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Animism and natural teleology from Avicenna to Boyle

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Argument

Historians have claimed that the two closely related concepts of animism and natural teleology were both decisively rejected in the Scientific Revolution. They tout Robert Boyle as an early modern warden against pre-modern animism. Discussing Avicenna, Aquinas, and Buridan, as well as Renaissance psychology, I instead suggest that teleology went through a slow and uneven process of rationalization. As Neoplatonic theology gained influence over Aristotelian natural philosophy, the meaning of animism likewise grew obscure. Boyle, as some historians have shown, exemplifies this uneven process. There is an unresolved tension between his religious convictions and the implicit animism of his empirical practice.

1. Introduction

In 1993, Betty Jo Dobbs began her keynote address to the History of Science Society with a warning: "It is entirely . . . possible that you will regret granting me this forum, for I intend to undermine one of our most hallowed explanatory frameworks, that of the Scientific Revolution" (Dobbs 1994, 633). Dobbs passed away the following year, but her challenge clearly resonated through the plenum, with subsequent years marked by a persistent enthusiasm among historians of science for critical reappraisals of Alexandre Koyré's influential 1943 claim that modern science began with a dazzling world-historical bang (Koyré 1943). Much work has now been done to demonstrate the robust continuities running between the new sciences of the seventeenth century and, for example, the preceding practices of post-feudal mercantile artisans and late Renaissance natural magicians (for mercantile artisans see Klein and Spary 2010 and Smith 2004; for natural magicians, see Henry 1997 and 2012).

One declared discontinuity, however, has proven more resilient: that early modern practitioners rejected the medieval Aristotelian belief in immanent final causation, or natural teleology. Indeed, Peter Dear has argued that, "to the extent that Aristotle's natural philosophy sought the final causes of things, and thereby to determine their natures, experimental science was therefore disallowed" (Dear 2006, 110). Likewise, Steven Shapin has claimed that it was the "teleological and animistic features of the traditional physics of motion that the new natural philosophers of the seventeenth century seized on – indeed, caricatured – as marks of its absurdity and unintelligibility" (Shapin 1996, 30). The alleged absurdity of medieval animism rested on its "attributing soul-like properties (the Latin *anima* means soul) to natural objects and processes" (Shapin 1996, 29). The "natures" that scholastic Aristotelians sought to determine by studying final causes were just the "soul-like properties" characteristic of animistic natural philosophy. Natural teleology was to be rejected because it slipped irretrievably into animistic absurdity.

Laurence Carlin has recently argued that – at least with respect to certain medieval scholastic Aristotelians, and the seventeenth-century savant Robert Boyle – Dear, Shapin and their fellow

travelers are wide of the mark. According to Carlin, "Boyle endorsed final causes in *precisely* the same way that these Scholastics endorsed them, and therefore there was no transition from medieval to modern on this score" (Carlin 2012, 58). This is a wonderfully bold claim of continuity … but perhaps not quite what it may at first seem.

Carlin writes that, according to Shapin, "immanent final causality was typical of medieval Scholasticism," and "this view entails that natural objects possessed intrinsic powers … to strive for certain ends" (Carlin 2012, 55). If Shapin is right, then Carlin would be committed to the view that scholastic natural teleology flowed uninterrupted into Boyle's philosophy of nature, staining it with the alleged absurdity of animism. But, according to Carlin, Shapin is *not* right, because, in fact, "late Aristotelians were not guilty of animism and … they denied 'full-blown' teleology to natural agents" (Carlin 2012, 56 n. 5). By "full-blown" teleology, Carlin means the ascription of an intrinsic end-directed power to nature. As we will see in the next section, animism is a special case of this natural teleology.

Carlin thus also challenges those historians of continuity who have asserted the persistence of animism in seventeenth-century atomistic and mechanical natural philosophy. Richard Westfall, for example, writes that "throughout the seventeenth century, mechanistic modes of expression disguised the survival of animistic modes of thought from earlier philosophies of nature" (Westfall 1971, 391). Margaret Osler, in turn, argues that "natural philosophers modified the mechanical philosophy – perhaps unwittingly – by introducing activity into matter" (Osler 2001a, 439). In particular, Pierre Gassendi "introduced elements of animism into his atomism," and "Boyle … appealed to immanent finality, albeit unwittingly and contrary to his own stated intentions" (Osler 2000, 203; Osler 2001b, 166). Several other historians of continuity have also emphasised the residual animism in Boyle's mechanical philosophy (Anstey 2002; Clericuzio 1990; Henry 1986).

Carlin, however, will have none of this. While he too affirms a continuity, one that runs through six centuries from Avicenna to Boyle, he also argues that the teleology of Avicenna and his successors had already been purified of animism. Hence, with respect to final causation, there was no revolutionary boom into the modern age because medieval Aristotelians had already adopted a fully modern – which is to say, anti-animistic – concept of teleology. In this paper, I will instead show, *pace* Carlin, that the period from Avicenna to Boyle was marked by a slow and uneven process in which teleology became rationalized. The tension between Boyle's explicit mechanism and his implicit animism, between his theological convictions and his natural philosophical practices, exemplifies the unevenness of this rationalization process. But first, we need to clarify some terminology.

2. Aristotelian animism

Defined in Aristotelian terms, animism is a teleological doctrine that ascribes an irreducible, intrinsic power of self-directedness to some – not necessarily all – entities (cf. Collingwood 1945, 82-89, 95). As noted by Shapin, when pre-modern natural philosophers observed telic motion, they often explained it by reference to the immanent power of a soul. Renaissance Platonists posited a world-soul, or *anima mundi*, which animated the world *in toto* (Yates 1964, 351). Aristotelian animists, in contrast, attributed soul to nature as a plurality, rather than a single soul to the world *in toto*. That telic power is immanent in nature is the basis for natural teleology. That some natural entities, under certain conditions, display their own immanent telic power – that they can be observed to move and direct themselves – is the basic idea of Aristotelian animism. Animism is thus a special case of natural teleology (Kochan 2021, 163-164).

