

THE BUSY CLOCKMAKER: GOD AND THE NATURAL WORLD IN BOYLE'S THOUGHT

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In 1648-9, when he was 21-22 years old, Boyle wrote an autobiographical sketch entitled "An account of Philarethes during his minority." In it, Boyle put special emphasis on what he recorded as an extraordinary religious experience, that he had in 1640, while he was in Geneva. In his autobiography, he described this experience (which occurred after a storm) as a conversion. He referred to his spiritual experience as follows:

*it confirmed Philarethes in his apprehensions of the Day of Judgement's being at hand: whereupon the Consideration of his Unpreparedness to welcome it.*¹

When he wrote his autobiographical sketch, Boyle had promoted the so-called Invisible College, and was an active member of the Hartlib Circle - contributing in the Hartlibians' projects of religious and intellectual Reform. Boyle's religious perspectives in the study of nature are well attested in the juvenile tract 'Of Arethology' (which he wrote at the age of 18), where he depicted the world as "the Harmonious Concert of so numerous a set of wel-tuned Creatures." But - he continues - we cannot "dive into the deep mysterys of the World without His [God's] illumination."² In the 3rd Essay of *The Usefulness of Natural Philosophy* (1663, but written c. 1650) Boyle expressed his views with a vivid image: "I esteem the world a temple... and if the world be a temple, man sure must be a priest..."³ This image of the natural world is not incompatible with Boyle's (moral familiar) one, namely the Strasburg clock, a metaphor which Boyle employed in the same work, i.e., *The Usefulness of Natural Philosophy*:

*the several pieces making up that curious engine are so fram'd and adapted, and are put in such a motion, that though the numerous wheels, and other parts of it, move several ways, and that without any thing either of Knowledge or Design; yet each performs its part in order to the various ends for which it was contriv'd, as regularly and uniformly as if it knew and were concerned to do its Duty....*⁴

Boyle closely linked the study of nature and the promotion of Christian religion, with an argument that became one of the pillars of the physico-theology. He maintained that the experimental philosopher has a substantial advantage towards being a Christian since the experimental philosophy discloses the excellencies displayed in the Universe and "leads directly

¹ R.E.W. Maddison, *The Life of the Honourable Robert Boyle* (London, 1969), p. 32

² J.T. Harwood (ed), *The Early Essays and Ethics of Robert Boyle* (Carbondale and Edwardsville, 1991), pp 00; 197

³ Boyle, *Usefulness*, part 1 (1663), *Works*, 3: 238.

⁴ Boyle, *Usefulness*, part 1, Boyle, *Works*, 3: 248.

to the acknowledgment and adoration of a most intelligent, powerful and benign author of things, to whom alone such excellent Productions may... be ascribed.”⁵ In his view, the new philosophy, namely the corpuscular or mechanical philosophy, must be grounded on experience and reason - but reason is to be aided by revelation. On this basis, he propounded his own version of the mechanical philosophy and distanced it from those that failed to recognise the power of God in the natural world.

Let’s start with Boyle’s mechanical philosophy. This is not the place to get into the details of Boyle’s theory of matter. I will take the expression ‘mechanical philosophy’ in a very broad sense, including a variety of versions of mechanism.

