided knowledge of the Creator and Sustainer, brought believers closer to God, and fulfilled Christian obligations to the Deity.

Finally, before delving into Newton’s natural theology, it is essential to briefly overview the main theological stances of Henry More and the Cambridge Platonists. Almost all historians of Newton’s theological, alchemical, and scientific beliefs cite More and his fellow Cambridge Platonists as premiere influences in both Newton’s theology and natural philosophy.64 This school of philosophers, predominant at Cambridge in the middle of the seventeenth century, attempted to strike a balance between what they viewed as the anti-scientific orthodoxy of Puritans and Calvinists and the materialist tendencies of men such as Hobbes. More, along with other notable thinkers such as Benjamin Whichcote and Ralph Cudworth, supported extensive studies of natural philosophy while displaying its compatibility with theology through Neoplatonic philosophy. Interestingly, More and others espoused Plato’s idea of a “world soul” in order to describe rather than reject God’s ongoing role in the universe. For More, the “world soul” lay in between the material universe and the Divine and was thus, the tool God utilized to play an active part in the daily workings of the universe.65 While mechanists like Boyle also held a deep belief in an intervening God, they usually defended the stance through revelation in Scripture as described above. In contrast, the Cambridge Platonists found a way to integrate God’s permanent control into their natural philosophical depiction of the universe.

For centuries leading up to the watershed year of 1687, different Western thinkers focused their attentions on the skies for underlying theological reasons. The different theological motivations for examining the cosmos evolved between the Timaeus and the meetings of the

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65 Dobbs, The Janus Faces of Genius, 94.
Cambridge Platonists in order to incorporate novel scientific and theological developments. However, despite these alterations, individuals during this large stretch of time consistently explored the heavens to learn more about God as the creator and sustainer, to enhance their relationships and understandings of the Deity, and to perform the duties of their Christian faiths. In his crowning achievement *The Principia*, Newton, the natural philosopher we most often view as the pioneer of a completely new method of comprehending Nature, proved to be no exception.
Chapter 3

God as an Intelligent Creator

We know him [God] only by his properties and attributes and by the wisest and best construction of things and their final causes. 66

-Isaac Newton in the “General Scholium” to the second edition of The Principia (1713)

Newton spent his entire life trying to uncover the hidden order of the universe. He found this mission to be worthwhile only because he believed that an omnipotent and omniscient God had created such an order. Newton explored the cosmos in 1687 in part to gain knowledge of the divine Creator. However, while only several of Newton’s writings around 1687 illustrate this objective, he made the majority of his most famous and explicit comments concerning God as the creator after 1700 in editions of both of his major scientific works as well as his scriptural analysis. As a result, the latter half of Newton’s life is a convenient, albeit imperfect, place to start to examine his theological motivations for exploring Nature and the cosmos.

In the General Scholium first published in 1713, Newton links the heavens’ perfection with the work of a divine Creator. He writes, “This most elegant system of the sun, planets, and comets could not have arisen without the design and dominion of an intelligent and powerful being.” 67 Echoing the sentiments of numerous Western thinkers, Newton views the “elegance” of Nature as a manifestation of an intelligent designer’s hand. He describes what he means by “elegance” immediately before beginning his discussion on God, stating, “The six primary planets revolve about the sun in circles concentric with the sun, with the same direction of motion, and very nearly in the same plane. Ten moons revolve about the earth, Jupiter, and

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66 Newton, Principia, 942.
67 Newton, Principia, 940.
Saturn in concentric circles, with the same direction of motion, very nearly in the planes of the orbits of the planets.”  

Newton makes it clear in Book 3 that the planets and moons actually follow elliptical paths, and thus, we must take his use of the term “circular” in this case to be metaphorical. Nevertheless, he clearly associates “elegance” with circles and circular motion, a concept that he explores in great depth throughout The Principia. Following the prefaces, The Principia opens with a set of eight “definitions,” which gives Newton an opportunity to articulate his precise meanings for familiar but often ambiguous terms such as “the quantity of matter,” “the quantity of motion,” and “inherent force.” Definitions five through eight are all concerned with circular motion and more specifically with the properties of a “centripetal force” which he defines as “the force, by which all bodies are drawn from all sides, are impelled, or in any way tend, toward some point as a center.” In Book 3, applying this notion of centripetal forces to the cosmos, he reiterates already well-known theories—the earth exerts a centripetal force on the moon causing it to move in orbit just as the sun exerts a centripetal force on the planets. Thus, from the onset, Newton introduces the critical concepts that will eventually lead to an “elegant” picture of the cosmos. It is therefore noteworthy that when describing the “elegant” framework of the heavens in the passage quoted above, Newton writes metaphorically that the planets revolve in circular paths around the sun rather than the elliptical routes described by Kepler and further explained in the third book of The Principia. Since circles were

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68 Newton, Principia, 940.
69 Newton repeats Kepler’s laws (see note 66) and describes the elliptical orbits of the planets and moons in Book 3 of the Principia. He describes the planets’ orbits around the sun as “concentric” because the sun is always one of the two centers of a planet’s orbit and since the sun is far more massive than the other planets, “the actions of the planets upon one another…are so very small that they can be ignored.” Newton, Principia, 818.
70 Newton, Principia, 405.
71 Originally published in 1609, the first of Kepler’s “three laws of planetary motion” states that the orbits of each planet (which at the time referred to only Mercury, Venus, Earth, Mars, Jupiter, and Saturn) are ellipses with the Sun as one of the foci (plural of focus). While a circle refers to all of the points a set distance away from one center, an ellipse is defined by two centers or foci such that if we add up the distance from one focus to any point on the ellipse to the distance from the other focus to that same point on the ellipse, it will always be constant.
considered by both the Ancients and contemporaries to be a symbol of beauty and perfection, Newton tactfully and metaphorically approximates “ellipses” with “circles” in order to embellish the “elegance” of the cosmos, and thus, gain further insight about the divine Creator.

Along with focusing on the “elegance” of the heavens as a mark of God’s creation, Newton, in the General Scholium, mentions the practicality, efficiency, and diversity of the grand design. In the third edition of The Principia from 1726 he added in the General Scholium, “So that the systems of the fixed stars will not fall upon one another as a result of their gravity, he [God] has placed them at immense distances from one another.”72 God must have created the cosmos because it is both aesthetically and pragmatically perfect. Finally, only an omnipotent being could have chosen to create such a wide variety of entities. Newton adds to the 1726 edition of the General Scholium, “No variation in things arises from blind metaphysical necessity, which must be the same always and everywhere. All the diversity of created things, each in its place and time, could only have arisen from the ideas and will of a necessarily existing being.”73 In the closing essay to his major work added in 1713 and then revised thirteen years later, Newton pinpoints these three principal aspects of Nature that provide information about an intelligent Creator—“elegance,” practical efficiency, and variety. By paying special attention to subjects such as circular motion, he conducts his study of the cosmos by emphasizing areas that will inevitably lead us towards these key qualities of the heavens. Yet, due to the political and personal influences described in the Chapter 1, we must also look elsewhere in Newton’s writings to state with authority that he actively sought knowledge of a supernatural Creator in his study of the cosmos.

72 Newton, Principia, 940.
73 Newton, Principia, 942.
He elaborates on this mission in the “Queries” section of his other central book, *Opticks*. Originally published in 1704, *Opticks* is still viewed as a crowning achievement in experimental physics. Unlike *The Principia*, which followed a standard, Euclidean-based structure relative to other works in seventeenth century natural philosophy—definitions and axioms followed by theories that were often supported by experimental evidence but mainly deduced through mathematical rigor, the majority of *Opticks* is composed of descriptions and analyses of experiments utilizing inductive reasoning. Although, Newton developed a large portion of his findings in *Opticks* long before its first publication, (as was the case with *The Principia*) he did not organize and publish such a comprehensive collection of all of his discoveries relating to the refraction of light and the study of colors until 1704.

The book concludes with a series of “queries” pertaining to what Newton viewed as the major mysteries in the study of light and colors that remained unanswered after his investigations. Newton did include the first several queries in the original edition, but he added the majority of them in subsequent editions of the book in 1706 and 1717, and then in the posthumously published edition from 1730. Similar to his conclusion to the second (and subsequent) editions of *The Principia*, these final queries, added in later editions, often focus more on general philosophical and theological issues rather than on specific topics relating to the rest of the book. In Query 31 from the 1730 edition, (although first seen aside from some modifications as Query 23 in the 1706 Latin edition) Newton reiterates his “elegance” argument presented in the General Scholium. He states, “blind Fate could never make all the Planets move one and the same way in Orbs concentrick…Such a wonderful Uniformity in the Planetary...
System must be allowed the Effect of Choice.”\textsuperscript{74} Once again, he stresses the beauty of approximately concentric orbits to illuminate God’s creating hand. Moreover, he highlights the “uniformity” or order in the universe, which he immediately refers to as an effect of “choice” by the Creator.

Later in the thirty-first query, he explains that an experimental philosopher’s chief goal is to arrive, through a methodical form of analysis, at the divine Creator. First, he gives a brief description of his “Method of Analysis,” which is essentially identical to Francis Bacon’s process of induction proposed almost a century earlier. Newton states, “This Analysis consists in making Experiments and Observations, and in drawing Conclusions from them by Induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiments, or other certain Truths.”\textsuperscript{75} We will discuss this method based on “inductive logic” in further detail in later chapters, but for now, it is important only to note that Newton believed and followed a consistent step by step process in which observations and experimentation lead to conclusions. He explains, “By this way of Analysis we may proceed from Compounds to Ingredients, and from Motions to the forces producing them; and in general, from Effects to their Causes, and from particular Causes to more general ones, till the Argument end in the most general. This is the Method of Analysis.”\textsuperscript{76} Newton expresses that the central purpose of his scientific method is to logically transition from effects to causes. Additionally, he does not deem the discovery of more specific causes such as the ingredients of the compound or the forces producing motion to be the final aim of his investigation. Instead, he wishes to employ his method until he reaches the most “general” cause. In Query 28, he extends the overarching objectives of his “Method of


\textsuperscript{75} Newton, \textit{Opticks}, 404.

