

# Christian theology and the rise of Newtonian science—imposed law and the divine will

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In order for science to progress, it was necessary to reject the erroneous view of nature handed down by Greek philosophers, and which dominated among the intellectual elite during much of the medieval period. Leading historians of science acknowledge that the Christian doctrines of God and Creation played a pivotal role in this process. The Greek view of nature as a living organism was replaced by the biblical view that only people and animals have souls. This led to the rejection of the Greek explanation for motion as arising from tendencies internal to objects, and its replacement with the concept of external, divinely imposed laws. The Greek view that natural processes are governed by eternal principles binding even on the gods was replaced by the biblical view of God's omnipotence and His freedom to create as He willed. This led to the belief that the laws of nature were determined entirely by God's choice and could, therefore, only be discovered by observations.

At the heart of scientific enquiry is the *faith* that the world is orderly and behaves consistently from one day to the next.<sup>1</sup> One might ask, however, how this belief arose. According to Peter Harrison, formerly Professor of Science and Religion at Oxford University, it was, in a large part, “the *theologically informed assumption* that there are laws of nature, promulgated by God and discoverable by human minds (emphasis added).”<sup>2</sup> Eminent Philosopher of Science Alfred North Whitehead would agree. He wrote:

“My explanation is that the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology.”<sup>3</sup>

Prior to the late medieval period, Greek philosophy dominated among the intellectual elite. However, around the 13<sup>th</sup> century onwards, there was a reaction against this by Christian theologians. Philosophers and historians of science have argued that this rejection of the Greek understanding of nature, particularly the teachings of Plato, Aristotle and the Stoics, and its replacement by the biblical worldview, substantially underpinned the rise of modern science.<sup>4,5,6,7,8</sup>

## The Greek view of nature

In the thinking of most Greek philosophers, the world was a living, divine organism. For some, even matter was understood to have god-like attributes, being self-sufficient and unchangeable, with inherent properties determining a universal world order binding even upon the gods. This divine substance governed the development of the world and dictated the movements of the heavenly bodies. Consistent with this belief, the Greek poet Hesiod (c. 700 BC) thought that the earth *generated* the mountains. In contrast, the

Hebrews saw the world forming according to God's *command* (e.g. Genesis 1).

## Plato

In the thinking of Plato (c. 428–348 BC), true reality is found in the realm of thoughts, rather than by observing and learning from our world. Using our senses, we perceive only shadows of reality. The principle is applied generally so that everything known in our world, material or immaterial, exists as a more perfect ‘ideal’ or true ‘form’ in some higher plane. Legal decisions made in courts are our best attempts to administer justice but are never wholly successful as true justice remains transcendent. Round plates produced by a potter or circles painted by an artist are merely imperfect representations of true roundness which can only be pictured in the mind or expressed mathematically. These ‘forms’ or ‘ideas’ are divine and explain the nature of objects. While ‘forms’ are eternal and immutable, objects are changeable. Hence, ‘forms’ are considered more certain than what is observed, and logical reasoning and analysis are understood to be more reliable than fallible observations.

According to Plato, when ‘the Demiurge’ (the creator) shaped the world, he was constrained to follow these pre-ordained ‘ideal’ patterns, rather than being free to make it as he wished. In addition, he had to use materials he had not created himself and these tended to resist his attempts to form them. Galen (c. 129–216) was another influential Greek writer who rejected the Genesis account of creation because this was contrary to his understanding that the creator would be limited in his work by the nature of matter.<sup>9</sup>

Instead of studying the motions of the planets and concluding from this that they follow elliptical orbits, as

did Johannes Kepler (1571–1630), Plato ‘reasoned’ that they must follow circular paths because circular motion is most perfect, an ‘ideal’ form, and most befitting to the gods. Similarly, he ‘deduced’ that the universe must be spherical because this is the ‘ideal’ shape. In fact, Plato explicitly rejected the view that astronomical observations were useful, arguing that we should “leave the starry heavens alone”.<sup>10</sup> In this he followed his teacher, Socrates (c. 470–399 BC), who, while regarding astronomy worthwhile in determining the time or day of the year, considered that learning the courses of the stars, or enquiring about the causes of their movements, was a waste of time. According to his pupil, Xenophon (430–350 BC), Socrates “held that speculators on the Universe and on the laws of the heavenly bodies were no better than madmen”.<sup>11</sup>

### Aristotle

Like Plato, Aristotle (384–322 BC) believed the world to be as it is due to necessity, conforming to eternal, unchangeable principles which could be deduced by processes of reason. To him the world was like a huge animal which breathed, grew, and decayed. In this he again followed Plato who asked: “In the likeness of what animal did the creator make the world?” In his writings Aristotle continuously appealed to biological similes, for example, likening earthquakes to animal digestion and the motion of stars to the locomotion of quadrupeds.<sup>12</sup> As did Plato, he saw the heavenly bodies as living beings.