The two ‘catholick principles’ of the mechanical philosophy are, according to Boyle, matter and motion. Matter is one and the same in all bodies; it is extended, impenetrable and divisible. Boyle denied the existence of atoms since – he argued – there is no limit to God’s power to divide matter, though in nature there are particles that are not actually separated. Matter has two main attributes: size and shape. Local motion as he put it ‘is the principal of second causes’. But what is the origin of local motion? on this ‘hotly disputed question’, Boyle endorsed Descartes’ view, maintaining that matter is inert and the origin of motion is from God.⁶ On the origin of motion Boyle disagreed with the ancient atomists, as well as with Gassendi. The contrast with the atomists’ views of motion as inherent to matter was the reason why Boyle changed his position on atomism, i.e., why he repudiated his juvenile adherence to the atomistic theory of matter - which is attested in a manuscript dated c. 1650. For Boyle, the activity of matter could easily bring about a materialistic philosophy. Boyle's changing views of atomism were clearly expounded in the fourth and fifth essays of the first part of *The Usefulness of Experimental Philosophy*, which were devoted to the rejection of the doctrines of those philosophers who, as Boyle put it, 'would exclude the deity from intermeddling with matter'.⁷ Boyle’s primary targets were those ‘neo-Epicureans’ (like John Evelyn and Margaret Cavendish) who endorsed Lucretius’ cosmology. On this issue Boyle wanted to distance his position from Gassendi’s. The difference between Boyle’s position and Gassendi’s is not little: while Gassendi postulated that all atoms are endowed with the same velocity from the beginning, and that they naturally tend to produce motion within natural bodies, for Boyle, God guided the motions of primary corpuscles in order to produce various concretions of corpuscles. According to Boyle, both the origin and the determination of motion (velocity and direction) depend on God. In his view, matter, barely put into motion and then left to itself, cannot ‘constitute this beautiful and orderly world.’ So he insisted that God guided the motions and added the Laws of Nature.

Boyle’s conception of the status and role of the Laws of Nature has little in common with Descartes’. Descartes maintained that the present state of the Universe is the outcome of matter, motion and the laws of nature.⁸ Boyle imposed severe restrictions to the Laws of Nature.

⁵ Boyle, *The Christian Virtuoso* (1691), Boyle, *Works*, 11: 293.

⁶ Boyle, *The Origine of Formes and Qualities* (1666), Boyle, *Works*, 5: 305-6.

⁷ Boyle, *The Origine of Formes and Qualities*, *Works*, 3: 244-80.

⁸ “It matters very little how I suppose matter to have been disposed at the beginning, since its disposition must afterwards be changed, according to the laws of nature; and one can scarcely imagine any disposition from which one could not prove that by these laws it must continually change, until finally it composes a world entirely similar to this

1. He reduced the causative power of the Laws of Nature. Boyle in fact denied that the laws of motion could bring matter into ‘so orderly and well contriv’d a Fabrick as this World’. God directly guided ‘the motions of the small parts of the universal matter as to reduce the greater System of them into the order...’⁹ Boyle also maintained that the laws of nature are not adequate to keep the structure of the universe, that, because of the increasing irregularities, would inevitably be reduced into chaos. The ordinary concourse of God is therefore necessary to keep the structure of the universe. As Boyle put it:

*That this most Potent Author, and (if I may so speak) Opificer of the World, hath not Abandon’d a Masterpiece so worthy of him, but does still maintain and Preserve it; so regulating the stupendiously swift Motions of the great Globes, and other Masses of the Mundane Matter, that they do not, by any notable irregularity, disorder the great system of the Universe, and reduce it to a kind of Chaos, or confus’d state of shuffl’d and depriv’d things.*¹⁰

2. Boyle conceived the Laws of Nature as contingent on God’s will. In the ‘Appendix’ to the *Christian Virtuoso* he explicitly stressed their contingency: “The laws of nature as they were first arbitrarily instituted by God, so in reference to him, they are but arbitrary still.”¹¹ The laws of nature depend on God’s will, which is entirely free. God is ‘a most free agent’, who did not create the world of necessity; God created it when there was no substance besides Himself, and no creature to which He owed any obligation or by which He could be restricted. As God is the most free and powerful Author of nature, He is able, whenever He thinks fit, to suspend, alter, or contradict those laws of motion, which He alone at first established and which need His perpetual concourse to be upheld.¹² God might thus at any time, “by withholding his concourse, or changing these laws of motion, that depend perfectly upon his will..., invalidate most, if not all, the axioms and theorems of natural philosophy.”¹³ Boyle went so far as to cast doubts about the universal validity of the Laws of Nature: it is not unreasonable to imagine that other regions of the universe might have peculiar Laws of Motion.¹⁴

3. Boyle put some restrictions to Descartes’ law of the conservation of the quantity of motion – one of the pillars of Descartes’ mechanical philosophy. Boyle objected that it is based on the immutability of God, but it is ‘not clear – he wrote– why God may not as well be immutable, tho’ he should sometimes vary the Quantity of Motion that he has put in the World. Indeed, Boyle stressed that all local motion “is still Continu’d and Preserv’d immediately by God.”¹⁵

one [...] For since these laws cause matter to take on successively all the forms it is capable of, if one considers all those forms in order, one will be able finally to arrive at the form that exists at present in the world.” (Descartes, *Principles of Philosophy*, 3, art. 46). Descartes’ view was also censured by E. Stillingfleet, *Origines sacrae* (London, 1662), who maintained that God is the source of motion and regulates the motions of matter.