\textsuperscript{76} Newton, \textit{Opticks}, 404.
Ben Kirschenbaum

Analysis” to natural philosophy in general. He writes, “the main Business of natural Philosophy is to argue from Phaenomena without feigning Hypothesis, and deduce Causes from Effects, till we come to the very first Cause, which certainly is not mechanical; and not only to unfold the Mechanism of the World, but chiefly to resolve these and such like Questions.” He is clearly referring to God when he speaks of the “very first Cause,” and he even refers to God directly as the “first Cause” in Query 31. While it is apparent that Newton understood the study of natural philosophy as a path towards God, the passages quoted above do not necessarily imply that he sought knowledge of God’s role as creator. In other words, “coming to the very first Cause” may primarily mean getting closer to an already well-known Deity, rather than gaining information about God as the creator of the universe. If we consider God’s role as creator to be one of the “Questions” that Newton attempts to “resolve” then he is in fact seeking knowledge of the Creator by studying Nature, but he does not elaborate further on this point in these published queries.

Newton explicitly articulates his aim to find information regarding a divine first cause rather than simply “coming to the very first Cause” in an originally unpublished draft of Query 28, which can be dated to around 1710. He comments, “We see the effects of a Deity in the creation and thence gather the cause and therefore the proof of a Deity and what are his properties belongs to experimental Philosophy.” In direct opposition to Descartes, who included God’s existence as the creator as one of the improvable postulates of his overall philosophy, Newton and many of his contemporary English theologians such as Richard Bentley believed that the appropriate examination of Nature would lead to information regarding a divine

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77 Newton, *Opticks*, 369.
78 Newton, *Opticks*, 405.
It must be noted that Newton’s search for “information” does not imply that he had doubts about God as the creator; on the contrary, he believed that Nature held some of the secrets regarding the Creator’s attributes. Moreover, he may have sought after clear details of a divine Creator in order to convince others of God’s role. He wrote *Opticks* in English rather than Latin and completely refrained from including less widely known mathematical language prominent in *The Principia*, thus, making *Opticks* far more accessible to the literate English layman. As a result, these discussions regarding the path towards knowledge of an intelligent Creator may have been not only a reflection of Newton’s personal quest for understanding but also a message to his English readers.

These segments of the later editions of both *The Principia* and *Opticks* along with several of Newton’s works not related to natural philosophy reveal the thinker’s intense interest in the causes or “origins” of phenomena during the last few decades of his life. In a later non-scientific work, *The Chronology of Ancient Kingdoms* (published posthumously in 1728) he builds upon previous work\(^8\) to give a comprehensive history of different ancient societies including the Greeks, the Persians, and the Egyptians in order to revise the commonly accepted chronology of historical empires and prove that Solomon from the Old Testament was the first king in history. He also wrote extensive essays on Athanasius of Alexandria, the fourth century bishop who Newton believed was particularly instrumental in the origin of heresy in the Church regarding the Holy Trinity.\(^8\)

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82 We will discuss Newton’s anti-Trinitarian views briefly in the following chapters. In private, Newton strongly opposed the concept of the Holy Trinity believing that it was wrong to view Jesus, the Holy Spirit, and the Father as being on the same level. In many of his unpublished writings, he cites Athanasius and his participation in the First Council of Nicaea of 325, in which Emperor Constantine officially established the canonical view of the Trinity, as central in spreading what Newton believed to be a blasphemous opinion. See: Isaac Newton, *Twenty-three queries*
chronological studies—one is overwhelmed by his preoccupation with origins.” Manuel goes on to write, “It has been suggested…that a passionate quest for the historical genesis of families and kingdoms and civilizations may be related to an anguished desire to recover lost parents.”

Newton’s father died before he was born, and he spent the majority of his childhood apart from his mother. While Manuel does not give much credence to such a psychological analysis, he does note that the search for origins can be linked to Newton’s ongoing quest to find the divine Father. In his writings, both those relating to natural philosophy and those concerned with other matters, Newton consistently attempts to move from effects to their causes. As he made clear in Opticks and its drafts, this quest to understand specific causes was only one step towards understanding the first Cause.

While Newton displayed a significant ambition to find knowledge of God as the creator in the General Scholium and other eighteenth-century writings, it is necessary to investigate his earlier works in order to comprehend his goals around 1687. English chemist, Robert Boyle died in 1691 and in his will he endowed a series of lectures to “for proving the Christian Religion against notorious Infidels, viz. Atheists, Deists, Pagans, Jews and Mohametans.” In 1692, Cambridge classicist and theologian, Richard Bentley delivered the first lecture titled “A Confutation of Atheism.” Following Boyle’s wishes, Bentley utilized modern breakthroughs in natural philosophy to support a Christian understanding of the Divine. To prepare for his talks, Bentley conducted a correspondence with Newton, which wound up revealing substantial elements of Newton’s thinking pertaining to natural theology. Historians Henry Guerlac and

about the word ὅµοιοις (“Homoousian”),


Manuel, The Religion of Isaac Newton, 18.


The High Priest of Nature
M.C. Jacob explain, “Richard Bentley…was the eminent English classicist…who, for some obscure reason, emerged in his youth as the first expositor of the religious significance of Newton’s natural philosophy.” Guerlac and Jacob are referring here to Bentley’s own formulations first articulated in the 1692 lecture inspired by conversations with Newton, but Bentley may also be seen as a key figure in our understanding of Newton’s natural theology simply for giving Newton an opportunity to record and disseminate his views on theological subjects relating to his natural philosophy.

In these letters, Newton voices his aim to find information of a divine Creator through his natural philosophy. He starts his correspondence dated December 10, 1692 writing, “Sir, When I wrote my treatise about our Systeme [The Principia] I had an eye upon such Principles as might work with considering men for the beliefe of a Deity & nothing can rejoyce me more then to find it usefull for that purpose But if I have done the publack any service this way ‘tis due to nothing but industry & a patient thought.” Of course, Newton may be exaggerating his original theological motivations simply to please Bentley who was specifically interested in the study of the New Science as a means to gain a greater understanding of the Christian God. Nevertheless, Newton’s opening statement to Bentley is his most explicit proclamation of his search for knowledge of an intelligent Creator through an examination of Nature. Moreover, he tells Bentley that he seeks to find such information not for himself but for the general public.

In the same letter, Newton reiterates his view of God’s role as creator. He explains, without resorting to theological arguments, that if the universe is infinite it logically follows that

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distinct pieces of matter can exist without collapsing to some center of gravity. However, he
concedes that many cosmological questions are left unanswered:

But how the matter should divide it self into two sorts & that part of it which is fit to compose a
shining body should fall down into one mass & make a Sun & the rest which is fit to compose an
opake body should coalesce not into one great body like the shining matter but into many little
ones: or if the Sun was at first an opake body like the Planets or the Planets lucid bodies like the
Sun, how he alone should be changed into a shining body whilst all they continue opake or all they
be changed into opake ones whilst he remains unchanged, I do not think explicable by mere
natural causes but am forced to ascribe it to the counsel & contrivance of a voluntary Agent.88

Once again, Newton remarks on the organization and “elegance” of the cosmos and instantly
considers these qualities to be signs of God’s work. For Newton, God made the most practical
and beautiful choice among many when he arranged the sun and the surrounding planets.

Newton finds more knowledge of the divine Creator by noting that the cosmos contains
no superfluous entities. He writes to Bentley,

The same power whether natural or supernatural, which placed the Sun in the center of the orbs of
the six primary Planets, placed Saturn in the center of the orbs of his five secondary Planets &
Jupiter in the center of the orbs of his four secondary ones & the earth in the center of the Moons
orb; & therefore had this cause been a blind one without contrivance & designe the Sun would
have been a body of the same kind with Saturn Jupiter & the earth, that is without light & heat.
Why there is one body in our Systeme qualified to give light & heat to all the rest I know no
reason but because the author of the Systeme thought it convenient, & why there is but one body
of this kind I know no reason but because one was sufficient to warm & enlighten all the rest.89

In addition to further underscoring the elegant organization of the heavens, Newton here places a
special emphasis on the efficiency of the heavens. In both his natural philosophy and his
scriptural analysis, Newton consistently adheres to the “law of parsimony” also known as
“Ockham’s razor” named after the fourteenth century English philosopher and theologian
William of Ockham.90 The doctrine states that in all circumstances, one must choose the
simplest and most economical explanation for a given problem over those that incorporate
extraneous assumptions. Newton makes this principle the first of his “Rules for the Study of

88 Newton, Original Letter from Isaac Newton to Richard Bentley, dated 10 December 1692.
89 Newton, Original Letter from Isaac Newton to Richard Bentley, dated 10 December 1692.
Natural Philosophy” at the beginning of Book Three of *The Principia*. He states, “No more causes of natural things should be admitted than are both true and sufficient to explain their phenomena.”\(^9^1\) Considering both his adherence to this fundamental policy and Newton’s belief that the simplicity of the cosmos helps prove the work of an intelligent Creator, we see that Newton directs his studies in *The Principia* so that it may ultimately lead to knowledge of the Creator. He instructs his readers to analyze the heavens using the law of parsimony. Following this rule, the most economical explanation is given for a certain phenomena. He then tells us that the explanation could only be so efficient because of how God created the heavens. When he explains his first rule he writes, “Nature does nothing in vain, and more causes are in vain when fewer suffice. For nature is simple and does not indulge in the luxury of superfluous causes.”\(^9^2\) Thus, Newton creates a circular or self-reinforcing series of logic with respect to Nature’s simplicity—1) We believe that God created a universe that adheres to Ockham’s razor 2) As a result, we should follow Ockham’s razor in our examination of Nature and not consider extraneous causes 3) Following this rule, we find the simplest explanations for certain phenomena like how the sun is the only “body in our Systeme qualified to five light & heat to all the rest” 4) Finally, we conclude that only an intelligent Creator could have produced such an efficient system, bringing us right back to step 1. In his letters to Bentley in the early 1690’s, Newton displays that he had the fourth step of this process in mind when he wrote *The Principia*. Newton further reveals his thoughts linking the cosmos and its Creator in a draft manuscript on “Place, Time, and God” written around the same time as his letters to Bentley.\(^9^3\)

Newton began revising certain sections of the first edition of *The Principia* soon after his

\(^9^1\) Newton, *Principia*, 794.  
\(^9^2\) Newton, *Principia*, 794.  
correspondence with Bentley, and this essay, organized as a list of eight brief ideas, was one of the writings that did not ultimately get published in the later editions. He ends the manuscript by commenting, “Every diversity of things which is found at diverse places and times, was not of necessity, but drew its origin from the will of a necessarily existing being. For only an intelligent being by the power of its will acting on account of final causes could bring about the variety of things. But variety is especially found in bodies, and the bodies which impinge on the senses are the fixed Stars, the Planets, the Comets, the Earth and their parts.” Here, Newton clearly links the “variety” seen in the universe to God. Newton mentioned this connection in both *The Principia* and *Opticks* by noting that only a divine entity could “choose” to create the universe as it is. A choice is only possible if there is more than one option, and the “diversity of things,” which humans experience display the great number of options.