In the thinking of Aristotle, physical objects are a compound of ‘matter’ and ‘form’, where ‘form’ unifies some matter into a single object and determines its structure, properties, and activities. Without ‘form’, matter cannot even exist. Aristotle’s god, however, has little power over nature, having jurisdiction over neither the matter nor the form of natural objects.<sup>13,14</sup>

Aristotle distinguished between ‘natural motion’ and ‘violent motion’, the former arising from the nature of an object, the latter being imposed on it. For example, the natural motion of a stone would be to fall to the ground. However, if thrown, it will for a time move in an unnatural or ‘violent’ way. Whereas the natural motion of terrestrial bodies is rectilinear, the natural motion of celestial bodies, due to their being made of a different substance, is circular.<sup>15</sup>

### The Stoics

According to the Stoics, the material world was impregnated with reason, and objects, along with people and animals, had souls. All was part of a universal world soul, with its individual parts in sympathetic relations to one another. To the Stoics, ‘natural law’ was ‘immanent’,

i.e. inherent in the structure of things, and this explained everything from the behaviour of people and animals to the movements of the heavenly bodies. ‘Laws of nature’ arise out of necessity, in the properties of matter, and hence knowledge of the nature of things is thought to be the key to understanding their relations to one another.

Medieval scholastics often amalgamated Greek and biblical thinking. For example, Thomas Aquinas (c. 1224–1274), while accepting the omnipotence of God, also saw natural law as immanent in the universe. For him, eternal law is nothing other than God.<sup>16</sup> Some wrote of ‘substantial forms’ impregnated in nature, internal causes of processes arising from objects possessing soul-like powers. Unobservable ‘occult qualities’ adhered to objects like ‘little ghosts’, producing effects by ‘sympathy’ and ‘antipathy’.<sup>17</sup> Sympathy, for example, was thought to explain the attraction of iron to a magnet—just as man is attracted to woman. The doctrine of *horror vacui* (abhorrence of a vacuum) was thought to explain why water rose in ‘suction’ or ‘vacuum’ pump barrels. Supposedly, this was because nature had an antipathy to empty space.<sup>18,19</sup>

### An impediment to science

Platonic thinking was antithetical to science because it detracted from the view that the world could be understood by learning from observations. In contrast, biblical thinking pointed to this as the only way of discovering reality. The Bible teaches that God is omnipotent and was in no way constrained to create according to any prescribed pattern. For, “Whatever the Lord pleases, he does, in heaven and on Earth, in the seas and all deeps” (Psalm 135:6). Since He created matter *ex nihilo* (from nothing) he could endow it with whatever properties He chose. In biblical thinking, the natural order arose as a result of a historical act of creation (Genesis 1:1ff); nothing about it is either eternal or necessary and the Creator was not constrained to follow pre-existing ‘forms’. Rather, the world is as it is, and behaves as it does, because of *divine choice*, the will of a sovereign deity. Hence, it is impossible to determine the nature of things based on reason alone. Only by studying His creation could God’s design be known.

The rejection of Greek thinking by the founders of modern science is exemplified in Roger Cotes’ preface to the second edition of Isaac Newton’s *Philosophiæ Naturalis Principia Mathematica* (*Mathematical Principles of Natural Philosophy*):

“Without all doubt this World ... could arise from nothing but the perfectly free will of God directing and presiding over all. From this fountain it is that those laws, which we call the laws of Nature, have flowed; in which there appear many traces indeed of

the most wise contrivance, but not the least shadow of necessity. These therefore we must not seek from uncertain conjectures; but learn them from observations and experiments.”