⁹ Boyle, *Origine of Formes and Qualities*, Works, 3: 353-4.

¹⁰ Boyle, *Christian Virtuoso* (1690), Works, 11:300

¹¹ Boyle, Works, 12: 423. The Appendix was first published by Birch in the 1744 edition of Boyle’s works.

¹² Boyle, *A Disquisition about the Final Causes of Natural Things* (1688), Works 11: 109.

¹³ Boyle, *Some Considerations about the Reconcilableness of Reason and Religion* (1675), Works, 8: 251-2,

¹⁴ Boyle, *The High Veneration Man’s Intellect owes to God* (1685), Works, 10: 175.

¹⁵ Boyle, *Christian Virtuoso*, Works, 301.

4. For Boyle, the Laws of Nature are to be understood as ‘notional rules’, because a law is a rule of action according to which an intelligent and free agent is bound to regulate his actions. But inanimate bodies are utterly incapable of understanding what a law is.¹⁶ In *Notion of Nature* he made his point very clear claiming that what we call laws of nature are real powers that God gave the parts of matter to transmit their motion to one another and that he maintains with his ordinary and general concurrence.¹⁷ Since the created world is a contingent artifact entirely depending on God’s power, Boyle denied that laws are immanent in nature and maintained that a law of nature is the conceptualisation of similarities observed in natural phenomena. This view of natural law (as observed McGuire in 1972) is based on Boyle’s nominalistic ontology and on his voluntaristic theology.

Boyle’s stress is on God’s direct intervention in the physical world. This a leit-motiv of his justly famous work on the Notion of Nature, where Boyle set out to discuss whether *nature* be that “almost divine thing..., or a notional thing, that in some sense is rather to be reckoned among our works, as owing its being to human intellects.”¹⁸ The received notion of nature - he claimed - was both useless to natural philosophy and dangerous to Christian religion. The view of nature as God’s lieutenant, i.e., an agent intermediate between God and the creation, would inevitably limit God’s power. He rejected the Aristotelian ‘nature’, as well as Henry More’s Spirit of Nature and Cudworth’s plastic natures, since - in Boyle’s view - they would interfere with God’s action in the world. Cudworth’s arguments (that John Ray endorsed in *The Wisdom of God*) were directed against the view that “God set his own hand, as it were, to any work and immediately does all the meanest and triflingest things himself drudgingly, without making use of any inferior and subordinate instruments.” For Boyle, God created the world and maintains it with His general concurrence without the assistance of a “vice-gerent”. But Cudworth had a powerful argument for the existence of his plastic nature - which he saw as a blind and unintelligent instrument of God. According to Cudworth, the plastic nature could explain “errors and bungles, whereas an Omnipotent Agent... would always do His work infallibly and irresistibly.”¹⁹ Boyle was aware of this objection and claimed that what we consider anomalies and irregularities in the course of nature might be explained as long term regularities, as he put it, ‘periodical phenomena, that have long intervals between them.’ In his tract on the Notion of Nature Boyle attributed the irregularities to our dim intellect. He noticed that, “The Divine Maker of the Universe, being a most free agent, and having an intellect infinitely superior to ours, may, in the production of

¹⁶ “I look upon a Law as a Moral, not a Physical, Cause, as being indeed but a notional thing, according to which, an intelligent and free Agent is bound to regulate its Actions. But inanimate Bodies are utterly incapable of Understanding what a Law is, or what it enjoyns, or when they act conformably or unconformably to it; and therefore the actions of inanimate Bodies, which cannot incite or moderate their own Actions, are produc’d by real Power, not by Laws...” (*Christian Virtuoso, Works*, 11: 302)