A juxtaposition of Newton’s divine associations with diversity and uniformity reveals his overall intentions in *The Principia*. On the one hand, Newton searches for knowledge of the Creator by exploring the variety of entities. He therefore studies every observable aspect of Nature from an apple falling to the ground to the rotation of the moons around Jupiter. After linking the great diversity of such phenomena to an intelligent Creator, he seeks to explore the similarities between the two events. Book 3 of *The Principia* underscores that the exact same force, gravity, with a uniform set of properties and laws associated with it, is the cause of both the moons’ rotation and the apple’s fall. So, by writing that both “variety” and “consistency” are marks of God, Newton wrote his major work with a set plan that could illuminate both of these characteristics.

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94 Newton, “Newton on Place, Time, and God,” 123.
While Newton clearly announced his desire to find knowledge of God as creator in *The Principia* after its first publication, we must still demonstrate that he had this ambition before 1687. The clearest articulation of this desire is found in his correspondences. In a letter dated April 25, 1685 Newton wrote to the physician William Briggs praising him for his discoveries in anatomy and optics in his work *Theory of Vision*. Newton ends the letter, “Continue…my distinguished friend, as you are doing, to develop these sciences by your notable discoveries, and bring home to us that the difficulties of natural causes can as easily be overcome by ingenuity as they are usually resistant to ordinary efforts.” As with his later writings, Newton endorses the pursuit for “natural causes,” which as we have seen earlier he ultimately associates with God. Moreover, he expresses his confidence that ingenious natural philosophy, which Newton certainly believed himself capable of, could lead a thinker to such causes.

Newton puts forth one last understanding of the intelligent Creator in his correspondence with the English theologian Thomas Burnett, who focused his theological studies on the creation of the universe. At the end of 1680 and the beginning of 1681, Burnett and Newton wrote to each other about the most reasonable reconciliations between the cosmos described in Scripture and new discoveries in natural philosophy. In a letter from January of 1681, Newton parses through specific lines of Genesis describing God’s creation of the world and explains how the correct interpretations of each of these passages are consistent with scientific understanding. After this lengthy analysis, Newton responds to a question from one of Burnett’s previous letters about the daily or “diurnal motion” of the earth around its axis. Newton explains,

> I must profess I know no sufficient natural cause of the earth's diurnal motion. Where natural causes are at hand, God uses them as instruments in his works, but I do not think them alone sufficient for the creation & therefore may be allowed to suppose that amongst other things God gave the earth its motion by such degrees & at such times as was most suitable to the creatures. If

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you would have a year for each days work you may by supposing day & night was made by the annual motion of the earth only & that the earth had no diurnal motion till towards the end of the six days. But you'l complain of long & dolefull nights.96

Thus, Newton introduces another element of the divine creation—the cosmos is structured perfectly for humans’ convenience.

From 1680 to his death in 1727, Newton expressed his desire to find knowledge of God as the creator through his natural philosophy. Since Newton already strongly believed in God’s role as the creator of the universe, he elected to interpret his science in such a way that he could learn more about the exact qualities and nature of God’s original design. Yet, since Newton wrote the majority of his theological writings, particularly those that also relate directly to his natural philosophy during the last few decades of his life, the majority of the aforementioned passages, with the exception of his letters to Burnett and Briggs, provide us with an incomplete understanding of Newton’s intentions in 1687. By the 1690’s and early eighteenth century, Newton had clearly articulated his theological drive to learn more of the divine Creator through the study of Nature, but in the years surrounding The Principia’s original publication, Newton seemed more concerned with a different aspect of the Divine.

96 The Correspondence of Isaac Newton: Volume II, 1675-1687, 334.
Chapter 4

Divine Intervention

Those men, who pretend that in an earthly government things may go on perfectly well without the king himself ordering or disposing of any thing, may reasonably be suspected that they would like very well to set the king aside.97

-Samuel Clarke in one of his letters to Gottfried Leibnitz from 1715

While Newton occasionally expressed his wish to learn more of a divine Creator in the 1680’s, he placed a greater emphasis during this period, on understanding God as the sustainer of the universe. Throughout all of his theological writings from his adult life, Newton underscored the Divine’s unlimited dominion over His Creation and a Judeo-Christian’s God permanent power to intervene in the workings of the universe. By the mid 1680’s, relatively novel theories of Nature, particularly the developing “mechanistic” outlook on the universe as articulated by Descartes, appeared to undermine a belief in God’s unbounded potency and control over Nature. Although Newton again made some of his clearest statements on God’s role as the sustainer in later works like the General Scholium, he also revealed his aspiration to develop a deeper knowledge of an intervening God of dominion through the study of natural philosophy in the 1680’s.

Newton never wavered in his belief that God continues to intervene in the universe following creation. He displays his belief in a personal God who maintains sovereignty over his creation in his college notebooks. In 1662, Newton wrote down a long list to God of his sins from his mundane offenses: “Eating an apple at Thy house” to his larger religious missteps: “Not

97 Samuel Clarke, The Leibniz-Cla rke Correspondence, 14. For more on Samuel Clarke and the Leibnitz-Cla rke Correspondence see note 118.
loving Thee for Thy goodness to us.”98 These early confessions, in many ways, set the stage for Newton’s continual relationship with the Divine. Newton needed to confess his sins and always follow God’s will because God was defined first and foremost by his ongoing dominion and supremacy. He underlines this point in the General Scholium. He writes, “the supreme God is an eternal, infinite, and absolutely perfect being; but a being, however perfect, without dominion is not the Lord God.”99 God is “eternal,” “infinite,” and “perfect” but according Newton, He would not be God if it were not for his omnipotence and “dominion.” As a result, he concludes, “the true God is living, intelligent, and powerful.”100 Historian James E. Force summarizes Newton’s consistent belief in providence:

While many of Newton’s religious understandings evolved greatly throughout the course of his life, he always contended that God permanently held absolute control over the universe.

Moreover, Newton actively sought for further understanding of God’s divine providence in many of his non-scientific studies. A large portion of his scriptural writings concerned God’s direct intervention in the world. From the 1670’s to the 1680’s, he wrote many drafts of “A Treatise on Revelation,” which dissected different instances of the Bible where God interrupted the normal “concourse of the laws of Nature” and revealed himself to a select prophet. Newton expressed a continual interest in studying revelation in the latter half of his life. He wrote a four-

100 Newton, *Principia*, 941.
part manuscript now known simply as “Notes on prophecies” at some point following 1700. Finally, he spent considerable time towards the end of his life composing a meticulous examination of the Book of Daniel, which was posthumously published in 1733.

His fascination with the prophecies of Daniel illustrates Newton’s ongoing interest in studying not only revelation but also the apocalypse. The Book of Daniel centers on the prophet Daniel who begins the Book as a slave in the Babylonian kingdom under King Nebuchadnezzar. Daniel eventually gains his freedom and is given the esteemed position of chief governor of the province of Babylon through his divinely inspired interpretation of the king’s dreams. The last five chapters of the book describe Daniel’s prophetic visions concerning the future of the Holy Land, which are directly referenced numerous times in the New Testament (in both the Gospels and the Book of Revelation) in passages concerning the Judgment Day and the end of times. In fact, the full title of Newton’s published manuscript is *Observations upon the Prophecies of Daniel, and the Apocalypse of St. John*. Newton expressed his concern with the end of days in his religious writings throughout the course of his life. In the early 1780’s he wrote a treatise in both English and Latin, which he titled “Prophesies concerning Christs 2d coming” mainly composed of a list of bible passages from the Books of Prophets such as Daniel and the New Testament. Additionally, he analyzed Scripture in order to pinpoint the exact dating of Christ’s second coming, a date which he revised at different points in his life. By dedicating so much of his religious studies to the subjects of revelation and the apocalypse, Newton clearly sought to further understand God’s ongoing role in the universe as outlined in the Book of Scripture.

Newton similarly pursued greater knowledge of divine providence in his alchemical studies. Betty Jo Teeter Dobbs traces the history of Newton’s alchemy in her pivotal work *The Janus Faces of Genius*. Dobbs writes, “Newton had no theological qualms regarding an active
universal agent that acted for God in the world to produce and guide the processes of vegetation; on the contrary he welcomed the existence of this spirit as certifiable evidence of providence. That was what alchemy was all about.”

Dobbs reports that Newton, for the majority of his life, envisioned a “vegetable spirit,” controlled by God that could determine the ongoing properties of matter. In the early 1670’s, Newton describes such a powerful spirit by stating, “This is the subtle spirit which searches the most hidden recesses of all grosser matter, which enters their smallest pores and divides them more subtly than any other material power whatever…This is nature’s universal agent, her secret fire.” In alchemy, Newton like many of his contemporaries including Robert Boyle, found the opportunity to trace God’s hand in the day-to-day workings of the universe. In the late seventeenth and early eighteenth century, thinkers like Newton and Boyle were particularly driven due to conflicting theories to further comprehend and reaffirm God’s providence in their natural philosophies as well.

Newton clearly found ways in both his alchemy and religious studies to investigate God’s continual role in the universe, but he also had incentives to incorporate his science in the endeavor. As introduced in Chapter 2, by the time of Newton’s first publication of The Principia numerous thinkers proposed theological ideas that potentially undermined God’s ever-present power in the universe. Proponents of the ancient Epicurean school of philosophy questioned God’s involvement in the universe after Creation. Epicurus was a Greek philosopher from the fourth century BCE most famous for his belief that all matter is composed of indivisible atoms that interact with each other without the influence of a Deity. As the philosophies of mechanism and atomism gained considerable support in the decades preceding Newton, many of Epicurus’ materialist theories found their way into the modern discussion, even if very few individuals

could be considered traditional “Epicureans.” Such notions as these set the framework for Deism, which was beginning to make its mark in England by Newton’s time.

Natural philosophers like Newton found perhaps their premiere impetus to solidify a belief in divine providence from their science in the philosophies of Descartes. The Cartesian conception of the universe received widespread approval amongst intellectuals on the continent in the latter half of the seventeenth century and remained among the dominant understandings of Nature well into the early eighteenth century. To comprehend the theological issues associated with Descartes’ philosophies, it is useful to organize the different elements of God’s assumed power. Dobbs describes the distinction between God’s *potentia ordinata* and his *potentia absoluta*. God’s *potentia ordinata*, or his “ordained power,” refers to the typical scenario where “though God can abrogate His natural laws whenever he so wills ordinarily He does not do so…but rather maintains the world in an orderly fashion by ordinary concourse.”\(^{104}\) In contrast, *potentia absoluta*, or God’s “absolute power,” reaffirms that “God may at any time use His laws in an extraordinary way, abrogate the laws completely, or decree that they be other than what they now are.”\(^{105}\) During the Reformation, many prominent religious leaders including Martin Luther, John Calvin, and Huldrych Zwingli wrote specifically about God’s absolute power to alter the ordinary laws of the universe.\(^{106}\) English “voluntarists” who, like Newton, found “God’s will to be His primary attribute” similarly stressed God’s two-pronged manner of controlling the universe.