Aristotle identifies four kinds of cause: material; efficient; formal; and final. Most important for understanding Aristotelian animism are efficient and final causes. The efficient cause was also called the moving cause, the cause of motion. Aristotle argued that the efficient cause alone cannot

explain regularity or directedness in natural motion. Criticising the atomists, he writes: "they say there is always movement. But why and what this movement is they do not say, nor, if the world moves in this way or that, do they tell us the cause of its doing so" (Aristotle 1941ª, 878 [*Metaphysics* 1071b, 34-36]). In other words, the efficient cause only explains the difference between the presence and absence of motion as such. But Aristotle wants furthermore to explain the difference between kinds of motion – say, between indeterminate and determinate, random and regular, motions. Alan Garfinkel glosses Aristotle's criticism as focusing on the failure of atomists to explain the relevant contrast between kinds of motion (Garfinkel 1981, 23). To overcome this failure, and to capture the relevant contrast, Aristotle introduces the final cause – that for the sake of which motion occurs. We will return to Garfinkel's account of contrastive explanation in the next section.

Because natural teleology concerns regularity in motion, it relies on both efficient and final causes. Telic motion is not random motion, but motion for the sake of some end. Insofar as natural motions display a pattern or directedness, they are telic. We might call them governed motions. They include the cyclical paths of heavenly bodies, the meandering descent of a river to the ocean, and the growth of an organism to maturity. The Aristotelian explains these different motions by reference to an immanent and irreducible power of self-government. In the case of celestial bodies and maturing organisms, this telic power is possessed by the entity itself. Hence, these are cases not just of natural teleology, but also of animism. In the case of water, Aristotle doubted that the telic power that pulls a river downward is possessed by the water itself. Of such heavy things, he writes, "their motion is natural," but "it is impossible to say that their motion is derived from themselves" (Aristotle 1941b, 364 [*Physics* 255ª2-7]). Water naturally moves downward, but it is not moved by its own nature. Aristotle was not an animist about water.

Medieval Aristotelians typically viewed immanent telic power as evidence for a soul. In *De anima*, Aristotle writes that "soul is the *first* actuality of a natural body which potentially has life" (Aristotle 1986, 157 [412ª20-21]). Translator Hugh Lawson-Tancred uses the term "actuality" to render Aristotle's neologism *entelecheia*, and notes that this literally means "intrinsic possession [*echō*] of an end [*telos*]" (Aristotle 1986, 15, 119). For Aristotelians, to have a soul means to possess telic power. The question of which entities possess a soul, which ones are potentially alive, is an empirical one. For Aristotle, heaviness was not a soul-like property of water. In contrast, a medieval Christian might consider holiness, in some cases, to be a soul-like property of water, so they could be animists about water (cf. Bynum 2011, 154).

Aristotle also distinguishes between artificial and natural motions (cf. Kochan 2017, 269-274). He writes that "art is a principle of movement in something other than the thing moved, nature is a principle in the thing itself" (Aristotle 1941a, 874 [*Metaphysics* 1070ª7-9]). An arborist trains a tree in order to direct its growth to maturity. A physician treats a patient in order to return her to health. A shipwright uses wood to produce a boat. As these examples show, while the final cause in art is external, the efficient cause may be more or less internal. At one extreme, the tree grows according to the arborist's purposes. At the other, wood is moved by the shipwright according to the shipwright's purposes. Between these extremes, the physician externally supplements the patient's internal metabolic movements for the sake of health.

Final causes are internal to entities that govern their own movement by nature, and they are external to entities that move under the direction of art. Hence, the art of ship-building is external to the wood used to build a boat. But Aristotle furthermore writes that "if the ship-building art were in the wood, it would produce the same results *by nature*" (Aristotle 1941b, 251 [*Physics* 199ᵇ27-29]). In this case, boats would naturally build themselves.

Aristotle also writes that "a doctor doctoring himself: nature is like that" (Aristotle 1941b, 251 [*Physics* 199ᵇ30]). While boats may, in theory, build themselves, humans really do cure themselves. The medical art is internal to the patient once the patient has learned medicine. This, then, is the nub of Aristotelian animism. Animate nature is conceived of as self-producing and self-governing, understood by analogy to art. An animate thing's telic power is an internal power that

can operate independently of external guidance, though it may also benefit from such guidance. When an entity exercises this internal power, it was often thought to possess a soul.

We now have the "full-blown" natural teleology that Carlin argues was rejected by both Boyle and his medieval predecessors. But Aristotle writes that "it is absurd to suppose that purpose is not present because we do not observe the agent deliberating. Art does not deliberate" (Aristotle 1941b, 251 [*Physics* 199^{b}26-27]). An experienced artist need not reflect on what she is doing, she may just do it. More recently, Gilbert Ryle has called it absurd to suppose that because art acts with purpose, deliberation must be present. Telic movement – while it may suggest the presence of intelligence – does not entail deliberation: "some intelligent performances are not controlled by any interior acknowledgements of the principles applied in them" (Ryle 1949, 31-32). Artful performance need not be self-aware.

This account of art served Aristotle as an analogue for his explanation of telic natural motion. Aristotelian animism attributes an end-directed soul to some natural entities, but this end-directedness need not be conscious or deliberative. In what follows, I will treat conscious, self-aware, or deliberative activity as *rational*, and activity without consciousness, self-awareness, or deliberation as *non-rational*. On this basis, the non-deliberative telic activity of those natural entities recognised by Aristotelians as animate is a non-rational activity.

3. Boyle's religious argument against animism

Let us now turn to Carlin's argument, beginning with his discussion of Robert Boyle. One of Carlin's interlocutors is Margaret Osler. To support her claim that Boyle's mechanical philosophy included a residual Aristotelian animism, Osler gives the example of Boyle's concept of "the spring of the air" (Osler 2001b, 166-67). In response, Carlin argues that "an examination of Boyle's texts on ... the spring of the air reveals that he had the resources to block any accusations of immanent teleology" (Carlin 2012, 62). We will return to the spring of the air at the end of this essay.

Another of Carlin's interlocutors is John Henry, who addresses the presence of "active principles" in Boyle's mechanical theory of matter (Henry 1986). Carlin attempts to deflect this apparent challenge by distinguishing – rightly – between active principles and immanent finality. Boyle's active principles, he argues, were not primitive, not "full-blown," principles, but were instead meant to be explained reductively in terms of God's externally imposed purposes. Carlin declares his account compatible in "large measure" with that of Henry, because Henry "do[es] not address the issue of finality" (Carlin 2012, 56). This is strictly correct, but perhaps too quick. According to Henry, although "Boyle was always very careful to deny that matter could think or display prescience or appetite," it was also the case that Boyle "did not deny that God *could* endow matter with such powers" (Henry 1986, 356, 366). In other words, Boyle recognised as possible God's creation of a world immanent with telic power, a world in which natural entities could govern themselves – thoughtfully or presciently – without external guidance.