¹⁷ “I must freely observe, that, to speak properly, a Law being but a notional rule of acting according to the declar’d Will of a Superior, ‘tis plain, that nothing but an intellectual being can be properly capable of receiving and acting by a law. For if it does not understand, it cannot know what the Will of the Legislator is; nor can it have any intention to accomplish it, nor can it act with regard to it; or know, when it does, in Acting, either conform to it or deviate from it. And ‘tis intelligible to me, that God should at the beginning impress determinate motions upon the parts of Matter, and guide them, as He thought requisite, for the primordial constitution of things: and that ever since he should, by his ordinary and general concurrence, maintain those powers, which he gave the parts of matter, to transmit their motions thus and thus to one another.” (*Notion of Nature, Works*, 10: 457)

¹⁸ *Notion of Nature, Works*, 10: 445.

¹⁹ Cudworth, *The True intellectual System of the Universe* (London, 1678), book, I, ch. iii, sect. 37.

seemingly irregular phenomena, have ends unknown to us, which even the anomalies may be very fit to compass.”²⁰

Boyle denied the existence of ‘natures’ as internal principles governing the behavior of natural bodies, which only depend on their mechanical contrivances. But, as Boyle often repeated, matter is dull, and devoid of perception, so material agents do not act with purpose. Given these premises, are we forced to banish teleology from nature? Boyle’s answer was negative. According to Boyle, the Creator disposed material agents in view of the achievement of an end; the teleological behavior of the parts being the consequence of the Artificer’s plan. But Boyle faced a very serious challenge to teleology, namely the one formulated by Descartes. The French philosopher did not reject the existence of final causes, but he denied that we can know God’s purposes. As Descartes put it: “we ought not be so arrogant as to think that we are participant in his plans.” Boyle was inevitably sensitive to Descartes’ argument stressing the gap between our intellect and God’s. Boyle admitted that it would be a presumption to claim that human intellect is able to achieve a complete understanding of God’s ends in the creation, but he opposed Descartes’ denial that we can discover them. As Boyle put it:

tho’ I judge it erroneous to say in the strictest sense, that every thing in the visible world was made for the use of man; yet I think ‘tis more erroneous to deny, that any thing was made for ends investigable by men.

We can safely assume that among the many ends that God has proposed to himself at the Creation one may be that we as intelligent creatures should discern the beauty and the goodness of the world. Such a discernment is only possible if we know the ends (at least some of them) for which God has designed the natural world.²¹ Though we cannot say that God’s only scope when he made the world was the benefit of man, it is not absurd to suppose that

among other purposes, they [i.e., the celestial bodies] were made to illuminate the terrestrial globe and bring heat and other benefits to the inhabitants of it: so that the contemplation of the Heavens, which so manifestly declare the Glory of God, may justly excite Men, both to admire his power and his wisdom in them...²²

The strongest support to Boyle’s argument that the final causes are knowable comes from the investigation of living organisms: final causes are both permissible and useful in the study of plants and animals. For Boyle, the anatomy of animals reveals God’s ends: “There is no part of nature known to us, wherein the consideration of final causes may so justly take place, as in the structure of the bodies of animals.”²³ This is apparent if we consider how exquisitely fitted the eye is to be an organ of sight. In addition, the consideration of the ends provides no little advantage to anatomists, as it is conducive to the discovery of the uses of bodily parts, and can bring about

²⁰ Boyle, *Notion of Nature, Works*, 10: 519

²¹ Boyle, *A Disquisition about the Final Causes of Natural Things, Works*, 11: 87-8; 95 .

²² *Ibid.*, 11: 96.