Although he went through great pains trying to reconcile his natural philosophy with common articulations of divine providence, Descartes, in the eyes of many, disturbed the

framework of such beliefs. Descartes’ theories of motion as laid out in both his 1633 *Treatise on Light* and 1644 *Principles of Philosophy* describes a God that “‘maintains…by His normal participation’ the same amount of motion with which He endowed the universe in the beginning and so guarantees that nature will always operate in a regular manner.”\(^{107}\) In Descartes’ conception of the universe, God created matter, set it in motion, and continues to oversee his creation through His *potentia ordinata*. Descartes describes the fundamental principles of motion in his first two “laws of nature” included in his *Principles*: “The first law of nature: that each thing, as far as is in its power, always remains in the same state; and that consequently, when it is once moved, it always continues to move...The second law of nature: that all movement is, of itself, along straight lines.”\(^{108}\) Generally speaking, these two laws articulate what Newton would later include as his first law of motion or “the principle of inertia” – unless acted on by outside forces, a body at rest stays at rest while a body moving with constant speed continues to move in a straight line with the same speed. Descartes immediately links his concept of inertia with the hand of God. After introducing his second law of nature, he writes, “This rule, like the preceding one, results from the immutability and simplicity of the operation by which God maintains movement in matter.”\(^{109}\) Descartes believes in a God of providence, but in instances such as these he downplays God’s *potentia absoluta* in favor of his overseeing the world through a set of consistent laws. Contemporary natural philosophers such as Pierre Gassendi as well as Cambridge Platonists like Henry More found this aspect of Descartes’ philosophy particularly troubling and immediately stressed “that God did not abandon the world

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\(^{109}\) Descartes, *Principles of Philosophy*, 60.
to run by itself after He created it. Scope must also be allowed for His special (extraordinary) providence; Descartes’s constantly operating mechanical laws cannot be the whole story.”

Descartes seemed to further dismiss God’s *potentia absoluta* in his cosmology. In Part III of his *Principles* titled “Of the Visible Universe,” Descartes describes the cosmos as being composed of adjacent “vortices” that leave no room for completely empty space. Descartes includes several illustrations of his vortex theory in the book, one of which is included at the end of this chapter (See Figure 3). In essence, the vortex theory divides the universe into a number of systems that can each be examined on its own terms. Descartes explains, “The matter of the heaven, in which the planets are situated, unceasingly revolves, like a vortex having the sun at its center.”

Within this “great vortex… {having the Sun at its center}, there are other smaller ones which we can compare to those I have often seen in eddies of rivers where they [all follow the current of the larger vortex which carries them, and] move in the direction in which it moves. One of these has Jupiter at its center, and moves with it four satellites [moons] which revolve around Jupiter…Similarly the vortex which has the Earth at its carries the Moon around the Earth.”

Inside each vortex, matter moves through an “aether” or some sort of propagating matter. Although the term’s meaning has changed depending on the situation, “aether” has been a central concept in attempts to understand a wide range of physical phenomena since the sixteenth century. In the context of seventeenth century cosmology, natural philosophers like Descartes and later Christian Huygens and the Swiss mathematician Nicolas Fatio de Duillier proposed that space is filled by invisible particles that constantly act on one another. These unseen pieces of matter explain how action can occur over greater distances. For example,

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natural philosophers of the seventeenth century who believed in the Copernican universe, agreed that the earth revolves around the sun. It follows logically that the sun must be exerting some sort of a force on the earth in order to cause these revolutions. But how can the sun exert a force on a body that is millions of miles away? Descartes reasoned that the sun and the earth are part of a larger system—the great vortex with the sun at its center. The system is completely filled up by matter, some which can be seen like the Earth and some that are imperceptible to human senses. All of this matter is consistently in contact, thus, the sun can affect the earth’s motion through the contact of all of the imperceptible matter in between the two entities.

As with his concept of inertial motion, many of Descartes’ contemporaries quickly attacked his vortex theory on theological grounds. Once again, thinkers like More believed that this Cartesian system was in danger of eradicating a providential God. More wrote of the vortex theory that it would, “at the very first seizure upon it,... fall a pieces like a rotten duck in a man’s hand, or vanish like a mist, and leave nothing but a few empty termes, or Logicall notions, insted of substantiall truth.”

Although More proposed a series of non-theological explanations for the Cartesian philosophy’s shortcomings, the root of his disdain for the theory related to God. More expressed his views on Cartesian philosophy in a series of letters to Descartes and then began to directly attack Descartes and his philosophies in his works Divine Dialogues (1668) and Enchiridion Metaphysicum (1671). In the latter book he writes, “No greater wound or injury can be inflicted upon those elements which are most essential to religion, than by the possible presumption of the resolution of all phenomena into purely mechanical causes, not excepting the bodies of plants and animals. Which is the Cartesian hypothesis...”

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refuted claims that his mechanical philosophy contradicted a providential God, but his vortex theory as well as his understandings of motion, appeared to many to describe a completely self-contained and self-sufficient system. In response, Henry More and then Newton made it a priority to shatter the Cartesian outlook.

Newton makes his mission to reclaim the prominence of a providential God apparent in the General Scholium. He begins the essay directly attacking Descartes’ vortex theory. He opens the General Scholium, “The hypothesis of vortices is beset with many difficulties” and then proceeds to list several of the physical contrasts between the Cartesian philosophy and his own findings. Newton begins his discussion of the Deity immediately after countering the Cartesian theory. As we saw briefly above, Newton stresses God’s ever-present power and dominion. He states, “We venerate and worship him because of his dominion. For we worship him as servants, and a god without dominion, providence, and final causes is nothing other than fate and nature.”

Thus, the General Scholium provides a window into Newton’s train of thought—he attacks Descartes’ vortex theory and then immediately after stresses the role of a providential God. Newton made arguments based on his natural philosophy in order to refute Descartes, but the remainder of the General Scholium starts to reveal that he took up the study for its theological implications.

At the end of the General Scholium, Newton reflects on his concept of universal gravitation, which at its core disproves fundamental aspects of the Cartesian cosmos. Newton posited that all bodies exert a force on each other known as gravity and that the strength of this force depends on a mathematical equation involving the masses of the two bodies and the distance between them. Therefore, one did not necessarily need to believe in an invisible

“aether” that in a sense “connected” the two distant bodies. Yet, this still brings us back to the question mentioned with respect to Descartes—how can a body exert a force on another body without making contact with it? Newton grappled with this conundrum for decades, and at different moments in his life, he articulated various explanations. Yet, in the General Scholium, Newton avoids making an educated guess. He tells his readers, “Thus far I have explained the phenomena of the heavens and of our sea by the force of gravity, but I have not yet assigned a cause to gravity. Indeed this force arises from some cause that penetrates as far as the centers of the sun and planets without any diminution of its power to act…and whose action is extended everywhere to immense distances…I have not as yet been able to deduce from phenomena the reason for those properties of gravity, and I do not feign hypothesis.”

Newton rejects the vortex theory, and supplants it with an overarching philosophy that provokes major questions, which in 1713 he had no answer for.

In the final paragraph of the General Scholium, Newton does not “feign a hypothesis” regarding the cause of gravity, but he does suggest to his readers that the underlying cause may be outside the realm of natural philosophy. He states, “A few things could now be added concerning 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.”

A great deal has been written over the past few centuries about this passage and the few lines that follow it, attempting to discover exactly what Newton meant by this mysterious “spirit.” For our purposes, it is most critical to note the usage of the word “spirit.” As mentioned above,

118 For more on the possible interpretations of the “spirit” see: Note “pp” in Cohen and Whitman, *Principia*, 943.
Newton often used the same term in his alchemy to describe a “subtle” metaphysical property that God utilizes to control the universe. He also mentions the word in his theological writings. In a late religious manuscript titled “Irenicum, or Ecclesiastical Polyty tending to Peace” he refers to the Holy Ghost as “the Spirit of truth from…the father.” In all of these cases, a “spirit” is a mysterious divine entity. Thus, Newton offers a potential replacement for the Cartesian vortex theory with a “spirit” ensuring that God remains in direct control of His creation. Even though Newton proposed different possible solutions to some of the fundamental questions of motion in the years before 1713, his persistence in debunking certain Cartesian philosophies in order to reestablish the role of a providential God was unwavering.

Moving back in time from the first publication of the General Scholium in 1713, we see that Newton continually explored his natural philosophy in order to better understand divine providence. In Query 23 of the 1706 Latin edition of *Opticks*, which later became Query 31, Newton writes that the “Actions of the Comets and the Planets upon one another” causes “Irregularities” in the structure of the cosmos that “will be apt to increase, till this System wants a Reformation.” Throughout the course of his life and particularly in his final years, Newton would develop a series of theories, many centered on the properties of comets, that could explain exactly how God “reformed” the world. Newton posited that God must regularly “reform” the

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120 Newton, *Opticks*, 402.
121 For a detailed analysis on the development of Newton’s cosmology with respect to comets and divine providence see: David Kubrin, “Newton and the Cyclical Cosmos: Providence and the Mechanical Philosophy,” *Journal of the History of Ideas* 28 (3) (1967): pp. 325-346. In this article, Kubrin traces the course of Newton’s thinking leading up to his declaration in 1706 that the cosmos were structured in such a way that it needed to be periodically “reformed.” Kubrin also provides background information comparing Newton and Leibnitz’ different notions of divine providence. Leibnitz objected to Newton’s opinion that the cosmos would ever require reformation. He reasoned that God would only need to “reform” the universe as Newton described if God had made an imperfect Creation, a view that Leibnitz (and almost all other contemporary Christians) would view as blasphemous. This debate between the theories of Leibnitz and Newton is best represented in the famous “Leibnitz-Clarke” correspondence from 1715 to 1716. Samuel Clarke was a renowned English philosopher and theologian and a staunch supporter of Newtonian
universe not only because of “irregularities” in motion but also because the aggregate motion in the universe perpetually decreased. In 1694 he stated, “Motion is more apt to be lost than got, and is always upon the Decay...Seeing therefore the variety of Motion which we find in the World is always decreasing, there is a necessity of conserving and recruiting it by active Principles.” By the early 1690’s, Newton had clearly reasoned that God must by some means, employ his *potentia absoluta* and directly interfere with the normal workings of the universe. After a discussion with Newton in 1694, the Scottish Mathematician David Gregory wrote that Newton asserted that “a continual miracle is needed to prevent the Sun and the fixed stars from rushing together through gravity.”