Moreover, in his 1686 *Free Enquiry into the Vulgarly Received Notion of Nature*, Boyle wrote: "I readily grant, that the All-wise Author of Things Corporeal has so fram'd the World that most things happen in it as if the particular Bodies that compose it, were watchful both for their Own welfare, and That of the Universe" (Boyle 2000a, 532). In short, it *appears* that natural entities consciously pursue ends, caring for the universe in general. Boyle sometimes described this as the view that nature acts as God's lieutenant or "vicegerent." He allows that the "All-wise Author" could have appointed such a vicegerent, "an Intelligent and Powerful Being ..., continually watchful for the good of the Universe," though not rational or prescient enough to prevent "destructive" events like the plague (Boyle 2000a, 449).

Although Boyle recognized that God could endow natural entities with an imperfectly rational telic power, he refused to accept that this was *really* the case (cf. Anstey 2001, 509). Rejecting a role for nature as God's vicegerent, Boyle instead argued that it is "more consonant to the respect we

owe to Divine Providence" to interpret apparently destructive natural events as playing an overall positive role in God's rational plan, a plan that "may in many Things have ends unknown to us" (Boyle 2000a, 449). To attribute disasters like the plague to the imperfect rationality of nature fails to honor God's absolute benevolence and power.

The subtlety of Boyle's position was sometimes overlooked by his contemporaries. As John Hedley Brooke has noted, even as sympathetic a reader as John Ray mistook Boyle as recognizing the presence of rational self-government in nature, an error for which he later duly apologized (Brooke 1991, 143).

Both Carlin and Henry recognize that Boyle allowed for the presence of active principles in nature, but that he did not accept them as evidence for an irreducible telic power in nature. Yet Carlin goes one step further. He also argues that Boyle had the resources to block potential accusations of animism. So what were these resources?

Carlin tries to tease them out in the form of two reasons that could have ostensibly grounded Boyle's resistance to Aristotelian animism while still allowing room in his mechanical philosophy for active principles. The first reason is that telic motion "requires a mind that can consciously represent the relevant end, and pursue it (*via* its active principle) accordingly" (Carlin 2012, 56). Carlin calls this an *ontological* reason: "natural agents simply are not the right type of thing that can contain an end-driven principle," where that principle is apparently present in the mind as an object for conscious deliberation (ibid.). In short, natural entities cannot possess telic power because they are not rational. The second reason is that active principles are non-primitive: "they can be reduced to mechanical properties of the agent" (ibid.) Carlin calls this an *epistemological* reason: "the behavior of natural agents can be completely understood and explained in a non-teleological way, without reference to end-states" (ibid.).

Boyle's epistemology seems to assume that natural motion is non-telic. Credible natural philosophical explanations will be mechanical, not teleological, because there are, *a priori*, no final causes in nature, only efficient or mechanical ones. Boyle's anti-animistic epistemology is thus underpinned by his mechanical ontology. The fundamental issue for Boyle was whether or not natural entities can rationally deliberate about the ends to which they are directed. Behind the question "Can nature govern itself?" lies the question "Is nature rational?"

Indeed, Boyle viewed the question of animism as a contrastive choice between two distinct ontologies of nature. In *Free Enquiry*, he writes: "I shall *first* demand, Whether Those, I reason with, believe Nature, though Corporeal, to act knowingly, *i.e.* with Consciousness of what She does and for pre-designed ends; or else to be blindly and necessarily moved and directed by a Superior Agent, indow'd with (what She wants,) an excellent Understanding" (Boyle 2000a, 554-55; cf. Boyle 2000b, 113-14). On one side is a rational and corporeal nature, with the power to govern itself. On the other side, as Boyle wrote in his 1688 *Disquisition about the Final Causes of Natural Things*, is a nature that is "Stupid and Inanimate," a nature governed not by itself but by "a most Wise Superintendent" (Boyle 2000b, 114, 151). For Boyle, the question of animism boils down to a choice between these two explanations for telic natural motion.

Let us consider this choice in terms of the method of contrastive explanation introduced earlier. Garfinkel argues that a contrastive explanation is determined by what is taken for granted in a demand for information – "*Given* A, why B?" – where B denotes the choice made from a range of possible explanations for A's being the case (Garfinkel 1981, 29; cf. Lipton 1990, Kochan 2010). In the present instance, given telic natural motion, why attribute the cause to God *rather than* to a rational and corporeal nature?

For Boyle, the answer is clear: "'tis a dangerous thing to Believe other Creatures than Angels and Men, to be Intelligent and Rational; especially/to ascribe to any of them an Architectonick, Provident and Governing Power" (Boyle 2000a, 483). But why dangerous? Boyle tells us: "I think it dangerous to Religion in general, and consequently, to the Christian. For this Erroneous Conceit defrauds the True God of divers Acts of Veneration and Gratitude, that are due to Him from Men" (Boyle 2000a, 487). So the reason for choosing God rather than a rational nature to explain telic

natural motion is that the former choice secures, while the latter choice threatens, Christian faith in God's absolute benevolence and power (cf. Potter 2001, 124-129).

Garfinkel argues that the finite range of possibilities from which B is chosen imposes "structural conditions" on any acceptable explanation of A. The narrower the range of possibilities, the fewer "degrees of freedom" will be available for an explanation (Garfinkel 1981, 44). In Boyle's case, he allowed only two possible explanations for telic natural motion. Remarkably, neither of those options included the explanation favoured by the Aristotelian animist, namely, that such motion may be explained by the non-rational exercise by natural entities of an immanent telic power.

