GOD OF THE GAPS OR THE GOD OF "DESIGN AND DOMINION"? RE-VISITING NEWTON'S THEOLOGY

by Eugenia Torrance

Abstract. Starting with Gottfried Leibniz, Isaac Newton's theology has often been caricatured as putting forward a "God of the gaps" argument for God's existence and continued involvement in the world. Peter Harrison has pointed out that this characterization of Newton's theology is "not entirely clear." A closer look at Newton's letters and the drafts to the *Opticks* reveals that, rather than arguing God's providential ordering and care over the world, he takes these for granted and is reluctant to specify instances of this order and care based on his physical research. He certainly believes in gaps in mechanical causes but is more eager to fill those gaps with nonmechanical natural causes than with God. Further, his system does not exhibit the two most prevalent weaknesses attributed to "God of the gaps" theologies: (1) that by describing God as intervening in natural causes his skill as a designer is maligned and (2) that by describing the physical details of God's involvement in the world one puts too much weight on theories likely to be replaced as science advances. Newton avoids the former weakness because it is only God's masterfulness as designer that he ties in any way to his theories of the physical world. He avoids the latter because he never points to God as the direct cause of any specific physical processes. Newton hoped that his system would cause his readers to marvel not only at God's providence but also at humankind's inability to sufficiently understand it.

Keywords: argument from design; deism; God of the gaps; Isaac Newton; science-engaged theology

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Those familiar with the meandering arguments and inconsistent terminology of Newton's *Principia* know well that the Newton of the textbooks has been scrubbed and polished for easy consumption. This is no less true for Newton's theology as it is for his physics. Although Newton does not play the hero in histories of theology as he does in histories of physics, he is still often portrayed according to a "type." If Newton is the pioneer who settles a new frontier in physics, in theology, he is more like the pioneer who ventures into an unknown territory only to succumb to the elements. Newton may have pushed out ahead, but in theology he is taken as an object lesson

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of what must be avoided at all costs. Central to this myth is the idea that Newton put forward a species of a "God of the gaps" argument, by which evidence for God's action in the natural world was correlated with a lack of evidence for natural causes. In his textbook on theology and science, Christopher Southgate describes this program of natural theology as "a love affair gone wrong (Southgate 2005, 26)." One prominent promoter of this reading of Newton and disparager of the "God of the gaps" strategy, C.A. Coulson, invoked a martial analogy: "We cannot hope to maintain a series of hedgehog positions on the battlefield, while all the time the enemy is pouring his energy and his forces into the region behind us (Coulson 1955, 20)." Coulson's chief evidence that Newton himself took this "hedgehog position" comes from one of Newton's letters to Richard Bentley in which Newton suggested: "the diurnal rotations of the planets could not be derived from gravity, but required a divine arm to impress it on them."[1] Coulson goes on to suggest that this argument from Newton is "asking for trouble" (Coulson 1955, 20). Even if Coulson's memorable imagery is not often taken up in current discussions of theology and science, the characterization of Newton as the paradigmatic purveyor of God of the gaps arguments still lives on (Gannsle 2012; Perry and Ritchie 2018, 134). A closer look at this caricature, however, shows that it is based on relatively little textual evidence—proof texts from the letter to Bentley and the Queries to the *Opticks* pressed into service—and fails to take into account the broader scope of Newton's project and the place that these texts have within that project.g