Over the next three decades, Newton would think of detailed descriptions of God’s necessary interventions in the mechanical world, but for our discussion here it is sufficient to note that Newton believed that clues of divine providence could be found in Nature as early as the 1690’s.

Newton wrote *The Principia*, in large part, to learn more about God’s ongoing control of the universe. As we have seen, he made this intention relatively clear in his writings after *The Principia*, but he also revealed this theological motivation in the original 1687 edition. In many ways, *The Principia* was a direct response to Cartesian philosophy. We discussed this claim briefly in Chapter 1 noting that the title of the work was a direct reference to Descartes’ 1644 book in which he articulates his cosmology. In his preface to the second edition of *The Principia*, Roger Cotes pinpoints Cartesian philosophy as the central doctrine Newton’s

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Principia sought to destroy. Cotes writes, “There are some who do not like all this celestial physics just because it seems to be in conflict with the doctrines of Descartes and seems scarcely capable of being reconciled with these doctrines. They are free to enjoy their own opinion, but...we should be allowed to adhere to the Newtonian philosophy, which we consider truer.”\textsuperscript{124} Many of The Principia’s early readers immediately connected it to Descartes’ major theories. In December of 1688 Huygens commented of The Principia, “Newton has brushed aside all difficulties [concerning the Keplerian laws] together with the Cartesian vortices; he has shown that the planets are retained in their orbits by their gravitation toward the sun.”\textsuperscript{125} For those less scientifically astute than Huygens, Newton explicitly highlights the inadequacies of Descartes’ vortex theory in The Principia itself. The entire second book of The Principia is included solely to refute Descartes’ vortices, and Newton concludes Book 2 by writing, “Therefore the hypothesis of vortices can in no way be reconciled with astronomical phenomena and serves less to clarify the celestial motions than to obscure them.”\textsuperscript{126} In writing his groundbreaking work of 1687, Newton sought to undermine Cartesian concepts such as Descartes’ vortices. As we have seen, such theories raised serious theological concerns for many of Newton’s influential acquaintances and contemporaries. These two statements, thus, beg the question—did Newton seek to refute Descartes in 1687 partially for theological reasons especially relating to divine providence?

Newton’s specific definitions of several fundamental terms at the beginning of his major work unveil that we must answer this posed question in the affirmative. Newton writes his third “definition” at the beginning of Book 1 on “vis insita” or “inherent force.” He states, “Inherent

\\textsuperscript{124} Newton, Principia, 393.
\textsuperscript{126} Newton, Principia, 790.
force of matter is the power of resisting by which every body, so far as it is able, preserves in its state either of resting or of moving uniformly straight forward...Inherent force may also be called by the very significant name of force of inertia.”

Although Newton goes on to distinguish inherent force from “impressed force...exerted on a body to change its state either of resting or of moving uniformly straight forward,” it is still surprising at first that Newton would use the term “force” to describe inertia. When we think of forces we are most likely picturing what Newton calls an “impressed force” that ultimately alters the motion of another body, not the inherent tendency for bodies to simply stay in the same state whether it be at rest or moving in a straight line at constant speed. Newton’s usage of the word “force” is the main distinction between his concept of inertia and the one proposed by Descartes in his first two laws of Nature in *Principles of Philosophy* quoted above. I. Bernard Cohen explains, “Newton’s concept of inertia introduced an important alteration that made a significant transformation of the concept discussed by Descartes. ‘Inertia’ in Descartes’s usage was a property of ‘inertness,’ whereby matter could not of and by itself keep moving when the moving force ceases to act. Newton’s concept...implied a ‘force’ of maintaining whatever state a body happens to be in.”

Newton’s demarcation of inertia as a “force” rather than a “property” is not merely a question of semantics. Cohen comments, “By introducing ‘force’ of inertia rather than simply ‘inertia’ as a property of matter, Newton...has not fully abandoned the ancient notion that every motion must require a ‘mover’ or some kind of moving force, even if a very special kind of internal force.”

Consequently, Newton begins to tackle questions of divine providence in the wake of Cartesian philosophy in one of the first pages of *The Principia*. Henry More and others believed that

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Descartes’ mechanistic form of inertia could potentially eliminate the need for God, and in his third definition, Newton attempts to fix the problem by deeming inertia a force. Cohen points out that Newton may have developed his idea of an inherent force from reading More’s *The Immortality of the Soul* in which he refers to an “innate force or quality…implanted in earthly bodies.”

While Newton’s theories did not perfectly line up with More’s Platonist perceptions, both men clearly noticed the same theological flaw in Descartes’ theory and proposed a similar alternative.

Newton further dismisses Descartes’ principles in order to make room for divine providence with his definitions of absolute space. In the first Scholium of *The Principia* following the first eight “definitions” Newton writes, “Although time, space, place, and motion are very familiar to everyone, it must be noted that these quantities are popularly conceived solely with reference to the objects of sense perception. And this is the source of certain preconceptions; to eliminate them it is useful to distinguish these quantities into absolute and relative, true and apparent.”

Like many of the terms that he defines in the previous section, Newton is aware that he often uses common expressions in a very particular fashion. After explaining his distinction between absolute and relative time, he explains, “Absolute space, of its own nature without reference to anything external, always remains homogenous and immovable.” He goes on to write that we perceive “relative space” rather than this “absolute” framework. In other words, there exists a constant and infinite structure of space, but due to our limited senses, we can only understand space based on the relative spaces that bodies take up.

He expands, “Place is the part of space that a body occupies, and it is, depending on the space,

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131 Newton, *Principia*, 408.
132 Newton, *Principia*, 408.
either absolute or relative.”\textsuperscript{133} Without probing too deeply into the subtle differences between these definitions, it is most important to note that Newton finds it crucial, at the very beginning of his work, to underline that “absolute” space and place exist while we can only understand these concepts “relatively.” Newton elucidates these complex ideas with an example. He states, “In a ship under sail, the relative place of a body is that region of the ship in which the body happens to be or that part of the whole interior of the ship which the body fills.”\textsuperscript{134} Thus, the relative “place” of the body is always measured with some larger framework in mind—e.g. the rest of the ship or the world. In contrast, the body on the ship has an “absolute” place in the universe that cannot be quantified.

Newton goes into a detailed discussion of absolute and relative space and place to continue to separate his ideas from those of Descartes. In his \textit{Principia of Philosophy}, Descartes famously distinguishes between two kinds of “substances”—mind and body or “corporeal substance.” He explains, “Each substance has only one principal property which constitutes its nature and essence, and to which all the other properties are related. Thus, extension in length, breadth, and depth constitutes the nature of corporeal substance; and thought constitutes the nature of thinking substance.”\textsuperscript{135} For Descartes, bodies or matter are defined by their “extension” or the place that they occupy. He later uses this understanding to reject the possible existence of a vacuum or “a space in which there is absolutely nothing.”\textsuperscript{136} While making this argument he writes, “the extension of space, or of internal place, does not differ from the extension of body. From the sole fact that a body is extended in length, breadth, and depth; we rightly conclude that it is a substance: because it is entirely contradictory for that

\textsuperscript{133} Newton, \textit{Principia}, 409.
\textsuperscript{134} Newton, \textit{Principia}, 409.
\textsuperscript{135} Descartes, \textit{Principles of Philosophy}, 23.
\textsuperscript{136} Descartes, \textit{Principles of Philosophy}, 46.
which is nothing to possess extension.”137 Looking at both of these passages, it is clear that Descartes and Newton proposed very different understandings of space and place. Descartes viewed place and body as inseparable concepts—a body is defined by its place and that place is, in turn, marked by the body that occupies it. Newton’s inclusion of an “absolute” place and space disagrees with such an outlook. For Newton, the ideas of space and place exist completely independent of the bodies that fill it.

Newton highlighted the contrast between absolute space and place in response to Descartes’ concept of extension in order to defend belief in a providential God. In the General Scholium, he links his idea of “absolute” time and space with the Divine. He states of God, “He is eternal and infinite, omnipotent and omniscient, that is, he endures from eternity to eternity, and he is present from infinity to infinity…He endures always and is present everywhere, and by existing always and everywhere he constitutes duration and space.”138 Ultimately, God rather than bodies define space. Newton had clearly noticed the theological distinction between Descartes’ ideas and his own at the time of writing The Principia. Around 1684139, Newton wrote a treatise titled De Gravitatione et Aequipondio Fluidorum directly addressing many of Descartes’ core concepts laid out in the Treatise on Light and Principles of Philosophy. In the work, he states, “If we say with Descartes (that) extension is body, do we not rather manifestly spread the way to atheism, for then that extension is not being created but was from eternity,

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137 Descartes, Principles of Philosophy, 47.
138 Newton, Principia, 941.
139 This document was thought to have been written earlier (around 1671) before Dobbs argued for the 1684/1685 dating in some of her main works. At this point, Dobbs’ dating is widely accepted amongst Newton scholars. See: Dobbs, The Janus Faces of Genius, 143-146; J.E. McGuire, “The Fate of the Date: The Theology of Newton’s Principia Revisited,” in Rethinking the Scientific Revolution, 271.
whereupon we have an absolute idea of it without any relation to God.”140 Along with pinpointing Cartesian extensions’ incompatibility with God’s power as the Creator, Newton additionally reveals why Descartes’ idea undermines belief in an ever-present and active God. Descartes proposed that bodies define the space that they occupy leaving God’s role in the grand structure obsolete. Thus, in the case of both inertia and absolute space and place, Newton includes particular definitions of certain terms in the first section of *The Principia* in order to denounce Cartesian philosophies in favor of a providential God.

In 1687, contemporary theories, especially those of Descartes prompted Newton to learn more about divine providence through his natural philosophy. Like Henry More and other devout Christians who examined the relationship between theology and science, Newton believed that certain elements of Cartesian philosophy threatened the position of an intervening God of dominion. As a result, in the years leading up to the first publication of *The Principia*, Newton found ways to explore and solidify God’s position as the sustainer of the universe through his scientific ideas.