Hence Boyle seems to beg the question against the Aristotelian animist when he writes, in his 1662 *A Defence of the Doctrine Touching the Weight and Spring of the Air*: "I am not very forward to allow acting for ends to bodies inanimate, and consequently devoid of knowledge" (Boyle 2000c, 40). Is it bad to beg the question? Not necessarily. After all, Boyle says explicitly that his goal, in this context, is to defend religion, not reason. Accordingly, Timothy Shanahan argues that "the 'scientific' usefulness of considering final causes is for Boyle an issue of decidedly secondary importance" (Shanahan 1994, 190). In this, Boyle was not unusual for his time. Amos Funkenstein writes that "to many seventeenth-century thinkers, theology and science merged into one idiom, part of a veritable secular theology" (Funkenstein 1986, ix). Carlin, too, recognises that in "Boyle's detailed analysis of final causes …, the main goal for Boyle is *theological*" (Carlin 2011, 672).

Jan Wojcik argues that, in those rare instances where there was a clear revelation concerning one of God's attributes, Boyle thought it justified, even in the absence of sufficient reason, to deny the opposite of that attribute. One such case was the revelation of God as an incorporeal being (Wojcik 1997, 111). On this revelatory basis, Boyle accepted as certain the ontological distinction between matter and mind. Because the mind is both incorporeal and the seat of telic power, telic power too must be incorporeal. Boyle's theologically infused dualism effectively pulls telic power out of the material world, where the natural teleologist had placed it, and instead roots it in an immaterial world of rational representations. Boyle's resources for blocking accusations of animism were thus secured not by natural reason but by revelation. As we will see later, Boyle's theological commitments sat uneasily with his natural philosophical instincts.

Boyle's mind–body dualism was, according to Peter Anstey, "heavily indebted" to René Descartes, with Boyle adopting Descartes's psychology "wholesale" (Anstey 2000, 188; Anstey 2001, 488). Like Descartes, Boyle believed the soul to be incorporeal and rational (Anstey 2001, 484-485). As Boyle saw it, "Man consider'd barely as an *Animal*, is a Creature little enough to be Contemptible; yet as He is endow'd with a *Soul*, Immaterial, Rational, and Immortal, he is a Creature much more Noble and Excellent than the whole Terraqueous Globe" (Boyle 2000b, 113-14).

It was God who endowed human beings with a rational soul. According to Boyle, this happens in the sixth week of embryonic development. The receipt of an incorporeal, rational soul separates humans from apes, with whom they share similar bodies.

Nay, *though* some Brutes, as particularly Apes, have the Structure of many Parts of their Bodies very like that/of the Analogous Ones of Human Bodies: Yet that admirable Work of the Formation and Organization of the *Foetus*, or little Animal, in the Womb, is granted by Philosophers to be made by the Soul of the Brute (that is therefore said to be the Architect of his own Mansion,) which yet is neither an Incorporeal, nor a Rational Substance. And, even in a Human *Foetus*, if we will admit the general Opinion of Philosophers, Physitians, Divines and Lawyers, I may be allowed to observe, that the Human Body, as exquisite an Engine as 'tis justly esteem'd, is form'd without the Intervention of the rational Soul, which is not infus'd into the Body, 'till This hath obtain'd an Organization, that fits it to receive such a Guest; which is commonly reputed to happen about the end of the Sixth Week, or before that of the Seventh. (Boyle 2000a, 553)

In this passage, Boyle seems to distinguish between two types of soul. The first is a corporeal and non-rational soul to which "Philosophers" credit the formation and organization of the fetus. Earlier, we considered Aristotle's claim that if the ship-building art were in the wood, it would produce the same results as a shipwright *by nature*. Likewise, if the telic power of embryonic development were internal to the embryo, then the embryo would develop itself by nature. In this passage, Boyle appears to acknowledge, if only implicitly, the perspective of the Aristotelian animist.

The second type of soul is an incorporeal and rational soul that is infused into the fetus in its sixth week of development. Boyle then asks, once we have this soul, "How much ... we are enabled to explicate the Manner, How the foremention'd Functions of an *Embryo* are perform'd" (Boyle 2000a, 553). In other words, on receiving a rational soul from God, we gain a capacity of unknown strength to consciously reflect on and understand the earliest stages of our own embryonic development.

We now have three distinct explanations for telic motion in nature, each of them present – more or less explicitly – in Boyle's writings:

(1) An incorporeal and rational God.
(2) A corporeal and rational nature.
(3) A corporeal and non-rational nature.

Yet, as we have seen, Boyle recognizes only the first two as legitimate choices when he turns to an explanation of telic motion in nature. By thus restricting the contrast space for a possible explanation – by excluding explanation #3, Aristotelian animism – Boyle effectively reduces the freedom available for explanations of telic natural motion.

Boyle's stance seems to result from his adoption of Descartes's psychology. For Boyle, telic natural motion consists of two ontologically distinct components, one material and the other immaterial. In Aristotelian terms, these two components correspond respectively to efficient and final causes. The spatial separation of the shipwright from the ship, the former being physically external to the latter, has been transformed into an ontological separation of the principle of governance from the world governed. Telic power is now understood, by definition, as an incorporeal power, a power necessarily external to the material world.

As a consequence, active principles, being inherently corporeal, cannot be a primitive source of telic power in Boyle's mechanical account of nature. Instead, he was committed to treating active principles reductively as the efficient cause of natural motion. Although it may appear that the early development of an embryo is governed by its own generative soul, in fact God has graced us with the rational ability to recognize these natural functions as a sign of God's divine involvement in nature. Hence, Boyle's psychology made it difficult for him to recognize the Aristotelian explanation for telic natural motion in terms of a non-rational corporeal soul. During the Renaissance, this non-rational corporeal soul was often called "vegetative" or, more broadly, "organic." According to Katharine Park, the organic soul was "the principle responsible for those life functions inextricably tied to the bodies of living beings," including "the higher cognitive functions of imagination and memory" (Park 1988, 464).

As Dennis Des Chene argues, "Descartes, when he erased the vegetative soul, had argued that wherever there is genuine activity, wherever there is *change directed at an end*, there must be cognition" (Des Chene 2000, 201). Hence, one consequence of Boyle's psychology was, writes Anstey, "that scholastic descriptions of vegetative and sensitive functions of animate creatures in terms of functions of the soul now seemed to Boyle to smack of attributing thought to matter" (Anstey 2001, 498).