The last half century has seen a flowering of scholarship drawing on Newton's unpublished writings in both theology and alchemy that points to the interconnectedness of Newton's physics with these lesser known strands of his thought.[2] The Newton that emerges from a wider reading of his unpublished writings and drafts of major works is not of someone composing a system with an eye to where God might fit in somewhere, nor of someone giving God a minor supporting role once all the important parts had already been filled. The Newton that emerges is rather someone who is certain of God's involvement of the world in general, open to finding evidence of that involvement, but not overly anxious to pin down the details. In other words, Newton is a more careful theologian than a quick perusal of one set of letters might reveal. He certainly thought it possible that there were nonmechanical causes in the universe that might be indicated by a lack of evidence for mechanical ones. He did not rush, however, to assume that a nonmechanical cause was necessarily a divine intervention but entertained a host of other options including aethereal spirits, vegetable spirits, light, electricity, and so on. He engaged in a form of abduction that sought to trace effects back to causes, but he applied this method equally to mechanical causes as to the first cause. Finally, although he was certain that God was active in the world, he did not claim

that he understood the details of that action. Far from naively championing a crude "God of the gaps" approach to divine action, Newton was a patient sifter of the evidence on many fronts. His arguments are better characterized as arguments for design and arguments for God's continuing presence and dominion in His creation, a presence and dominion that is not threatened by the existence of mechanical causal explanations. Although modern theologians may not agree with his results, there is much to learn from his early explorations of the frontier between theology and science. Especially as the field of theology and science begins to consider a new paradigm for relating theology to the sciences, that is, science-engaged theology (Perry and Leidenhag 2021), it is important to re-examine the historical narratives that motivated previous paradigms. Although Newton may not be a shining exemplar of science-engaged theology, he certainly did fit this model in broad strokes: he paid attention to empirical evidence as a resource for doing theology even while seeking to remain faithful to scripture and to his own understanding of protestant values (Iliffe 2016, 487). Understanding the ways in which his arguments failed or worked in their own contexts, while avoiding the myths that surround his theology, is fruitful for the nascent project of science-engaged theology.

In the next section, I will lay out two common criticisms leveled at God of the gaps arguments in general and at Newton in particular. Specifically, I will discuss Leibniz's famous rebuff that Newton had belittled God's abilities as engineer by allowing that God would need to intervene in creation. Second, I will discuss the charge that God of the gaps arguments are vulnerable to scientific advancements that eventually fill those gaps with mechanical causes so that God appears to be replaced. In "Gaps in the Newtonian System" section, I will discuss how Newton dealt with the gaps in mechanical causes that his experimental research inexorably led to. I contend that, although he admitted gaps in mechanical causes, he was reluctant to fill them with instances of divine intervention. Where he did readily describe God's action, however, was as a First Cause and Designer of the universe. Moreover, his praise of God as designer, even when it is rooted in his physical theories, is less susceptible to the charge of being replaced by future physical theories. Even when mechanical causes are found for particular marvelous elements of the world system, these mechanical causes can still be attributed to God as designer and coordinator of those causes.

Criticizing the God of the Gaps Approach

Leibniz and God as Imperfect Engineer

Before looking more closely at Newton's approach to divine action, it is helpful to have in mind the caricature that has since been drawn and

especially the arguments that have been laid against the idea of a God who regularly intervenes in the workings of nature. Though Coulson, as we saw, so eloquently described the problems with a "God of the gaps" in the twentieth century, Newton faced similar criticisms in his own day from Gottfried Leibniz.

As early as 1675, Newton began drafting what would become the *Queries* to the *Opticks*.[3] Here he articulated two problems that he would wrestle with at least until he published the final version in 1718: the problem of the decay of motion and the problem of the irregularities of the solar system. Both of these problems seemed to Newton to be insoluble under a purely mechanical hypothesis and both acted as a spur for him to look to other sources—whether in history, alchemy, or the scriptures—for solutions. He described the second of these problems thus:

> For it became him who created them to set them in order. And if he did so, it's unphilosophical to seek for any other Origin of the World, or to pretend that it might arise out of a Chaos or by the mere Laws of Nature; though being once formed it may continue by those Laws for many Ages. For while Comets move in very excentrick Orbits in all manner of Positions, blind Fate could never make all the Planets move one and the same way in Orbs concentrick, some inconsiderable Irregularities excepted which may have risen from the mutual actions of Comets and Planets upon one another, and which will be apt to increase till this System wants a Reformation.[4]

In this passage, it is not entirely clear either what feature of the "System" requires "Reformation" or what agent or cause he considers would enact this reformation.[5] He does, however, go on to insist that God *could* "reform the Parts of the Universe" should he choose to. Emphasizing God's power to reform the universe is a far cry from insisting that He does reform it, but Leibniz clearly took the bait.