Newton himself, in the very first sentence of his preface, wrote of how modern thinkers, having discarded “[soulish] substantial forms and occult qualities have endeavoured to subject the phenomena of nature to the laws of mathematics”. A committed biblical creationist, he also rejected the Greek view that God would have been constrained in His acts of creation in any way. He wrote of God:

“... we admire him for his perfections; but we reverence and adore him on account of his dominion ... and a God without dominion, providence, and final causes [i.e. design], is nothing else but Fate [i.e. necessity] and Nature.”<sup>20</sup>

### The world—animate or inanimate?

Plato taught that the cosmos created by the Demiurge was a living organism, that the world had a divine soul, and the stars and planets were gods. In a similar vein, Aristotle taught that stones fall to the ground because they have a *yearning* for the centre of the universe (which he believed to be the centre of the earth). Such thinking was an obstruction to science because it attributed causes of motion to motives and inner compulsions, rather than to impersonal, external forces.<sup>21</sup>

In contrast, the Bible clearly distinguishes between the Creator and the creature (i.e. that which was created). God is spirit (John 4:24) and is a being separate from the world. There is only one God (Isaiah 45:5) and His creation is not divine; for God said: “Before me no god was formed, nor shall there be any after me” (Isaiah 43:10). Indeed, to attribute divinity to the creature is idolatry. As argued by Oratian priest Nicole Malebranche (1638–1715), there can be only one cause which is “nothing but the will of God”. For Malebranche, Greek ‘forms’ are nothing more than “the little gods of the heathen” introduced by the evil one to occupy the hearts which the Creator has made to belong to himself.<sup>22</sup>

The cosmos is not an organism and does not have a soul, this being firmly established in the very first book of the Bible. Here only animals and people are described as ‘living creatures’ (Genesis 1:20, 24). The universe is not eternal and does not have any self-sustaining or self-generating powers. Rather it is the work of a single Creator upon whom it is totally dependent. Hence, objects do not have minds and desires, and are not subject to laws inherent within their natures; instead the non-living world operates according to laws imposed on it from without. The moon gives rise to tides, not because it has some sort of friendship with the water of the oceans, but because of the impersonal law of gravity.

### The lawgiver

The God of the Bible is the lawgiver in both the moral and physical realms. He gave the 10 commandments to Moses (Exodus 20:3–17) and wrote the requirements of the law on the hearts of men so that they “by nature do what the law requires” (Romans 2:14–15). He is the one who gathered the waters together (Genesis 1:9) and “assigned to the sea its limit, so that the waters might not transgress his command” (Proverbs 8:29). He “made a decree for the rain and a way for the lightning of the thunder” (Job 28:26). He created the sun to govern the day and night (Genesis 1:16), “commanded the morning ... and caused the dawn to know its place” (Job 38:12). He created the stars to mark the seasons (Genesis 1:14), knows “the ordinances of the heavens”, and established “their rule on the earth” (Job 38:33). He continually “upholds the universe by the word of his power” (Hebrews 1:3).

In the Old Testament, God’s commands to nature are often expressed in legal language. For example, the Hebrew word *huq* is used in both Proverbs 8:29 and Job 28:26. Its verbal form means to ‘engrave’ or ‘legislate’ and is often used in the context of God giving moral and ritual laws. In both these verses, the 4<sup>th</sup> century Vulgate translation uses the Latin word *lex*, meaning ‘law’. According to philosopher of science Edgar Zilsel, verses such as these “were quoted through the centuries again and again, and have decidedly contributed to the formation of concepts in rising natural science.”<sup>23</sup> Galileo Galilei (1564–1642), for example, wrote that nature “never transgresses the bounds of the laws imposed to it”, being a “most careful executor of the orders of God” and argued for nature’s strict observance of God’s commands citing, among others, Job 28:26, 38:8–11 and Psalm 104:9.<sup>24</sup> According to Professor Friedrich Steinle, for Galileo the concept of law in nature was “most intimately and inextricably connected with theological considerations concerning God’s activity as legislator”.<sup>25</sup>

Nobel Prize winner Melvin Calvin also acknowledged the influence of the Bible in these matters. Referring to the necessity of conceiving of the world as orderly, he remarked:

“As I try to discern the origin of that conviction, I seem to find it in a basic notion ... enunciated first in the Western world by the ancient Hebrews: namely that the universe is governed by a single God, and is not the product of the whims of many gods, each governing his own province according to his own laws. This monotheist view seems to be the historical foundation for modern science.”<sup>26</sup>

Drawing on his Christian theology Newton wrote:

“This most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being. ... This Being governs all things, not as the soul of the world,

but as Lord over all; and on account of his dominion he is wont to be called *Lord God or Universal Ruler*.<sup>27</sup>

### Imposed vs immanent law

The Greek view of the cosmos as an organism drew upon an analogy between the natural world and a human being. As such it was understood to have been endowed with intelligence and life. In contrast, the Christian view was based on an analogy between the natural world and a machine.<sup>28</sup> Hence, the movements of bodies were not due to their being capable of controlling themselves; nor did they arise from ‘immanent laws’ (i.e. those inherent in objects and in the structure of reality itself). Rather they were the result of ‘imposed laws’ set up by an external, omnipotent Designer.<sup>29</sup> According to the Bible, this same God had created the mind of man after His own likeness (Genesis 1:26–27, 5:1–3); hence it was considered possible for us to understand His designs and describe the scientific principles by which they operated.<sup>30</sup>

### The divine will

Francis Oakley, formerly Professor of the History of Ideas, Williams College, Massachusetts, documents how, beginning around the 13<sup>th</sup> century, European theologians rejected Greek thinking about God and nature and replaced it with biblical thinking.<sup>16</sup> This began in 1277, when Etienne Tempier, Bishop of Paris, and Robert Kilwardby, Archbishop of Canterbury, formally condemned a list of 219 philosophical propositions as contrary to the Christian faith. These focused particularly on the teaching of Aristotle and the need to refute the view that God was in any way limited in His absolute power to do whatever He wishes.

This emphasis on the ‘divine will’ was strengthened, among others, by William Ockham (c. 1332), who insisted that both moral law and the whole of creation are entirely subject to God’s choice. Ockham drew attention to God’s ability to overrule natural law by reference to Shadrach, Mishach, and Abednego’s emerging

unscathed from Nebuchadnezzar’s fiery furnace (Daniel 3). Jean Buridan (c. 1350) argued that God, “in his most free will” may have created things which did not seem reasonable to the human mind—and this, of course, is true. Who would have thought that light would sometimes behave like a wave and sometimes a particle? Nicole Oresme (c. 1377) rejected Aristotle’s assertion that the earth must be stationary and that the heavenly bodies must move in circular orbits. To Oresme, God would do as He pleased.<sup>31</sup>

Of great significance is that two of the great German reformers, Martin Luther (1483–1546) and Philipp Melancthon (1497–1560), in order to demonstrate the power of God over nature, also referred to Shadrach, Mishach, and Abednego’s deliverance, along with, Francisco Suárez (1548–1617), William Perkins (1558–1602), John Preston (1587–1628), William Ames (1576–1633), Thomas Shepard



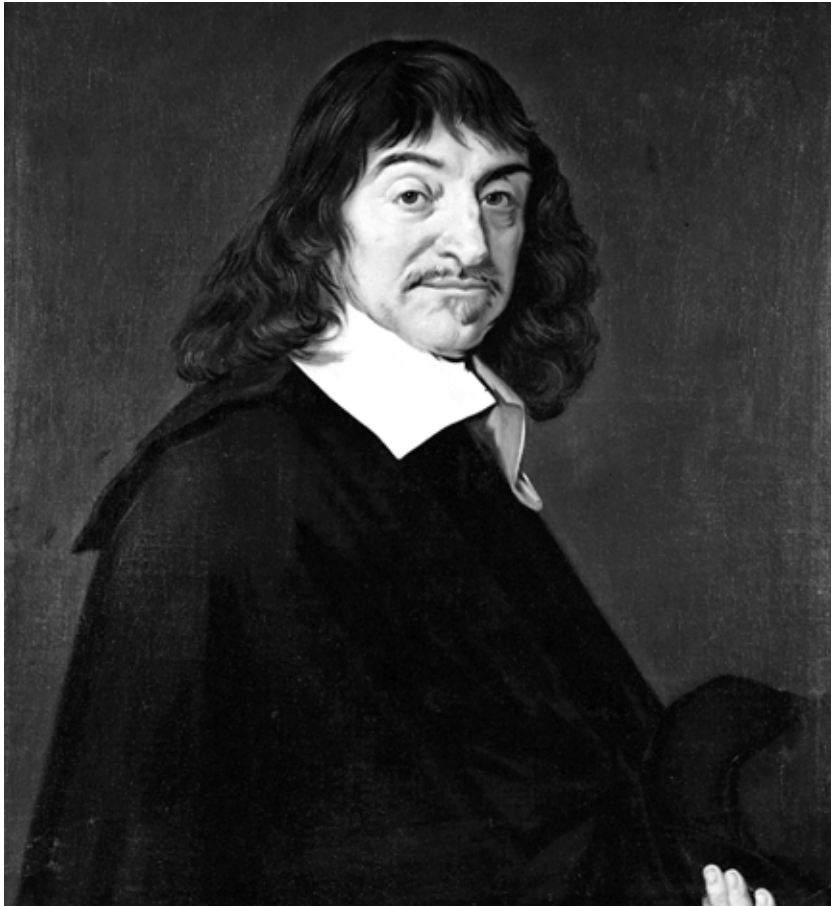
**Figure 1.** The ‘father of chemistry’, Robert Boyle (1627–1691), argued that God could have made other worlds where the laws of nature were different.