Recalling our three explanations for telic natural motion, we may now say that Boyle's reflex was to collapse option #3 into option #2, leaving only #1 and #2 as possible explanations. In Boyle's restrictive view, Aristotelian animists, now faced with a choice between only these two possibilities, mistakenly choose the second, and so commit the heresy of ascribing rationality to nature. That they might have instead attributed to nature an irreducible, non-rational telic

power goes unacknowledged by Boyle. As Shapin observes, in a passage cited earlier, seventeenth-century natural philosophers caricatured Aristotelian animists, so as to then accuse them of absurdity and unintelligibility. We now have a better sense of how that caricature – along with the absurdity it served to produce – could operate in practice.

In light of these considerations, we seem confronted with a distinct shift in the history of natural philosophy, one marked by the ascendance of a mechanical conception of nature. Guido Giglioni has characterized this as a "shift from *vegetative soul* to *natural automaton*: the latter incorporates what the ancients attributed to nature, an inner principle acting to attain an end" (Giglioni 1995, 269). Boyle understood the telic activities of an organic soul in terms of the active principles of a mechanical nature, with those principles further construed reductively as a combination of immanent and corporeal efficient causes and the external and divine guidance of a rational and incorporeal God.

But if there was in fact a shift in conceptions of telic natural motion between medieval and early modern natural philosophy, then we may doubt Carlin's claim that "Boyle endorsed final causes in *precisely* the same way that these Scholastics endorsed them, and therefore there was no transition from medieval to modern on this score" (Carlin 2012, 58). On the other hand, if Carlin were right, then perhaps there was, after all, no cultural shift in conceptions of final causation. Perhaps, as Carlin claims, medieval philosophers never attributed an irreducible and corporeal telic power to natural entities. Let us test this claim.

4. Avicenna's dual-aspect theory of final causes

The continuous thread of Boyle's predecessors, who, according to Carlin, endorsed final causes in precisely the same way that Boyle did, begins, in Carlin's account, with Avicenna [Ibn Sīnā] (c. 980–1037), and runs forward through Thomas Aquinas (1225–1274), William of Ockham (c. 1287–1347), John Buridan (c. 1300–1358/61), Francis Toletus (1532–1596) and Francisco Suárez (1548–1617), before finally reaching Boyle (1627–1691). I wish to challenge the smooth continuity of Carlin's narrative. I will do so by first focusing on Avicenna, Aquinas and Buridan in sections 4-6. I aim to show that Boyle's three predecessors did not, in fact, precisely share his conception of final causes. Section 7 then addresses subsequent developments in the Renaissance, and Section 8 concludes with a return to Boyle. Rather than Carlin's smooth continuity, we instead find a slow and uneven process of rationalization. As teleology became rationalized, the meaning of animism grew increasingly obscure.

The method of contrastive explanation will guide our comparison of Boyle's account of final causes with those of Avicenna, Aquinas and Buridan. Our contrastive question was "Given the fact of telic natural motion, why argue that the cause is [1] God (incorporeal and rational), *rather than* [2] nature (corporeal and rational), *or* [3] nature (corporeal and non-rational)?" As we saw, Boyle restricts the contrast space to explanations #1 and #2, with explanation #2 then rejected as both absurd and a threat to Christian authority. Boyle therefore excludes explanation #3 from the contrast space, and so implicitly begs the question against the Aristotelian animist.

Did Avicenna also exclude explanation #3 as a possible explanation for telic natural motion? Carlin thinks so. He writes:

> In *al-Shifa'*, Avicenna discussed the way in which ends can move agents to action, and noted that the only way this can happen is if the end has a prior non-physical "being" (*choséité*) in the agent, in which case it is "the cause of its own subsequent [physical] existence." This led him to the conclusion that the "being of the end is a cause only if it has been represented first within a soul, or something like a soul," a conclusion that at least suggests a ruling out of immanent teleology for natural agents, since he seems not to have attributed soul-like entities to non-cognizers. (Carlin 2012, 56; brackets in original)

But hold on. Carlin's ontological argument for rejecting irreducible telic motion in nature is that such motion requires "a mind that can consciously represent the relevant end" (Carlin 2012, 56). In the lines Carlin quotes, however, Avicenna says nothing about consciousness or rationality. Indeed, the lines appear to be compatible with explanation #3, and thus with Aristotelean animism. It looks like Avicenna was ready to attribute soul-like properties to non-cognizers after all.

Indeed, Henrik Lagerlund argues that the terminology of representation in Avicenna's *al-Shīfā* ("The Healing") is an artefact of Latin translators who used that terminology to render a number of different Arabic terms. But, equally important, in the Latin translation "there is no attempt . . . to use this terminology in relation to the intellect or mind" (Lagerlund 2007a, 6). Perhaps Robert Wisnovsky's translation should be preferred to Carlin's, as Wisnovsky's makes reference, not to a representation, but to "an image formed in the soul" (Wisnovsky 2003, 173).

This might make us wary of Carlin's construal of Avicenna's final cause as an incorporeal "being" (*choséité*). Here Carlin is relying on Georges Anwati's French translation of *al-Shīfā*, where the original *shayʾiyya* is rendered as *choséité* (Avicenne 1985, 42). Yet *choséité* might also be translated as "thingness." Indeed, in their respective English translations of this same passage from Avicenna, Wisnovsky and Michael Marmura render *shayʾiyya* as "thingness" (for Marmura, see Avicenna 2005, 228). Here is Wisnovsky's translation of the passage: "its [i.e., the end's] thingness does not become a cause unless it occurs as an image formed in the soul" (Wisnovsky 2003, 173 [bk. 6, ch. 5, §28]; bracketed text modified). In this reading, the end becomes a cause only in combination with a soul. Hence, whether the final cause is incorporeal depends on whether the soul is incorporeal. Was Avicenna's soul incorporeal?

First, consider Avicenna's example of a man who absent-mindedly fiddles with his beard (Avicenna 2005, 224 [bk. 6, ch. 5, §15]). He calls this a purposeful act wherein "there is no cogitative end." But the act nevertheless includes "the end belonging to the imaginative desire." A final cause can therefore be imaginative without also being cogitative or rational. Imagination is different from rationality because "imagining is other than the awareness of one's having imagined" (§16). Hence, the final cause, as an image in the soul, is a representation, but it need not be a rational representation. One may fiddle with one's hair without deliberation.