Leibniz assumed that Newton had argued that the solar system needed God's intervention in order to continue its harmonious functions. He considered this suggestion an impious besmirching of God's goodness as creator:

> Nay, the machine of God's making, is so imperfect, according to these gentleman; that he is obliged to clean it now and then by an extraordinary concourse, and even to mend it, as a clockmaker mends his work; who must consequently be so much the more unskillful a workman, as he is oftener obliged to mend his work and to set it right. (Leibniz 1956, 11)

To understand how Newton might—and to some extent, did—respond to such an attack will require the more thorough treatment of his approach to divine action as laid out in the "Gaps in the Newtonian System" section.[6] For now, let us simply call this the "God as Imperfect Engineer" argument and attend to yet another argument against the "God of the Gaps" that was clarified in the nineteenth century.

Laplace and the Hedgehog Position

Accounts describing Newton's purported "God of the Gaps" often pair it with an infamous tale about the French physicist and polymath from the following century, Pierre Simon-Laplace (Brooke 2014, 201). It features in what appears to be a book of hearsay stories from the nineteenth century:

> The following anecdote is well-known in Paris but has never been printed entire. Laplace once went in form to present some edition of his "Système du Mond" to the First Consul, or Emperor. Napoleon, whom some wags had told that this book contained no mention of the name of God, and who was fond of putting embarrassing questions, received it with—"M. Laplace, they tell me you have written this large book on the system of the universe, and have never even mentioned its Creator." Laplace, who, though the most supple of politicians, was as stiff as a martyr on every point of his philosophy or religion… drew himself up, and answered bluntly, "Je n'avais pas besoin de cette hypothèse-là." (Morgan 1872, 249, 250)

Whether this story is true or merely the crystallization of the Victorian fear that science was inherently atheistic, it nicely illustrates the point that Coulson made about the "God of the Gaps." If Newton had rested his conviction that God acted in the universe on certain calculations of the orbits in the solar system, these hopes would be vulnerable to any new advances in the field of cosmology. As Coulson described so vividly, assuming that divine action would fit into one of the convenient fox-holes left by our current scientific description of the world is like taking a "hedgehog position": defending against forces in front while the enemy is coming from behind. In other words, no matter how well the theology fits into current science, we know from experience that current science changes, and when it does current apologetics will look foolish and outdated. It will stand out, like a "hedgehog fortification," embattled on all sides and not worth saving. In the "Gaps in the Newtonian System" section, I will suggest that Newton's own teaching on divine action is not an attempt to take a "hedgehog position," primarily because it never definitively points to God as an intervening cause in specific natural processes. But first, we will need to discuss Newton's approach to finding divine causes in general.

Gaps in the Newtonian System

As hinted at in the previous section, Newton realized, possibly as early as 1675, that mechanical causes were not enough to describe the workings of the full range of corporeal phenomena, particularly gravity, fermentation, magnetism, electricity, and the animation of the soul. Moreover, he appeared to share the worry with others at Cambridge, that an overly mechanical philosophy led inevitably to atheism and to a banishing of God to the margins (Dobbs 1991, 33ff).[7] These two concerns—the empirical search for the causes of phenomena whether mechanical or otherwise, and

the desire not to produce a system that conduces to atheism—remained with Newton throughout his career. Although he seems to have assumed, as many in his time did, that divine causation required some gap in mechanical causation, he treated those gaps very differently depending on whether they occurred in present phenomena or in the past. For reasons that he never clarifies, Newton was more reluctant to specify God's role in the present workings of the universe than in its formation. In both cases, however, he was far more confident in general that God was at work than he was in the details about how this work was accomplished.