Portrait of The Honourable Robert Boyle (1627 - 1691), Irish natural philosopher, by Kerseboom. Credit: Wellcome Collection. CC BY



(1605–1649), John Norton (1606–1663), Increase Mather (1639–1723), and Samuel Willard (1640–1707). Another was the ‘father of modern chemistry’, Robert Boyle (1627–1691; figure 1), who referred to this incident in no less than three of his works. Oakley argues that this is strongly supportive of his contention that “the scientific idea of divinely imposed laws of nature had its origins in a living theological tradition which went back to the last years of the thirteenth century”.<sup>16</sup>

Kepler argued that the failure of the Greek philosophy to birth the concept of mathematical law could be explained by Aristotle’s belief that the world was eternal and that Aristotle’s god did not impose order on the world. In contrast, Kepler maintained that “our faith holds that the world, which had no previous existence, was created by God in weight, measure, and number, that is in accordance with ideas co-eternal with Him”.<sup>32,33</sup> Kepler’s understanding of ‘eternal ideas’, however, was very different to that of the Greeks. For Plato, because ‘ideas’ were eternal, they were also immutable and binding on the gods. For Kepler’s God (the God of the Bible), the principles which He used to determine the order of nature were entirely of His own choosing.



**Figure 2.** The ‘father of mathematics’, René Descartes (1596–1650), wrote that “the rules of nature are identical with the rules of mechanics”.

Both Boyle and Newton argued that God could vary the laws of nature. Boyle considered it plausible that God had made other worlds where “the laws of this propagation of motion among bodies may not be the same with those that are established in our world.”<sup>34</sup> Similarly, Newton argued that “God is able ... to vary the Laws of Nature and make Worlds of several sorts in several Parts of the Universe.”<sup>35</sup>

This belief that the laws governing the natural world were determined entirely by the Creator’s choice led to the realisation that the world order could not be deduced by *a priori* reasoning, but only empirically, through observation and experiment.

### The orderliness of creation

The God of the Bible is the One who “laid the foundation of the earth ... determined its measurements” and “laid its cornerstone” (Job 38:4–6). He “gives the horse its might”, and it is by His “understanding that the hawk soars and spreads his wings toward the south” (Job 39:19, 26). The Israelites were told to consider the stars and remember their God, who “brings out their host by number, calling them all by name; by the greatness of his might and because he is strong in power, not one is missing” (Isaiah 40:26). He is the One who established a “covenant with day and night and the fixed order of heaven and earth” (Jeremiah 33:25). “The Lord is the everlasting God, the Creator of the ends of the earth ... his understanding is unsearchable” (Isaiah 40:28).

In forming the world, God brought forth order from disorder. The original creation was “without form and void” (Genesis 1:2) and the first man was made from the dust of the ground (Genesis 2:7). Israel is said to be like clay in a potter’s hand (Jeremiah 18:6); according to the apostle Paul, God is not a God of disorder but of peace (1 Corinthians 14:33). In the first chapter of John’s gospel, the Creator is revealed to be ‘the Word’ (Greek *logos*), the incarnate Son of God. *Logos* also carries the sense of logic and reason. This *logos* is also the One whose act of redemption will one day liberate the fallen creation from its bondage to decay (Romans 8:21). Early Christian theologian Origen (c. 185–254)

argued that God conferred upon His creation an intrinsic rationality and order that reflected the divine nature itself.<sup>36</sup> This is in stark contrast to the polytheism of some pagan religions where the natural world might be subject to the whims of temperamental deities with conflicting interests. In such a world, almost anything could happen!