So, *pace* Carlin, Avicenna does attribute a non-cognitive telic power to the soul. But is Avicenna's soul corporeal or incorporeal? It seems to have been both. In a discussion of celestial spheres, Avicenna writes that a sphere "would, by reason of its body, have imagination – that is, an imaged representation" (Avicenna 2005, 325 [bk. 9, ch. 3, §21]). Here, image is grounded in body. Hence, also *pace* Carlin, the soul, as the site for an image, belongs to body – it is corporeal. Yet Avicenna also writes that "to each sphere there would belong a separate intellect whose relation to it is as the relation of the active intellect in us" (ibid.). So, as with humans, celestial spheres have an intellect that is "separate" from the body. Hence, now in agreement with Carlin, Avicenna's soul, as the site for rationality, is incorporeal.

Lenn Goodman offers a helpful analogy for understanding Avicenna's dual-aspect theory of the soul. As corporeal, "soul is to body as seaworthiness is to ship"(Goodman 1992, 155). As incorporeal, "soul is to body as pilot is to ship." In the first instance, the soul is an abstract form inseparable from the body. In the second, it is a distinct substance separable from the body. This substance is "the rational soul, the human mind or consciousness" (ibid.). The soul as abstract form within a corporeal body is, in contrast, non-rational.

As Elevina Miteva notes, Avicenna sought in his theory of the soul to synthesize Platonic and Aristotelian perspectives. He saw no necessary contradiction between the two: "We can admit, says Avicenna, that the soul is the form of the body, if we only keep in mind that this is its main function, but not its essence. By its essence the soul is a spiritual substance, independent from the body" (Miteva 2012, 91-92). On the one hand – Plato's hand – the soul is essentially separate from the body, rationally directing the body from without. On the other hand – Aristotle's hand – the soul is an inseparable function of the body, non-deliberately directing the body from within. Anneliese Maier thus describes Avicenna's final cause as grounding the "operation" (*Wirken*)

of the efficient cause (Maier 1955, 302). It internally guides the body's movement toward an actuality of form, as when an acorn grows into an oak tree.

In *On the Generation of Animals*, Aristotle writes: "first, the final cause, that for the sake of which a thing exists; secondly, the formal cause, the definition of its essence (and these two we may regard pretty much as one and the same)" (Aristotle 1941c, 665 [715ª4-7]). Thus Andrea Falcon argues that the Aristotelian natural philosopher could justifiably speak of a single "formal/final" cause (Falcon 2019, §3, §5; cf. Cooper 1982, 200, Frey 2015, 147). This points up a potential tension in Avicenna's attempted synthesis of Platonism and Aristotelianism. On the one hand, the soul is a separable essence. On the other, it is an inseparable function. Yet, for the Aristotelian natural philosopher, essence and function – formal and final cause – are pretty much the same. The Aristotelian view thus seems to contradict that of the Platonist.

This potential tension becomes especially clear in Avicenna's later work, where, according to Wisnovsky, Avicenna replaced his earlier term for final cause, shay°iyya ("thingness"), with the term māhiyya, or "essence." Wisnovsky argues that Avicenna did this because, "[u]nlike šay'iyya, māhiyya was clearly identified with form, so natural phenomena with forms but no [conscious] intentionality could be more easily accommodated in a universal teleology" (Wisnovsky 2000, 219; see p. 214 on intentionality as "consciousness"). In other words, Avicenna was keen to preserve a natural philosophical space for Aristotelian animism even at the risk of increased tension with the Platonic doctrine of the incorporeal soul. Unlike Boyle, he recognized a place for explanation #3.

On the other hand, like Boyle, Avicenna recognized a place for explanation #1 – telic motion caused by an incorporeal and rational God. In fact, Avicenna viewed explanations #1 and #3 as complementary. As Goodman writes, "Ibn Sīnā's [i.e. Avicenna's] intent was to locate some of the causal efficacy and control of events within their proximate causes, whether natural or volitional, without derogation from the ultimate causal responsibility of God" (Goodman 1992, 87). Hence, Avicenna endorsed the view that natural entities govern themselves using power delegated to them by God. This recalls, from the previous section, an idea explicitly rejected by Boyle, that nature acts as God's vicegerent. Yet, in Boyle's case, this vicegerent is rational (explanation #2) while for Avicenna it can be non-rational (explanation #3). Boyle rejected animism not in its Aristotelian sense, but in a sense informed by the Neoplatonic identification of telic power with a rational soul (cf. Kochan 2021, 180).

Lagerlund argues that "Avicenna draws a distinction between the study of the soul in itself, which belongs to metaphysics, and the study of the soul as the principle of animation, which belongs to natural philosophy" (Lagerlund 2007b, 5). The conceptual distinction between Neoplatonist and Aristotelian perspectives in Avicenna may thus be viewed as a disciplinary distinction between metaphysics and natural philosophy. In part because of Avicenna's powerful influence, medieval Latin scholars "tended to mix these conceptions of the soul and sometimes emphasize one more than the other, but they never clearly separated them" (Lagerlund 2007b, 4).

Therefore, while Carlin speaks of a single thread, running from Avicenna to Boyle, joining those who endorsed final causes in precisely the same way, it may be better to speak instead of two interwoven threads – one natural philosophical, the other metaphysical – existing in a constant state of, at least potential, tension. This was the Arabic-language legacy that Avicenna's dual-aspect theory of the soul left to subsequent Latin accounts of telic natural motion.

5. Instability in Aquinas's doctrine of the soul

Avicenna's dual-aspect account of the soul and its telic power found new direction in the work of Thomas Aquinas. Lagerlund writes that "the two perspectives on the human soul derived from Avicenna . . . come into explicit tension in Aquinas's thinking on the soul" (Lagerlund 2007b, 6). This tension grew sharp in Aquinas because he decisively favoured the Neoplatonic perspective –

which more clearly supported the Christian doctrine of an incorruptible and immortal soul – over the Aristotelian perspective. This preference corresponded to a disciplinary preference for metaphysics over natural philosophy. As Brooke observes, Aquinas, much like Boyle, insisted that reason be subordinated to revelation: "for Aquinas, there was … a point where faith and revelation had to take over, physical knowledge was subordinate to metaphysical knowledge, and ultimately to faith" (Brooke 1991, 61). Aquinas's preference was furthermore accompanied by a prescriptive demand that Aristotelian natural philosophy should not just defer to, but also serve, the Christian faith. As a consequence, writes Craig Martin, "Thomas was responsible for the longest lasting and most thorough integration of Aristotelian thought with Christian theology" (Martin 2014, 18).