Finding Gaps in the Present System

Newton's focus on the possibility of nonmechanical causes in present phenomena was driven by at least two major problems: the first was a general one that we mentioned in the "Criticizing the God of the Gaps Approach" section whereby resistance would cause all motion to decay without a source of active motion; the second was the specific problem of gravity. In other words, these two questions, the question of "active principles" and the question of gravity both presented to Newton precisely the kind of gaps that one imagines him filling in gleefully with divine causes. What we find is a very different procedure. He does certainly look for mechanical causes first, then for nonmechanical natural causes, but there is scant evidence that he considered divine causes with much fervor or confidence.

From his experiments describing air resistance in the motion of pendulums, Newton became convinced that the motion of the universe was liable to decay. Yet he saw all around him sources of activity that were not explained by his laws of motion. Many objects appear to move violently without the presence of contact forces. Despite his conviction that matter was inert, the world around him seemed to be very much alive. He attributed this life to what he called, following alchemical language, "active principles" (McMullin 1978, 43).[8] Although he could name them, he did not know what they were or how they arose.

His search for "active principles," and to understand the causes of chemical phenomena, fed an intense period of alchemical research that lasted for two decades (McMullin 1978, 24ff; Dobbs 1991, 44).[9] These researches gave him a great store of examples of "active principles" at work, which he described at length in Query 31/23 of the *Opticks*, for example:

> And when *Aqua fortis* or Spirit of Vitriol poured upon Filings of Iron, dissolves the Filings with a great Heat and Ebullition, is not this Heat and Ebullition effected by a violent Motion of the Parts, and does not that Motion argue that the acid Parts of the Liquor rush toward the Parts of the Metal with violence, and run forcibly into its Pores till they get between its outmost Particles and the main Mass of the Metal, and surrounding those Particles loosen them from the main Mass, and set them at liberty to float off into the Water? (Newton 1718, 352)

The drafts of this Query show that he changed his mind over the years about whether the evidence for activities and attractions in nature were evidence of special divine intervention. In the earliest manuscript, dated to 1675, several drafts of this query exist ending with a long passage describing experimental evidence for "activity" in nature. In a first draft, he suggests that most of the motion of the world can be attributed to "these active principles and the power of the will" (Newton 1675).[10] A later draft in the same manuscript drops the cryptic "power of the will" so that the motion in the world is "owing to these active principles" alone. The *Optice*, published in 1706, has a similar phrase in Latin that these motions arise " vel ex his Principiis actuosis, vel ex imperio Voluntatis [either from these active principles of from the supreme will]" (Newton 1706, 343). Finally, the 1718 version of *Opticks* omits the reference to will, whether divine, human or unspecified, leaving: "owing to these active principles" (Newton 1718, 375).

What these drafts show is that Newton is unsure about the causes of the activity in natural phenomena. He has gained a great deal of evidence that the kind of activity that would require an impressed force in his system of motion happens all the time without any seeming contact with a source of that motion. Given that he sees no evident natural cause for activity in the world, he considers making the "supreme will" the direct cause. Ultimately, he simply leaves the cause up to "active principles" without claiming to understand these principles.

Newton, of course, is more famous for grappling specifically with the cause of gravity. Having been able to demonstrate his inverse square law with great precision and over a wide range of phenomena in the *Principia*, he was left with the task of finding an explanation, or cause, for gravity. The major problem, of course, was that gravity appeared to act at a distance. When Bentley suggested that gravity might be essential to matter, Newton bristled, insisting that such an imputation was a category mistake:

> Tis unconceivable that inanimate brute matter should (without the mediation of something else which is not material) operate upon & affect other matter without mutual contact; as it must if gravitation in the sense of Epicurus be essential & inherent in it. And this is one reason why I desired you would not ascribe {innate}gravity to me. That gravity should be inherent & {essential} to matter so that one body may act upon another at a distance through a vacuum without the mediation of anything else by & through which their or force {may} be conveyed from one to another is to me so great an absurdity that I believe no man who has in philosophical matters any competent faculty of thinking can ever fall into it. (Newton 2022)

Here, Newton describes the central predicament of his approach to gravity. On the one hand, he sees it as a universal property of all matter that it is attracted to other matter. On the other, given that matter for Newton is inert, it cannot be the source of action of the force of gravity.