Figure 3

One of Descartes’ diagrams from the *Principles of Philosophy* of his “vortex” model of the universe. The sketch depicts disjoint and adjacent sections of the cosmos each centered on a certain point (marked for example by “S” or “F”). Taken from the final illustrations section of: Descartes, *Principles of Philosophy*. 
Chapter 5

His God-Given Mission

The things that so often vexed the minds of the ancient philosophers/ And fruitlessly disturb the schools with noisy debate/ We see right before our eyes, since mathematics drives away the cloud/ Error and doubt no longer encumber us with mist;/ for the keenness of a sublime intelligence has made it possible for us to enter/ The dwellings of the gods above and to climb the heights of heaven...Join me in singing the praises of Newton, who reveals all this./ Who opens the treasure chest of hidden truth...No closer to the gods can any mortal rise.141

-Edmond Halley’s Ode at the beginning of The Principia

Newton’s search for a greater understanding of God as the creator and sustainer of the universe is only one element of his larger theological mission. In Chapters 1 and 2, we listed four principal branches of the study of natural theology—the first two pertaining to knowledge of God as the creator and preserver, and the other two relating to one’s personal quest to get closer to God and to fulfill one’s God-given duties. In the case of Newton, these two latter categories are so intimately connected that it is appropriate to discuss them in conjunction. In this chapter, we shift away from Newton’s attempts to acquire knowledge of God specifically as creator and sustainer and examine his more general theological ambitions with respect to his natural philosophy. While many of Newton’s writings reflect different changes and developments in his thinking over time, he had a relatively consistent understanding of his God-given responsibilities, and this divine quest clearly incorporated his aspirations to become closer to the Deity. In 1687, he believed that scriptural analysis complemented with scientific studies could help him achieve these goals.

We may divide Newton’s overarching theological aims into two principal categories—1) a more standard ambition to be what he deemed “a good Christian,” chiefly in order to be saved

141 Edmond Halley, “Ode on This Splendid Ornament of Our Time and Our Nation, the Mathematico-Physical Treatise by the Eminent Isaac Newton,” in Principia, 379.
on the Judgment Day 2) his wish to gain a more significant understanding and intimacy with the Divine than the average believer. We have already seen from Newton’s theological notebook while still a student at university that he cared deeply about personally respecting God’s dominion and following God’s rule. Newton’s basic understanding of God’s principal laws as laid out in Scripture remained fairly constant throughout his life. He begins the late religious treatise “Irenicum, or Ecclesiastical Polyty tending to Peace” stating, “In matters of religion the first & great Commandment hath always been: Thou shalt love the Lord thy God with all thy heart & with all thy soul & with all thy mind. And the second is like unto it: Thou shalt love thy neighbour as thy self. On these two hang all the Law & the Prophets.”

Newton stressed that God required all Christians to obey these two fundamental laws. As historian Scott Mandelbrote succinctly puts it, “Duty, rather than election, is the key to man’s relationship with God, for Newton.”

As we viewed previously, Newton’s God is defined first and foremost by his power and dominion, and for this reason, we can never question our duty towards Him. He states in the “Irenicum” that “The true religion consists in our duty towards God, our duty towards our neighbour, & our duty towards Christ.” We are obliged to obey God’s will, in large part, in order to be saved on the final Judgment Day. In an “Untitled Treatise on Revelation” from the 1680’s, he comments, “Greater judgments hang over the Christians for their remisness than ever the Jews yet felt.”

Here Newton refers to the Jews during Christ’s life who did not accept Jesus as the messiah. In other words, since the apocalypse is quickly approaching, Christians must, more than ever, follow God’s overarching laws in order to be saved.

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142 Newton, *Irenicum, or Ecclesiastical Polyty tending to Peace.*
144 Newton, *Irenicum, or Ecclesiastical Polyty tending to Peace.*
Beyond seeking redemption through his dedication to God’s will, Newton wanted to gain a particularly powerful personal relationship with and knowledge of God. Like many contemporary English natural philosophers as well as other eminent thinkers like Galileo and Kepler, Newton considered himself part of an elite group, which was capable of gaining a special comprehension of the Divine. In the “Irenicum” Newton quotes the apostle Paul to distinguish between two levels of Christian worship. All Christians must abide by the simple “first Principles of the doctrine of Christ”; they must be baptized and then follow the basic “catechizing” laid out in the Gospels. All Christians are to follow “the first two commandments…forsake the Devil, that is, all fals Gods & all manner of idolatry…forsake the flesh & the world…believe in one God, the father, almighty in dominion…and in one Lord Jesus Christ the son of God, who was born of a Virgn & sacrificed for us on the cross, & the third day rose again from the dead…& who shall come again to judge the quick & the dead raised again to life.”

After listing off these core beliefs that must be held by all individuals who are baptized and then granted “admission into communion” Newton writes,

All this the Apostle Paul calls milk for babes & the foundation & first Principles of the doctrine of Christ. And those things which are to be learnt after admission into communion he calls strong meat for men of riper years. For in writing to the Hebrews he saith: When for the time ye ought to be teachers, ye have need that one teach you again which be the first principles of the oracles of God; & are become such as have need of milk & not strong meat. For every one that useth milk, is unexercised in the word of righteousness, for he is a babe. But strong meat belongeth to them that are of full age, even those who by reason of use have their senses exercised to discern both good & evil.

Throughout his life, Newton was not content to remain a “babe” but instead sought after the “strong meat” awarded to men of “full age.” He did not view the acquirement of this “strong meat” as “necessary to salvation”; it was a supplementary reward reserved for the sagacious and exceptional.

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146 Newton, *Irenicum, or Ecclesiastical Polyty tending to Peace.*
147 Newton, *Irenicum, or Ecclesiastical Polyty tending to Peace.*
While Newton had ambitions to attain “stronger meat,” he always underlined the inherent limitations to his understanding of God. In the General Scholium Newton reflects of God,

He is all eye, all ear, all brain, all arm, all force of sensing, of understanding, and of acting, but in a way not at all human, in a way not at all corporeal, in a way utterly unknown to us. As a blind man has no ideas of colors, so we have no idea of the ways in which the most wise God senses and understands all things. He totally lacks any body and corporeal shape, and so he cannot be seen or heard or touched...We have ideas of his attributes, but we certainly do not know what is the substance of any thing. We see only the shapes and colors of bodies, we hear only their sounds, we touch only their external surfaces, we smell only their odors, and we taste their flavors. But there is no direct sense and there are no indirect reflected actions by which we know innermost substances; much less do we have an idea of the substance of God.  

Although Newton certainly had substantial theological goals, he always expressed a fear of allowing his pride to “provoke the wrath of God his Father.” He manifested this concern by continually stating that different ancient thinkers had already known many of his most important discoveries. Numerous Newton historians over the past century, notably J.E. McGuire, P.M. Rattansi, and B.J.T. Dobbs have examined Newton’s *prisca sapientia* or his belief in the wisdom of the ancients in his theological, alchemical, and scientific writings. Lawrence M. Principe describes Newton’s *prisca sapientia*, which he notes “was popular in the Renaissance and early modern period” writing, “Newton believed that the ancients were possessors of abstruse truths in both theology and natural philosophy...he believed that even his inverse-square law of gravitation was known to the ancients, and consequently that he was its restorer, not its discoverer.” Frank Manuel convincingly argues that Newton held a steadfast belief in ancient wisdom because he feared excessive pride in his theological endeavors. Manuel states, “He was so terrified by the *hubris* of discovery of which he was possessed that, as if to placate God the

Father, he assured his intimates and himself that he had broken no prohibitions against revealing what was hidden in nature, that he had merely uttered in another language what the ancients had known before him.”152 Thus, Newton’s personal theological goals always remained complex and almost contradictory. He firstly needed to, like all “babes,” strictly follow God’s “first Principles”. Additionally, he considered himself chosen, in what some historians including Manuel have considered a prophetic sense, to acquire a much greater and deeper knowledge of the Divine. Yet, in his pursuit of this layered religious agenda, he must remember to never fly too close to the sun on wings of wax.

Newton integrated his various endeavors in order to reach his theological aims. Following many of the leading Protestant thinkers of the Reformation, he considered an in depth knowledge of Scripture paramount to reaching his goals. In his “Untitled Treatise on Revelation” Newton tells the reader to “search the scriptures thy self & that by frequent reading & constant meditation upon what thou readest, & earnest prayer to God to enlighten thine understanding if thou desierest to find the truth.”153 As we have already discussed, Newton placed a particular emphasis on the prophets of the Old Testament, particularly Daniel and their predictions of the apocalypse. In the same treatise, Newton introduces his scriptural analysis by explaining why a close reading of prophecies is such a critical enterprise. He writes, “That the benefit which may accrew by understanding the sacred Prophesies & the danger by neglecting them is very great & that the obligation to study them is as great may appear by considering the like case of the Jews at the coming of Christ. For the rules whereby they were to know their Messiah were the prophecies of the old Testament.”154 He goes on to describe how Jews who

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152 Manuel, The Religion of Isaac Newton, 23.
153 Newton, Untitled Treatise on Revelation.
154 Newton, Untitled Treatise on Revelation.
did not accept Jesus as the Messiah conducted an improper examination of the prophecies in the Old Testament, and since, as we saw before, Christians in Newton’s day awaited even “Greater judgments” than the Jews, they needed to immediately parse through the prophecies so that they would not accept the Antichrist as their savior when he arrives. After commenting that God forced the Jews to “incur eternall damnation” for not accepting Christ as the Messiah, he states, “If God was so angry with the Jews for not searching more diligently into the Prophesies which he had given them to know Christ by: why should we think he will excuse us for not searching into the Prophesies which he hath given us to know Antichrist by? For certainly it must be as dangerous & and as easy an error for Christians to adhere to Antichrist as it was for the Jews to reject Christ.” As a result, Newton deemed that Christians needed to know and study Scripture in order to fulfill key elements of “God’s first Principals”—namely, to consistently worship the one God of dominion and not be tempted by false deities and beliefs.

Moreover, Newton prioritized the study of Scripture to fulfill his role as one of the chosen individuals who were given “strong meat.” In the passage quote above from the “Irenicum” where Newton discusses the difference between babes and those receiving “strong meat” he names the latter group “teachers” who remind the rest of “the first principles of the oracles of God.” Since Christians can understand these first principals by looking at Scripture, Newton could present his analysis to others to distinguish himself as one of these “teachers.” He opens the “Untitled Treatise on Revelation” writing, “Having searched after knowledge in the prophetique scriptures, I have thought my self bound to communicate it for the benefit of others,

155 Newton, *Untitled Treatise on Revelation.*
remembering the judgment of him who hid his talent in a napkin.” 156 Newton later states that he intends his treatise to be “a guide” for others. 157 Newton could not ignore Scripture if he truly intended to be a great teacher who gained a deeper knowledge of God. He comments, “The wise men of the world are often too much prepossessed with their own imaginations & too much intangled in designs for this life” to gain a deep understanding of Scripture, which he calls the “gift of God.” 158 Newton refused to be one of these men, and chose instead to utilize God’s granting him “wisdom” by meticulously investigating his Word.