²³ *Ibid.*, 11:125.

important discoveries, as attested by Harvey's understanding of the use of the valves in the veins. Boyle also found evidence for teleology from the generation of animals, and his scattered notes on this subject clearly show that he adopted the theory of the preformation, claiming that development involves the unfolding of the pre-existent form. This view is to be found in his manuscript on generation (now published in the 13th volume of the Works) and in an aphorism of the second part of the *Christian Virtuoso*, published for the first time in 1744:

*The cicatricula of an egg, or the germen in the seed of a plant, being, in reality, a model of the animal, or plant, to be produced from it; the wonderful minuteness of a machine, at once so very little, and so curious, does abundantly recommend the matchless skill of the divine mechanist. But it does no less recommend his providence too, which both foresaw, that the concurrence of so many external bodies, and adjuvant causes, was necessary to plump up, compleat, and display, the parts that lay admirably folded, and packed up, in this little seeds, and took care, that, ordinarily, they should be provided of all that assistance, which was necessary for them to have, from the favourable concurrence of external agents, and helpful causes.*²⁴

In a justly famous article of 1972, McGuire argued - on the basis of a convincing assessment of Boyle's voluntaristic theology and nominalistic ontology - that causal power cannot be ascribed to physical agents. According to McGuire, causation - for Boyle - is imposed by men upon observed regularities. McGuire's interpretation was criticized by Shanahan, who defined Boyle's position as concurrentist and distanced Boyle's position from the occasionalists'. In Shanahan's view, "Boyle takes for granted that God and natural entities each play causal role."²⁵ I am not convinced that for Boyle material agents have independent causative power. God's general concurrence is necessary to for the causal efficacy of every physical agent, and, as Boyle often stated, God can suspend it, as in the case of miracles. In a paper on Cartesian Philosophy (composed between 1670 and 1680 and published by Peter Anstey in 1999) Boyle made significant concessions to the occasionalist views. Boyle was asked to give his opinion about occasionalism (he knew the scholastic version of it, namely Durandus de Saint Purçain's, and those put forward by La Forge and by Cordemoy) and wrote a short paper on the subject - that was in fact supposed to circulate, as it was translated into Latin. In it, we find some important statement showing (at least) that Boyle had a favorable opinion of the occasionalist views. I quote the relevant passages (see photocopies):

After repeating the principle of parsimony, Boyle writes: "it does not manifestly appear to us, that one body does really and truly move another, but that only upon a moved body's hitting another, there follows a motion in the body that is shocked, or hitt against..." Boyle continues by answering the objection that such a view would appear paradoxical since it deprives material agents of the honor of being causes. His answer is in my opinion very telling since it shows that

²⁴ Boyle, *The Christian Virtuoso*, part II, *Works*, 12: 528.

²⁵ J.E. McGuire, "Boyle's Conception of Nature", *JHI*, 33 (1972), 523-42; T. Shanahan, "God and Nature in the Thought of Robert Boyle", *JHP*, 4 (1988), 547-69

though Boyle is still undecided about the occasionalist thesis, he does not find any strong objection against it:

“And I think – he writes – it might be considered, whither it may be more safe, as well as more pious, in a doubtful case, to attribute a power that must be lodged somewhere, rather to an omnipotent spirit, than to senseless matter, it being a less dangerous error to derogate from bodys, than from God.” After all – Boyle concludes – whereas Descartes ascribes “to God all the quantity of motion in gross, the others [i.e., the occasionalists] ascribe to him in parcels.”²⁶ Boyle’s views are not a detour from his mechanism. If we pay attention to some of his comments on the Cartesian philosophy, we find that Boyle (contrary to what Anstey states on p. 63 of the article I quoted) that Boyle was aware of the possible occasionalist interpretation of Descartes’ mechanism:

*According to the Cartesians, all Local Motion is adventitious to Matter, and was at first produc’d in it, and is still every moment Continu’d and Preserv’d immediately by God: Whence may be inferred, that he concurs to the actions of each particular agent (as their are physical)...*²⁷

Boyle gave his assent to both the premise and the consequence. Boyle also referred to the occasionalist solution of the mind-body problem in the second part of the *Christian Virtuoso* and again he gave a positive evaluation to the occasionalist position:

*And if you should tell me, with some new Cartesians, that it is not the mind itself, that excites and governs these motions, but God who does it, at the wish and endeavour of the mind: I shall answer, that the objection much strengthens my argument...*²⁸

As we have seen, Boyle often repeated that God’s general concurrence

*is necessary to the conservation and efficacy of every particular physical agent, we cannot but acknowledge, that, by with-holding his concurrence or changing these Laws of Motion, which depend perfectly upon his Will, he may invalidate most, if not all the Axioms and Theorems of natural philosophy...*²⁹

This occurs on the occasions of miracles, as attested in Daniel 3, 19-27, where we read that the fire of the furnace did not burn Daniel’s friends. For Boyle, God just with-held his concurrence and the fire did not operate according to the Laws of Nature.