In the 1660s, Newton recorded his first attempts to give a mechanical explanation for gravity that rested on the idea of a corporeal aether. He described this aether as fine enough to pass through all the pores of a body, moving swiftly in streams that grow thicker as they come nearer to massive bodies, pressing bodies together (Newton 1983, 363, 365, 427). Unfortunately, however, Newton's experiments on air resistance combined with his analysis of Kepler's data showed that there could be no mechanical aether massive enough to push bodies together but not massive enough to resist their motions appreciably through space (Dobbs 1991). Even before the publication of the *Principia*, then, Newton had abandoned mechanical explanations for gravity and started to look elsewhere.

Although Newton did certainly look for evidence of a nonmechanical cause of gravity, there is little explicit evidence that he considered God as the *direct* cause of gravity (Dobbs 1991, 92ff). The best evidence that we have is from friends who do not address the question of divine intervention directly. For instance, he spoke to David Gregory, the Scottish mathematician, about the necessity of God's omnipresence and his conviction that some ancient philosophers considered God as the cause of gravity, drafting some of these thoughts in a never published *Classical Scholium* (Henry 2020, 341–43). Yet, as John Henry notes, not only is this evidence second-hand, it never actually answers the question about whether Newton considered God as a *direct or proximate*, as opposed to a primary, cause of gravity.

In 1712, Leibniz pushed Newton toward a divine solution to the problem of gravity by suggesting that by not giving a mechanical cause of gravity, he had by default made it into a miracle or an occult quality. Newton drafted, but never sent, this response:

> [I]f any should say that bodies attract one another by a power whose cause is unknown to us or by a power seated in the frame of nature by the will of God, or by a power seated in a substance in which bodies move & flote without resistan{ce} & which has therefore no vis inertiae, but acts by other laws than those that are mechanical. I know not why he should be said to introduce miracles & occult qualities & fictions into the world. For Mr. Leibnitz himself will scarce say that thinking is mechanical as it must be if to explain it otherwise be to make it a miracle an [sic] occult quality & a fiction… And to understand [gravity] without knowing the cause of gravity, is as good a progress in philosophy as to understand the frame of a clock & the dependence of the wheels upon one another without knowing the cause of the gravity of the weight which moves the machine is in the philosophy of clockwork. (Newton 1712)

This response is a helpful summary from Newton himself of where he stood near the end of his career. He gave several options for what might cause gravity: a power unknown to us, a power seated in the frame of nature by God, or a power seated in a substance that does not cause

resistance. Although he suggests possible divine involvement, it is the involvement of a Creator rather than an intervener. Ultimately, he falls back on the value of his own work even though the cause for gravity remains unknown.

In the case of gaps in our understanding of present phenomena, then, Newton is reluctant to point to God as a cause. As we saw in the "Criticizing the God of the Gaps Approach" section, Newton is willing to admit when his system is lacking. He admits that, given the laws of motion that he has devised, the solar system will eventually lose its stability and he cannot explain why the universe is filled with so much life, activity, and gravitational attraction. Ironically, it appears to be this very humility that prompts Leibniz's attacks. In both cases where Leibniz accuses Newton of falling back on "supernatural" causation, Newton has not specified supernatural causes but merely admitted his failure to find mechanical ones (Newton 1712). In the *Opticks*, Newton admits that the solar system will need "reformation" but never specifies the cause of that reformation. In Leibniz's attack on Newton's theory of gravity, we see the same pattern: Newton is faulted not for explaining gravity by divine causes, but simply for not explaining it. In other words, Leibniz's critique of Newton is not for rushing to use God to fill in gaps in his system, but merely for having gaps in the first place.