As we have seen, Avicenna argued that the final cause, as a representation or image imprinted in the soul, was inseparable from the body. In terms of imagination, the soul was corporeal; but in terms of cognition, it was incorporeal. According to Lagerlund, Aquinas "tries to make one perspective out of the two outlined by Avicenna" (Lagerlund 2004, 373). He does this, in part, through an "extension" of Avicenna's terminology of representation to include the "intellect or mind" (Lagerlund 2007a, 6; cf. Lagerlund 2007c, 24-25). Aquinas thus challenged Avicenna's distinction between corporeal imagination and incorporeal cognition.

By intellectualizing representation, and so also final causes, Aquinas permitted the separability of final causes from the body. This move was paralleled by his insistence that natural philosophy be integrated into Christian doctrine. Indeed, William McDougall argues that "Aquinas attributed immortality to the whole of the human soul, including the vegetative and sensitive powers" (McDougall 1928, 36). Aquinas thus sought to make the soul in its entirety – including its telic power – separable from the body.

Lagerlund notes that, in proclaiming the singularity of the soul, "Aquinas firmly argues against the majority view in the thirteenth century" (Lagerlund 2004, 371). It was common in Aquinas's time to uphold the plurality of the soul, with the organic parts (vegetative, nutritive, sensitive) being corporeal and the rational part being incorporeal. However, one generation after Aquinas's death, the Council of Vienne (1311-1312) endorsed Aquinas's theory of the unified soul, although they held back from also demanding that natural philosophers toe the theological line (Martin 2014, 26). This latter move, as we will see, still lay ahead, in the Renaissance.

In addressing Aquinas's account of final causes, Carlin cites Aquinas's statement, in his *Summa Theologiae*, that "some things are said to act or to be moved for the sake of an end in the sense that they are acted upon or directed to their end by another, in the way that an arrow moves toward the target because it is directed by the archer" (Carlin 2012, 56). On the basis of this passage, Carlin argues – correctly – that "Aquinas distanc[ed] himself from the sort of immanent teleology found in Aristotle" (ibid.). But Carlin immediately follows with this claim: "we never find Aquinas asserting that God implants in natural agents the relevant goal-driven principle (though there may be an active principle so implanted). Rather, the metaphors employed suggest *purely* extrinsic finality is at work: neither the arrow nor the natural agent have the requisite teleological ability" (ibid). This second claim goes too far.

In the same section of *Summa Theologiae* cited by Carlin, Aquinas writes:

> The natural necessity inherent in things that are fixed on one set course is itself an imprint [*impressio*], as it were, from God's guidance of them to their end, even as the trueness of the arrow's flight towards the target is an impetus [*impressio*] from the archer and not from the arrow itself. Note this difference, however, that what creatures receive from God constitutes their natures. (Aquinas 1975, 7 [ques. 103, art. 1]; brackets added)

Just as the shipwright imprints seaworthiness on the materials of a ship, so the archer imprints "trueness" on the arrow's flight. Yet Aquinas seems to recognize that seaworthiness and trueness,

once imprinted on the things in question, then belong to those things as an intrinsic impression. Indeed, for Aquinas, when God stamps "oakness" onto an acorn, this then constitutes the acorn's natural power to mature into an oak tree. The acorn thus acts as a secondary agent in its own maturation. As Aquinas argues later in *Summa Theologiae*, "God does act sufficiently within things as the first agent cause and that does not imply that the activity of secondary causes is superfluous" (Aquinas 1975, 79 [ques. 105, art. 5]). He thus allows that nature may act as God's vicegerent, guiding natural motion on the basis of delegated power. Hence George Steiner can observe that Aquinas and his near contemporary Dante Alighieri "find in Nature the 'unsteady hand' of a secondary making" (Steiner 2001, 104).

With Aquinas, Avicenna's dual-aspect theory of the soul becomes a dual-agent theory of telic natural motion. What had been a single thing viewed from two distinct perspectives is now two distinct things viewed from a single perspective. In his *Summae contra Gentiles*, Aquinas tells us that "it is ... not inappropriate for the same effect to be produced by a subordinate agent and by God: from both immediately, if in two ways" (Aquinas 1990, 301 [ch. 70]). Telic power is distributed between primary and secondary agents – God and nature – who together share a single, albeit hierarchically differentiated, ontological scale.

Aquinas furthermore writes that "things without knowledge [*cognitione*] also act for the sake of an end, ... they are able to strive out of natural appetite for the good [*appetere bonum naturali appetitu*], as well as for their resemblance to God and their own perfection .... [E]verything is good insofar as it is perfect" (Aquinas 1990, 95 [ch. 24]). Guided by the "trueness" of its nature, the arrow seeks perfection in flight, and so resemblance to God. Aquinas thus argues that divine telic power is defined not by its "insufficiency," but by its "immeasurability" (*immensitate*) (Aquinas 1990, 303 [ch. 70]). From within the finite limits of their own natures, creatures strive for the limitless perfection of their Creator. God is the immeasurable vanishing point at the high end of a telic scale that includes both nature and God. Creatures lower on the scale – like an arrow, ship, or oak tree – exercise imperfect non-rational telic power over themselves and those below them. Creatures higher on the scale – like an archer, shipwright, or arborist – exercise imperfect rational telic power over themselves and those below them. Only God exercises perfect telic power downward without also being subject to it from above.

On the basis of this ontological scale, Aquinas proposed a compromise between Aristotelian natural philosophy and Neoplatonic theology. Catherine Wilson describes this compromise as a "moderate" position that was "remarkably vulnerable to displacement by more extreme points of view" (Wilson 1987, 152). The extreme-right view denies any telic power to nature, concentrating it absolutely in God. The extreme-left view subverts the hierarchy of governance, allowing telic power to flow freely among natural agents. In the first case, the vicegerents are dismissed, and God reigns supreme. In the second, the vicegerents mutiny, and seize power for themselves. As we saw earlier, Boyle argued for the first scenario. He explicitly rejected, as dangerous to religion, the moderate claim that nature could serve as God's vicegerent. Only angels and humans, whose rationality evinces their separation from the corporeal world, were allowed a share in telic power.