I would like to conclude this paper with some reflections on Boyle’s views of miracles. First of all, I agree with what Jack McIntosh stated in his article on Boyle and miracles: ‘with Boyle we are long away from the notion that miracolous (or at least supernatural) intervention is

²⁶ P. Anstey, “Boyle on Occasionalism: An Unexamined Source.”, *JHI*, 60 (1999), 57-81.

²⁷ Boyle, *The Christian Virtuoso*, I, Works, 11: 301.

²⁸ Boyle, *The Christian Virtuoso*, II, Works, 12: 503.

²⁹ Boyle, *Reason and Religion* (1675), Works, 8: 251-2.

extraordinary.³⁰ Boyle in fact saw prophecies as miraculous events. Boyle's position about miracles (as well as another crucial theme after Restoration, namely the relationship of Reason and Revelation) was not entirely orthodox. Whereas orthodox Anglicans (as for instance Thomas Sprat) held that the age of miracles was past, Robert Boyle admitted the possibility of modern miracles. The Anglican doctrine of the cessation of miracles was directed against both Catholics and 'enthusiasts.' Boyle agreed that miracles are to be tested against religious truths, not the other way round, and that they were necessary to the establishment of revealed religion. But Boyle was significantly open minded on this issue. In his answer to a letter of Henry Stubbe on the supposed prodigious cures of Valentin Greatrakes (the Irish stroker), Boyle stated: "I never met with any cogent proof that miracles were to cease with the age of apostles." He went on by claiming that he would be happy 'at the appearing of a Protestant that is enabled and forward to do good in such a way; especially in an age in which so many do take upon them to deride all that is supernaturall."³¹ But since he did not find anything supernatural in Greatrakes' healings (which, as attested by his working diaries, he thoroughly investigated), Boyle put forward the hypothesis that Greatrakes' cures were rather performed by effluvia emating from his hand and operating by means of the patient's imagination. In addition, Boyle noticed that the Irish stroker (whose supernatural power was extolled by More, Whichcote and Cudworth) claimed to be able to perform exorcisms, but, as we read in Boyle Diary of 1666, he was by no means convinced of such supposed supernatural operations: "He [Greatrakes] thinks most Epileptick Persons to be Demoniaks, notwithstanding what I could say of the contrary."³² Finally, Boyle concludes, since Greatrakes proposed neither a religious message, nor a new doctrine, his cures cannot be considered miracles.

This episode confirms Boyle's views that the Christian Virtuoso is qualified to distinguish

*between things that are only strange and surprizing, and those that are truly miraculous, so that he will not mistake the Effects of Natural Magick, for those of a Divine Power...*³³

This brings us to consider Boyle's conception of supernatural. I do not agree with McIntosch's statement that in Boyle 'mechanical and natural overlap'. Boyle divided phenomena into three groups, namely, in supernatural, mechanical and supra-mechanical. The last are the operations of the human mind and "its organical body upon one another". They –Boyle writes– "**are not to be accounted for by mere matter and its mechanical powers**".³⁴

A final note to explain the title of my paper: Boyle's God is a **clockmaker** who makes and repairs clocks, but he also created the seminal principles, by which all living organisms propagate themselves. So He was a clockmaker who also produced and worked on watches. He was by no means idle. As matter is dull and inert, He is busy to wind up and to repair the clockwork he made.

³⁰ J.J. McIntosch, "Locke and Boyle on miracles and God's existence", M. Hunter (ed), *Robert Boyle Reconsidered* (Cambridge, 1994), 193-214. The quotation occurs on p. 207.

³¹ Boyle to Henry Stubbe, 9 March 1666, *Correspondence*, 3: 95.

³² BL Add MS 4293, f. 51.

³³ Boyle, *The Christian Virtuoso*, I, *Works*, 11: 316.

³⁴ Boyle, *The Christian Virtuoso*, II, *Works*, 12, 477.