Newton's reluctance to detail God's action in the present workings of the universe, however, did not belie a doubt that that was the case. Although Leibniz had argued that God's competence as designer would be under attack if he continued to "meddle" in the affairs of the world, there is nothing in Newton's writings to suggest that he agreed with Leibniz. There are two points in Newton's life where he is faced with the argument, in fact, and at neither time does he appear to accept its validity. The first time was in 1712, when he drafted his response to Leibniz. Newton's reply to Leibniz , as we saw above, stays focused on his experimental evidence for gravity and the "progress in philosophy" that it brings even absent a full explanation (Newton 1712). In 1715, when Newton's friend Clarke responded to Leibniz on the whether the Newtonian system made God out to be an imperfect engineer, Clarke responded with a reiteration of God's continual presence and providence in the world (Leibniz 1956). Newton would make the same arguments in his "General Scholium" to the second edition of the *Principia*, arguing that: "a god without dominion, providence, and final causes is nothing other than fate and nature" (Newton 1999, 942). We see then, that Newton did not disbelieve in God's continual activity in the world and, therefore, did not accept Leibniz's suggestion that this continued activity was demeaning to God's excellence as designer. Rather, Newton suggested that it is because of God's "dominion, providence, and final causes" that "we worship him as servant" (Leibniz 1956). A lack of knowledge about the specific details of God's action did

not cause him to doubt his conviction that God was still at work in the universe.

Finding Gaps in the Formation of the Present System

Although Newton was reluctant to pin down God's action in the present workings of the world, he was more eager to discuss God's role as designer. In fact, in the last version of his *Opticks*, he included the search for first causes as an integral part of natural philosophy:

> Later Philosophers banish the Consideration of such a Cause out of Natural Philosophy, feigning Hypotheses for explaining all things mechanically, and referring other causes to Metaphysicks: Whereas the main Business of Natural Philosophy is to argue from Phænomena without feigning Hypotheses, and to 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.[11]

What Newton describes is a kind of abduction, looking for the best explanation of the effects seen in nature. There are abundant examples of Newton suggesting a role for God in his formation of the world including the arrangement of the orbits of the planets and the arrangement of the bodies of animals.[12]

Although Newton is more ardent in his descriptions of God's design of the universe, he nonetheless recognized that the details of this design were less certain than the general fact. Thus, Newton gives more details in contexts where he is free to speculate and sticks to generalities in contexts where he is carefully expounding his system. In his letters to Bentley, Newton admits that he had hoped that his *Principia* would be aid for belief in a Deity (Newton 1692). At Bentley's prompting, he goes on to discuss specific ways in which the system that Newton has so carefully and mathematically described would be impossible without a designer "very well-skilled in Mechanicks & Geometry" (Newton 1692). He attributes to God's design the distribution of masses, the difference between luminous and nonluminous bodies, the concentric orbits of the planets, the velocities of the planets, the distribution of masses in the solar system, the distances between bodies in the solar system, and finally the transverse motions of the planets that Coulson noted depended on the "divine arm."[13]

In the Queries to the *Opticks*, Newton admitted that he had not finished his project and chose to conclude by "proposing some Queries in order to a farther search to be made by others" (Newton 1718, 313). In other words, the queries represent a form of speculation, more polished than what he shared with Bentley, but nonetheless tentative. It is in the Queries that we find Newton's attribution of the "wonderful uniformity" of the planetary system including the fact that the orbits are concentric which "blind Fate could never make" (Newton 1718, 378).