Both of Newton’s chief theological aims led him to closely examine Scripture throughout the course of his life, causing him to pinpoint the most effective approaches to carry out the mission. Newton believed that Scripture was purposely written in an intricate fashion that most men could not understand. In the “Untitled Treatise on Revelation” he states that it is “contrary…to God’s purpose that the truth of his religion should be as obvious & perspicuous to all men as mathematical demonstration.” 159 Newton directs these words towards Catholics whom he believes blindly follow the inaccurate interpretations of Scripture conducted by others rather than investigating God’s Word for themselves. He views a personal examination of Scripture to be so crucial because the Bible is very difficult to decode accurately. Theologians of the past have failed to properly interpret Scripture because both the Old and New Testaments, and the Prophets in particular, are written in a specific and complex form. In an “Incomplete treatise on prophecy” written during the 1680’s, Newton declares, “He that would understand a book written in a strange language must first learn the language & if he would understand it well

156 Newton, Untitled Treatise on Revelation; The reference to “him who hid his talent in a napkin,” is an allusion to Luke 19:20: “And another came, saying, Lord, behold, here is thy pound which I have kept laid up in a napkin.” It means not taking full advantage of one’s unique God-given abilities.

157 Newton, Untitled Treatise on Revelation.

158 Newton, Untitled Treatise on Revelation.

159 Newton, Untitled Treatise on Revelation.
he must learn the language perfectly. Such a language was that wherein the Prophets wrote, & the want of sufficient skill in that language is the main reason why they are so little understood.”160 For one, Scripture often makes use of what Newton calls “figurative Language.” In the treatise on “Revelation,” he explains that the Prophets often make use of “the Comparison of a Kingdom to the World & the parts of the one to the like parts of the other. And accordingly the Sun signifies the King and the Kingly power. The Moon the next in dignity that is the priestly power with the person or persons it resides in.”161 Thus, when we read lines in Scripture, especially the more abstract sections like the final chapters of Daniel, we can never fall into the trap of believing that the literal or most obvious interpretation is necessarily the accurate one.

Additionally, it is challenging to understand Scripture properly because it is often written for the layperson who has a limited potential for comprehension. Before Newton, both Kepler and Galileo reasoned that certain sections of the Bible only seemed incompatible with new scientific discoveries because the Book of Scripture was written in a figurative language for those who could not grasp scientific and mathematical ideas. Manuel explains, “Galileo and Kepler had based their fundamental arguments on an ancient dictum of scriptural interpretation by the Talmudic rabbis, passed down through the Church Fathers: “The Bible speaks in the language of everyman.” This it was hoped, freed science from the fetters of any literal exegesis of Genesis and other Biblical texts.”162 Manuel contrasts Kepler and Galileo to those in seventeenth and eighteenth century England who sought to solidify a “physica sacra, a study of the history of creation as presented in Genesis and in the works of Newton, showing line by line

161 Newton, Two Incomplete Treatises on Prophecy.
162 Manuel, The Religion of Isaac Newton, 36.
the perfect harmony between them.”

Newton blends these two approaches in his theological writings. Like Galileo and Kepler, he often asserts that Scripture was written for the layman or what he deems “the vulgar.” In “An Account of the Systeme of the World described in Mr. Newton’s Mathematicall Principles of Philosophy” usually dated shortly after the first publication of The Principia, Newton writes,

In determining the true systeme of the world the main Question is whether the earth do rest or be moved. For deciding this some bring texts of scripture, but in my opinion misinterpreted, the Scriptures speaking not in the language of Astronomers (as they think) but in that of the common people to whom they were written. So where tis said that God hath made the round world so fast that it cannot be moved, the Prophet intended not to teach Mathematicians the spherical figure & immoveableness of the whole earth & sea in the heavens but to tell the vulgar in their own dialect that God had made the great continent of Asia Europe & Africa so fast upon its foundations in the great Ocean that it cannot be moved therein after the manner of a floating Island.

Here, Newton reveals his loyalties to parts of both the Galilean and *physica sacra* position. God, through chosen individuals like Daniel, Moses, and Jesus speaks in the language of the “vulgar” as Kepler and Galileo claimed. However, even though God’s Word is not written with an emphasis on clear mathematical truths, it is also never incompatible with the actual workings of the universe. In other words, we may always interpret parts of the Bible, perhaps using metaphorical or figurative language, to comply with the accurate mathematical structure of the universe.

Newton insists that although Scripture is often written in a perplexing and allegorical manner, there is always one and only one correct interpretation of passages. In an “Untitled Treatise on Revelation” Newton claims that the “true sense of any portion of Scripture” “results most freely & naturally from the use & propriety of the Language & tenor of the context in that

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& all other places of Scripture to that sense.”\textsuperscript{165} In the same manuscript, Newton goes on to outline his rigorous method for finding such “true senses” of portions. Just as he does in writings on natural philosophy like \textit{The Principia}, he introduces sets of “definitions,” “rules,” and even “proofs” to structure his “Method” for uncovering the correct meanings within Scripture.\textsuperscript{166} In summary, Newton strongly believed that it was essential to uncover the unique true interpretations of Scripture in order to reach his personal theological aims, and he recognized that it was particularly difficult to find these accurate understandings of God’s Word. In the years leading up to and during his writing of \textit{The Principia}, Newton found that knowledge of natural philosophy could help lead towards a correct reading of Scripture.

He displays that an understanding of natural philosophy can be used to interpret Scripture in his correspondence with Thomas Burnett in 1680 and 1681. As mentioned briefly at the end of Chapter 3, Newton exchanged letters with the renowned English theologian Burnett, regarding the interplay between the Creation story in Genesis and the newest scientific conceptions of the cosmos. He tells Burnett, “You seem to apprehend that I would have the present face of the earth formed in the first creation. A sea I beleive was then formed as Moses expresses, but not like our sea, but with an eaven bottom, without any precipices or steep descents as I think I exprest in my letter.”\textsuperscript{167} We already saw that Newton advanced the notion of \textit{physica sacra} that could simultaneously preserve the accuracy of both Scripture and modern natural philosophy. In his letters to Burnett, he never denies Moses’ words, but as the previous passage demonstrates, he adapts and generalizes the language to agree with his scientific thinking. One must have an

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\textsuperscript{165} Newton, \textit{Untitled Treatise on Revelation}.
\textsuperscript{166} Newton, \textit{Untitled Treatise on Revelation}.
\textsuperscript{167} Newton, \textit{Correspondence with Thomas Burnett},
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accurate understand of the sea and logically deduce its evolution in order to properly grasp the first chapters of Genesis. In the same letter he states,

As to Moses I do not think his description of the creation either Philosophical or feigned, but that he described realities in a language artificially adapted to the sense of the vulgar. Thus where he speaks of two great lights I suppose he means their apparent, not real greatness. So when he tells us God placed those lights in the firmament, he speaks I suppose of their apparent not of their real place, his business being not to correct the vulgar notions in matters philosophical {but} to adapt a description of the creation as handsomly as he could to the sense & capacity of the vulgar.\textsuperscript{168}

Since Moses avoids rigorous scientific accuracy in his description of the Creation, Newton can call upon his scientific understanding of the universe in order to fully comprehend Moses’ words. Natural philosophy allows him to surpass the “vulgar babes” who are limited to an incomplete interpretation.

In his influential essay “The Scientific Revolution Reasserted,” Richard Westfall identifies the Burnett-Newton correspondence as representative of a watershed in the history of Western thought. He states, “Newton defended the truth of Genesis, arguing that it stated what science…would lead us to expect…Newton used science to judge the validity of Scripture. To speak merely of the autonomy of science does not seem enough; we need to speak rather of its authority, to which theology had now become subordinate. The positions of the two had been reversed. That change has never been reversed anew.”\textsuperscript{169} If we consider Newton’s broader theological beliefs rather than solely focusing on these few letters, we see that Westfall’s claim exaggerates Newton’s dedication to scientific over scriptural truths. After all, Newton believed strongly in divine revelation as well as countless miracles carried out by the prophets that could not be explained by standard natural philosophy. It is unreasonable to suppose that Newton “used science to judge the validity of Scripture” because this assertion would insinuate that Newton believed Scripture could potentially be “invalid”—a view he definitely did not hold.

\textsuperscript{168} Newton, \textit{Correspondence with Thomas Burnett}.

\textsuperscript{169} Westfall, “The Scientific Revolution Reasserted,” 50.
However, Newton, in his letters to Burnett does use science to discover which interpretation of Scripture is valid.

Newton not only made use of his scientific knowledge in reading Scripture but also he employed his mathematical aptitude in order to decipher God’s book. In the late 1670’s, Newton became particularly interested in Jewish theology and commentary believing that many of the secrets regarding revelation could be uncovered by studying Jewish ceremonies and the works of significant rabbinical scholars. While he was developing these interests, he became concerned with the structure and dimensions of the Holy Temple in Jerusalem. Newton titles the fifth Chapter of his posthumously published *The Chronology of Ancient Kingdoms Amended*, “A Description of the Temple of Solomon.” Building on analyses that he most likely began in the late 1670’s or early 1680’s, Newton describes the Temple:

Two square areas, being parted only by a marble rail, made an area 200 cubits long from west to east, and 100 cubits broad: this area was compassed on the west with a wall, and on the other three sides with a pavement fifty cubits broad...the whole made an area 250 cubits long from west to east, and 200 broad, and was compassed with an outward Court, called also the Great Court, or Court of the People, which was an hundred cubits broad on every side; for there were but two Courts built by Solomon: and the outward Court was about four cubits lower than the inward, and was compassed on the west with a wall, and on the other three sides with a pavement fifty cubits broad, upon which stood the buildings for the People. All this was the Sanctuary, and made a square area 500 cubits long, and 500 broad, and was compassed with a walk, called the Mountain of the House: and this walk being 50 cubits broad, was compassed with a wall six cubits broad, and six high, and six hundred long on every side: and the cubit was about 21 1/2, or almost 22 inches of the English foot, being the sacred cubit of the Jews, which was an hand-breadth, or the sixth part of its length bigger than the common cubit.¹⁷⁰