In his book, *Mind of God*, Paul Davies acknowledges that “the justification for what we today call the scientific approach to inquiry was the belief in a rational God whose created order could be discerned from a careful study of nature.”<sup>37</sup> According to Alistair McGrath, Professor of Science and Religion at Oxford University:

“This insight is directly derived from the Christian doctrine of creation and reflects the deeply religious worldview of the medieval and Renaissance periods . . . . This foundational assumption of the natural sciences—that God has created an ordered world, whose ordering could be discerned by humanity, which had in turn been created ‘in the image and likeness of God’—permeates the writing of the period.”<sup>38</sup>

### The natural world as a mechanism

According to the Bible, God is the Creator and sustainer of the universe and, at the same time, wholly separate from it. This, together with the sense of the orderliness of the creation, led theologians and philosophers to see the natural world as designed mechanism. Discussing blood circulation in his *Discours de la Méthode (Discourse on Method)*, René Descartes (1596–1650; figure 2) stated that “the rules of nature are identical with the rules of mechanics” and, in his *Le Monde (The World)*, he asserted “that God is immutable, and that acting always in the same manner, He produces always the same effect”. These laws, he said, are not immanent but ‘imposed’ on nature by God.<sup>39</sup> The courses of the planets, the oceanic tides and the universe in general are regular and predictable because they are determined by the God of the Bible who is faithful and sure. Descartes’ contention that the natural world is governed by an unchanging God, and hence behaves consistently from one day to the next, was an essential step in scientific progress.

Although Zilsel controversially argues that the concept of laws of nature arose primarily from sociological factors—for example, the politics of absolute monarchy—he acknowledges that Descartes “took over the basic idea of physical regularities and quantitative rules of operation from the superior artisans of his period. And from the Bible he took the idea of God’s legislation. By combining both he created the modern concept of natural law.”<sup>23</sup>

French Bishop Nicole Oresme (c. 1320–1382) and French theologian Pierre D’Ailly (1350–1420) both wrote of the workings of the world as analogous to a clock.<sup>40</sup> Melanchthon

(1497–1560) referred to the “whole machine of the world” serving “perpetual laws” and insisted that God is a “most free agent, not, as the Stoics used to teach, bound by secondary causes”.<sup>16</sup> In his *De Revolutionibus Orbium Coelestium (On the Revolutions of the Heavenly Spheres)*, published in 1543, Nicolaus Copernicus (1473–1543) wrote of the “the movements of the world machine, created for our sake by the best and most systematic Artisan of all”.

In a work containing numerous biblical quotations, Boyle argued that “the universe being once framed by God, and the laws of motion being settled and all upheld by his incessant concurrence and general providence, the phenomena of the world thus constituted . . . operate upon one another according to mechanical laws.”<sup>41</sup> He also expressly denied the concept of immanent law, arguing that “the laws of motion, without which the present state and course of things could not be maintained, did not necessarily spring from the nature of matter, but depended upon the will of the divine author of things”.<sup>42</sup> According to Professor Hooykass, in the thinking of Boyle and his contemporaries, “Holy Scripture . . . had made their science truly free”.<sup>43</sup>

### Conclusion

According to Oxford philosopher Michael Foster:

“[T]he method of natural science depends upon the presuppositions which are held about nature, and the presuppositions about nature in turn upon the doctrine of God. Modern natural science could begin only when the modern presupposition about nature displaced the Greek . . . but this displacement itself was possible only when the Christian conception of God had displaced the Pagan as the object . . . of systematic understanding. To achieve this primary displacement was the work of Medieval Theology.”<sup>44</sup>

By de-deifying nature and de-personalising motion, Christian theology emancipated science from its stagnation under Greek philosophy. It asserted that the universe is not eternal but created, and its nature and operating principles did not have to conform to any eternal, unchangeable ‘forms’. Emphasising God’s omnipotence and His freedom to create as He willed led to the view that the scientific method necessitated observations. The belief that there are laws imposed upon a world by an orderly, faithful, and immutable God caused philosophers to see the universe as a designed mechanism, rather than an eternally existing organism. This, in turn, led to the belief that the workings of God’s creation could be investigated, understood, and described mathematically. All this hung on the Christian doctrine of creation, as articulated so clearly in the Nicene Creed: “We believe in one God, the Father Almighty, Maker of all things visible and invisible.”

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