A clear indication of how Newton considered his design arguments to have a different level of certainty from his mathematical ones is how he discussed God in the *Principia*. The first edition, from 1687, includes just one reference to God in Proposition VIII, Corollary 5 of Book III: "God set the planets at different distances from the Sun so each one might, according to the degrees of its density, enjoy a greater or smaller amount of heat from the Sun."[14] In the second and third editions, however, Newton removed the word "Deus" and rewrote the sentence with a passive verb. From the first to the second editions of the *Principia*, therefore, Newton removed the mention of God as designer from the body of the text and added the "General Scholium" where he gives his most conclusive statement about God's design of the "system of the world" (Snobelen 2010, 388–89). Separating the "General Scholium" from the rest has a similar effect to his discussion of God in the Queries to the *Opticks*. It shows Newton's hesitancy about his exposition there. He begins this exposition by describing why mechanical causes cannot account for the arrangement of the solar system, specifically why Descartes' hypothesis of vortices fails due to the absence or near absence of resistance in the solar system. Then, he suggests that "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" (Newton 1999, 940). Although Newton is more decisive in his attribution of first causes to God, he is still more hesitant about the details than about the general fact that God is to be praised for the order found in nature.

It is Newton's hesitancy about the details of God's design of the universe that makes him less vulnerable to the attack made by Coulson, that Newton's theology amounted to a "hedgehog position" that would forever be on the defensive especially as new scientific findings endeavored to "close the gaps." Although many of Newton's specific arguments, for instance that God would need to provide the transverse motion of the planets, have not weathered the centuries, their general form still remains. Accepting that the universe comprises a "most elegant system" that has arisen by "the design and dominion of an intelligent and powerful being" is still widely shared by theologians, even if more specific design arguments are frowned upon.

Conclusion

It is tempting to read Newton's references to divine action as arguments for the existence of God or for a certain specific construal of God's action in the workings of the universe. Read in this way, Newton's arguments are certainly a failure, especially in light of changing empirical evidence. But read in context, Newton's discussion of divine action does not appear to work in either of these ways: he does not seem to be overly concerned

to prove either that God exists or that he acts in a particular way. What *is* important to Newton is to show that God *does* continue to act and that the mechanical philosophy cannot give a complete picture even of the workings of the physical world. He is especially eager to see that his system does not banish God to the margins.

Finding gaps in mechanical causes in which to fit God was not central to or even a part of Newton's program. His program consisted, rather, of finding evidence for God's original and wise design, a program that he realized was unfinished and that he invited others to continue and modify as new evidence arose. This new evidence, however, would be less dangerous to a design argument than to a "God of the gaps" argument. Arguments for design depend on wise coordination but, crucially, not direct causation. That Laplace's nebular hypothesis seemed to explain the origins of the solar system through Newton's own laws does not undermine Newton's argument that the solar system is wisely designed. The wise designer, unlike the intervening God, is not undermined by secondary causes. Laplace's work is still, fundamentally, a part of the Newtonian program in that it continues to trace the causes backward toward the First Cause. Laplace is only the enemy of Newton if we assume that the nebular hypothesis has completed and replaced Newton's work and that the positions and momentums of the particles that interacted to form our solar system somehow "stand in" and replace the First Cause. A "God of the gaps," that is, can be made redundant in a way that the First Cause cannot. Newton's natural theology, then, is not a species of "God of the gaps" argument but of design argument. If his design arguments fail, they fail for other reasons, and not because they are rendered superfluous by an idealized science that continuously fills in our causal picture of the world.

Moreover, Newton's arguments concerning God's relationship to natural causes turn out not to be occasionalist or crudely apologetic.[15] To the extent that they are vulnerable to expanding empirical evidence, they have this feature in common with any theological argument that looks to empirical resources for forming presuppositions about the world. In other words, the weaknesses of Newton's physio-theological project turn out to be the same challenges that face any science-engaged theology. Further, Newton's solution, to stress the provisionality of such a project, is likely the best strategy available to theologians who wish to join this endeavor (Kojonen 2016, 308).[16]