He often complemented such extensive descriptions with illustrations of the layout, one of which can be found at the end of this chapter (See Figure 4). He could create such a detailed picture of the Temple only by combining his scriptural methodology with his mathematical and arithmetic talents. Over the course of several decades, he analyzed and converted the units of measurement and manipulated the often-ambiguous numbers provided in Scripture in order to construct a

comprehensive model of the Temple. In his originally unpublished “A Dissertation upon the Sacred Cubit of the Jews and the Cubits of the several Nations” he conducts a lengthy investigation of the unit, “cubit,” referred to in Scripture, and attempts to pinpoint the exact mathematical meaning of the term by studying its different historical definitions. Once again, he found scriptural use in a topic traditionally associated with natural philosophy—mathematics.171

Newton believed that his natural philosophy could aid his theological aims not only because it provided insight into interpreting the Book of Scripture but also because there was significant spiritual value in understanding Nature in itself. Echoing the sentiments of natural philosophers who supported the “Two Books” model, Newton believed that the Book of Scripture “meant to demonstrate his [God’s] omnipotent power to men, as Nature demonstrates his infinite wisdom.”172 Thus, in order to gain more insight of the Divine, Newton could directly call on his scientific work. In the General Scholium, right after he explains the limits to humans’ understanding of God he states, “We know him only by his most wise and excellent contrivances of things, and final causes.”173 These final causes belong to the realm of natural philosophy—the structured analysis of phenomena in Nature. As a result, studying Nature is a direct form of theological study and worship. The professor of Science and Intellectual History, Robert Iliffe writes of Newton’s theological convictions, “men were supposed to worship their God ‘by the Study of the frame of world.’ All over the learned world, worship was organized by the local equivalent of the priest.”174 Newton made this observation during his studies on the history of

171 For more on Newton’s studies of the Holy Temple see: Westfall, Never at Rest, 346-347.
173 Newton, Principia, 942.
various religions. In “Draft chapters of a treatise on the origin of religion and its corruption” from the early 1690’s he comments,

Twas one designe of the first institution of the true religion to propose to mankind by the frame of the ancient Temples, the study of the frame of the world as the true Temple of the great God they worshipped. And thence it was that the Priests anciently were above other men well skilled in the knowledge of the true frame of Nature & accounted it a great part of their Theology. The learning of the Indians lay in the Brachmans who were their Priests, that of the Persians in the Magi who were their Priests, that of the Babylonians in the Chaldeans who were their Priests. And when the Greeks travelled into Egypt to learn astronomy & philosophy they went to the Priests. And what there was of the true knowledge of Nature amongst the Greeks lay chiefly in the brest of some of their Priests.  

Religious leaders have always studied Nature because it is one of the main tools at our disposal from which we can learn more about God. For this reason, many thinkers in seventeenth century England including Newton endorsed the vocation of the “theologian-natural philosopher” who simultaneously explored Nature and its intimate connection to its Creator and Sustainer. In this case, priests or “theologian-natural philosophers” are not examining Nature in order to better comprehend Scripture and thereby learn more of the divine plan, but are instead investigating the world and the cosmos as a direct pathway to God.

Newton described two ways that a close study of Nature could directly aid his theological endeavors—understanding the Book of Nature could help Newton and others follow God’s first Principles and it could help Newton gain a better, albeit limited knowledge of the Divine and His Word. Recall that Newton’s two fundamental Principles of religion were to worship and love the one true God and to “love thy Neighbor as thyself.” In Query 31 of the Opticks, he asserts that a close examination of Nature can assist pious individuals in following God’s most essential commands. He writes, “For so far as we can know by natural Philosophy what is the first Cause, what Power he has over us, and what Benefits we receive from him, so far our Duty towards

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176 Manuel, The Religion of Isaac Newton, 32.
him, as well as that towards one another, will appear to us by the Light of Nature.”\textsuperscript{177} Since, as we discussed in the previous two chapters, the Book of Nature provides insight into God’s role as both the creator and preserver of the universe, natural philosophy will logically lead individuals to obey the one real God. Moreover, Newton thinks that natural philosophy will help believers understand and live by God’s wishes, particularly to “love thy Neighbor.” In the same section of Query 31 he asserts, “And if natural Philosophy in all its Parts, by pursuing this Method [of Analysis], shall at length be perfected, the Bounds of Moral Philosophy will be also enlarged...And no doubt, if the Worship of false gods had not blinded the Heathen, their moral Philosophy would have gone farther than to the four Cardinal Virtues\textsuperscript{178}; and instead of teaching the Transmigration of Souls, and to worship the Sun and Moon, and dead Heroes, they would have taught us to worship our true Author and Benefactor.”\textsuperscript{179} Newton’s logic in this regard seems straightforward—if we understand Nature then we better understand God. If we better understand God, we will appreciate and respect his authority. Finally, if we appreciate and respect his authority we will do what He wills us to do—namely, worship him and no false Gods and treat others with virtue.

Newton closely examined Nature not only to follow God’s main principles, but also to gain a greater understanding of the Deity; in other words, to receive his “strong meat.” God partially revealed his attributes through Nature or as Newton called it his “dominion”. However, certain aspects of Nature were either too small or too distant to be easily perceived by the senses. In the 1660’s and 1670’s Newton made his most groundbreaking discoveries concerning the

\textsuperscript{177} Newton, \textit{Opticks}, 405.
\textsuperscript{178} The four “cardinal virtues” Newton refers to are 1) Prudence 2) Justice 3) Temperance 4) Fortitude. Plato is often credited as the first thinker to formulate these four pillars of moral action in his \textit{Republic}, but, as Newton insinuates in this comment, prominent Christian thinkers from Augustine to Aquinas expanded on and “Christianized” the concept.
\textsuperscript{179} Newton, \textit{Opticks}, 406.
properties of light, which he would eventually incorporate in Opticks. Through years of ingenious experimental investigation with prisms, Newton concluded in his 1665-66 study titled “Of Colours” and then further in a series of drafts “concerning light and colors” from the 1670’s, that white light was composed of different light “rays” each corresponding to a certain color. In his essay on Newton’s “experimental philosophy” especially with respect to optics, Michael Ben-Chaim comments, “Conceived of in terms of the natural theology of dominion, it suggested that light, by the fiat of God, was a configuration of unequally refrangible rays [rays of different colors bounce off the prism at different angles], and for this reason the experimenter, with his prism, could separate the heterogeneous beam into its distinctive components.” Natural philosophers could actually conceive of “properties of God’s benevolent government” that the layperson did not know existed. Science historian A.R. Hall writes, “A ray of light…previously a convenient fiction of geometrical optics, has become for Newton a physical entity.” Natural philosophers found missing infinitesimal pieces of God’s grand design, and thus, gained a better understanding of the Creator himself.

Newton illustrated that natural philosophy could lead to greater knowledge of the Deity on the macro as well as the micro level. In his manuscript from the early 1690’s on “Place, Time, and God” discussed in Chapter 3, Newton refers to God’s works and dominion as “infinite” and “eternal”. He then writes, “Still I admit that an infinite number of things is difficult to conceive, and is therefore taken by many people as impossible: but there are many things concerning numbers and magnitudes which to men not learned in mathematics will appear paradoxical, and yet are entirely true. As that an area of infinite length, and solid of infinite

length and width, can be measured.”\(^{183}\) He then lists a series of scientific and mathematical truths such as “motion in a merely finite space can be increased to infinity” and “that a finite line can be divided at points infinite in number” that can only be grasped by those who comprehend both natural philosophy and this concept of “infinity.”\(^{184}\) The natural philosopher has an advantage because he is already comfortable with ideas like “infinity,” which for Newton, are critical in gaining an accurate depiction of God. Just as natural philosophers can access the minute and imperceptible entities within God’s dominion, he is also specially trained to take in the immensity of God’s universe.

Throughout the course of his life, Newton had both modest and far-reaching theological ambitions. He desired to be both a “good Christian” like his fellow man and to also acquire an exceptional understanding of and proximity to the Christian God. He always assumed that an in depth comprehension of God’s Word was invaluable in order to attain these goals, but he did not think that the Book of Scripture was the only instrument at his disposal. By the time of *The Principia*’s first publication, Newton clearly expressed his belief that the Book of the Nature could be employed to help achieve his theological aims.

183 Newton, “Newton on Place, Time, and God,” 119.
184 Newton, “Newton on Place, Time, and God,” 119.
Figure 4

Newton’s drawing of the Temple of Solomon meticulously drawn to scale based on his analysis. From: Westfall, *Never at Rest*, 397.
Conclusion

In 1687, Isaac Newton published the book that would stand as a pivotal symbol of Western science for centuries. *The Principia* builds upon the novel discoveries and methodologies formulated in sixteenth and seventeenth-century Europe to produce the most comprehensive examination of motion, force, and the cosmos of the time. While we tend to emphasize *The Principia’s* additions to Western science, rationalism, and experimentation, we often overlook the theological aspects of the work. Newton viewed his *magnum opus* not as a piece of “science” as understood today but as a work of “natural philosophy.” For Newton, it was an investigation towards a Truth intimately linked to God. Newton explored Nature and specifically, the cosmos, in part to find out more about his Christian God who created and preserved the universe, and to fulfill what he saw as his core ambitions and duties with respect to that God. Outside factors, including the development and spread of various philosophies within Europe, influenced which elements of natural theology Newton would undertake at a specific time. Yet, for almost all of his eighty-four years of life, Newton followed an overarching agenda that was partly theological in nature while also interwoven with his pursuits in natural philosophy.

Numerous historians studying sixteenth through eighteenth century Western science have settled many of the apparent contradictions in the history of Newton and other major contemporary thinkers. By placing Newton within his own time and place, these historians help a modern reader reconcile Newton’s experimental science and mathematical pursuits with his alchemical and theological writings. While it is critical to contextualize Newton, as well as the other preeminent figures of the Scientific Revolution, it may also be useful to remember that in certain ways, they are not so different from the twentieth or twenty-first-century thinker.
Nineteenth and twentieth-century German physicist Max Planck, often deemed the chief pioneer of quantum physics, inscribed over the door to his laboratory, “Let no one enter here who does not have faith.”\textsuperscript{185} Modern thinkers have “progressed” beyond studying many of Newton’s more esoteric interests, but an intimate bridge from Newton and his times to the present day may be found in a common quest for knowledge and Truth—a journey that can be undertaken properly and fruitfully only by those with both an open mind and an unshakeable faith.

\textsuperscript{185} Max Planck as quoted in: Peter Bouteneff, \textit{Sweeter than Honey: Orthodox Thinking on Dogma and Truth} (Crestwood, NY: St. Vladimir’s Seminary Press, 2006), 35.
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