When Newton's arguments are read more carefully in their context, taking into consideration his full project and his humility in matters of theology, it is hard to view him as an enthusiastic defender of the God of the gaps program. Even if we disagree with him about the specific character of mechanical causes, we can certainly agree that there is no complete mechanical description of the universe as Leibniz imagined. Although there was a period when the dream of a unified, deterministic

picture of the universe seemed just over the horizon, that time has largely passed in the wake of quantum mechanics, general relativity, and their incompatibility with one another. Further, many theologians will agree that God continues to work in the universe in some fashion. Rather than read Newton through the lens of Leibniz's caricatures or fault him for the speculations he shared with colleagues, it is better to see him as he hoped to be seen: as someone who had done a service to Christianity by his "industry & patient thought" (Newton 1692). Insofar as Newton was doing theology, we can say that he was doing something like *science-engaged* theology: whereby his science was a resource for his theology along with scripture and tradition (Perry and Leidenhag 2021, 248).

Notes

1. Quoted in Coulson (1995, 20). The original text reads somewhat differently: "In my former I {represented} that the diurnal rotations of the Planets could not be derived from gravity but required a divin{e} power to impress them." The "divine arm" appears later in the text: "And thô gravity might give the Planets a motion of descent towards the Sun either directly or with some little obliquity, yet the transverse motions by which they revolve in their several orbs required the divine Arm to impress them according to the tangents of their orbs" (Newton 1692).
2. Snobelen (2010) gives a helpful summary of these efforts relating to theology. A fuller treatment of Newton's theological manuscripts can be found in Iliffe (2017). For Newton's alchemy, see Dobbs (1991) and Newman (2019).
3. Shapiro (2021, 1–31) gives the most comprehensive study of the composition of the *Optice/Opticks*, but he does not focus on the queries . A manuscript that contains drafts of these queries has been dated to 1675, but the queries may reflect a later addition (Newton 1675).
4. Query 23/31. Version from manuscript begun c. 1675 (Newton 1675). Latest version: Newton (1718, 372–80).
5. Kubrin (1967, 335) reads this passage as referring to the problem of the stars losing their fuel and sees comets as Newton's ultimate answer. Snobelen (2012, 160–61) reads "Reformation" as implying religious overtones. I prefer to read it through the lens of Newton's letters to Richard Bentley where he describes the problem of the equal distribution of matter so that bodies would not fall into on another (Newton 1692).
6. It was a friend of Newton's Samuel Clarke who gave the most direct response to Leibniz (1956, 12–14). Newton drafted a letter in response to Leibniz's letter to the Editor of *Memoirs of Literature* which had made similar arguments about Newton's system, but he never sent this letter (Newton 1712). I will discuss these responses in the "Conclusion" section.
7. Newman and John Henry discuss the evidence that Newton abandoned the idea of a mechanical cause for gravity in the published Queries to the Opticks (Newman 2019, 469; Henry 2020b, 543–44).
8. Newman (2019) relates "active principles" to alchemical terms such as seeds/semina (176–79).
9. Newman offers an important corrective to the tendency in both Dobbs and McMullin to imagine that Newton's alchemical practice is subservient to the quest to understand the cause the gravity. Newman nonetheless agrees that Newton considered "active principles" as the underlying causes of both gravity and many chemical phenomena (Newman 2019, 176–79).
10. It was McMullin who pointed out that Newton had changed his mind about whether the divine will was directly responsible for this activity. See McMullin (1978, 138n86).
11. See Newton (1718, 344, Query 28).
12. See Newton (1718, 378, Query 31).
13. See Newton (1692). Note that the context is *design* not *intervention*.
14. Quoted and translated by Snobelen (2010, 388).

15. Although I disagree, of course, with the ascription of "God of the gaps" to Newton's project, I am following the insight of Gannsle here that any project that depends on empirical evidence is liable to revision in the face of future empirical advances (Gannsle 2012, 134).

16. Again, without admitting that Newton has a God of the gaps argument, we can point to Gannsle and Kojonen, who stress the necessity of provisionality for arguments that depend on empirical results (Gannsle 2012, 134; Kojonen 2016, 308).

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