Where Aquinas extended final causes from the non-rational soul to the rational soul, Boyle sought instead to secure final causes exclusively for the rational soul. Returning to our contrast space, we can now see that both Aquinas and Boyle affirmed explanation #1. Boyle furthermore rejected explanation #2 – which attributes to corporeal nature a rational telic power – and ignored explanation #3 – which attributes to corporeal nature a non-rational telic power. Aquinas's moderate position, in contrast, appears to have drawn him into an unstable compromise between explanations #1 and #3. Indeed, Aquinas seems not to recognize explanation #2 at all. He wants to fully separate the soul from the body, but does not want to fully rationalize its functions. He thus appears to hold that telic natural motion may be explained, in part, by reference to a soul that is both incorporeal – like God – and non-rational – like nature.

We might call this compromise explanation #3a. According to this explanation, telic natural motion can be explained, at least in part, by

(3a) An incorporeal and non-rational "nature."

I have placed the term "nature" in scare quotes to signal the tension created when incorporeality, otherwise attributed to the soul, is instead attributed to nature. This tension arises from Aquinas's ambiguous account of soul-body relations. On the one hand, the soul is manifest in the telic operations of a corruptible, corporeal body. On the other, it strives after the telic perfection of an incorporeal and boundless God. In other words, as a telic principle operating in nature, the soul appears, in Aquinas's account, to be simultaneously immanent and transcendent.

It is tempting to see this as a consequence of Aquinas's need to assert the substantive unity of the soul while also attributing to it both rational and non-rational functions, each of which appear to pull in different ontological directions. Lagerlund argues that, in Aquinas's attempt to forge a single perspective out of Avicenna's dual perspective, "the ontological status of the human soul . . . becomes obscure" (Lagerlund 2004, 373). I would generalize this to include Aquinas's treatment of the soul as such. Insofar as telic power is an attribute of soul, Aquinas's account of final causes is also obscure.

Boyle slipped past this problem by ignoring the possibility of non-rational functions. As a consequence, he does not recognize the possibility of explanation #3 – Aristotelian animism. Aquinas, in contrast, recognized Aristotelian animism, but it was the corporeality of animistic functions that disturbed him, not their alleged rationality. Indeed, he explicitly rejected Aristotelian animism as represented in the work of Alexander of Aphrodisias (ca. 200 CE). Alexander, according to many of his medieval readers, had argued that Aristotle, correctly interpreted, asserted the full corporeality of the soul – including its rational part. As Olaf Pluta notes, Aquinas, in response to this claim, "fiercely attacked" Alexander (Pluta 2007, 152; cf. Pluta 1986, 15, and Pluta 1996, 88).

We have seen that both Avicenna and Aquinas acknowledged the possibility of explanation #3 while Boyle did not. We can now also see that, unlike Boyle, neither Avicenna nor Aquinas explicitly rejected explanation #2. Indeed, it is not clear that they even recognized it. Aquinas's unstable compromise between explanations #1 and #3 – what I called explanation #3a – upsets the orthodox Neoplatonic distinction between rationality and corporeality. It seeks to separate telic power from the body without also insisting that it be rational. As we will see with Buridan, preserving the distinction between rationality and corporeality, while still maintaining the incorporeality of telic power, will prompt the full rationalization of final causes. Once this has been achieved, explanation #3 falls out of contention. In Boyle's case, Aristotelian animism is then misconstrued as explanation #2.

6. Buridan's rationalized teleology

Let us now move into the fourteenth century, and consider John Buridan. Did Buridan endorse final causes, as Carlin claims, in precisely the same way as did Boyle? No. This is because Buridan defended the independence of natural philosophy from religion, while Boyle, like Aquinas, did not. Boyle rejected Aristotelian animism, as he understood it, as a threat to religion. Buridan, in contrast, seems not to have felt the force of this threat. Hence, he openly explored – but did not endorse – explanation #3 as found in Alexander of Aphrodisias. As Pluta writes, "Buridan was the first medieval scholar to show a sincere philosophical interest in Alexander's philosophy of mind" (Pluta 2007, 153). Indeed, Eckhard Kessler furthermore notes that Buridan "adopts Alexander's materialistic doctrine of the soul and defends it as the one that most conforms to the *ratio naturae*, emphasizing that natural philosophy is independent of theology and metaphysics" (Kessler 2011, 19). In doing so, Buridan and his students "laid the foundation for the genuine interest in Alexander's teaching during the Renaissance" (ibid.; cf. Pluta 1996).

Yet, despite defending the autonomy of natural philosophy and preparing the ground for Renaissance interest in Alexander's naturalistic account of the soul, Buridan himself endorsed a view of final causes that conformed to the prevailing Christian doctrine of his period. As Carlin puts it,

> Buridan sought a reduction of all final causes to efficient causes. He uses as an example a lady being asked why she is going to church. Her response, "that I *intend* or *want* to hear mass," implies, according to Buridan, that it is the mental state doing the work here, and its work is efficient causal in nature as it incites movement in the lady. (Carlin 2012, 57)

The idea here is that the soul is a distinct, incorporeal substance, separable from the body, and that it directs the body as an object or instrument, much like a craftsperson manipulates the materials of their craft. The difference is that the craftsperson belongs to the same ontological category as the materials – both are corporeal – while the soul is understood to belong to a different ontological category – incorporeality. As Carlin presents it, Buridan's example of the churchgoing woman is meant to describe how ordinary speech signals an ontological distinction between body and soul.

In fact, however, Buridan's account of the churchgoing woman was not descriptive but prescriptive. It represents not how the churchgoing woman ordinarily speaks, but how Buridan thinks she should speak. Buridan recognizes and describes her ordinary way of speaking in this way:

> If you ask a little old lady why (*propter quam causam*) she goes to church . . ., she will say to you that she goes for the sake of hearing a mass. . . . Claims accepted in this way by everyone should not be entirely dismissed. (Cited in Pasnau 2001, 316)

For Buridan, this reference to a final cause – that for the sake of which one acts – should not be entirely dismissed, but, in his view, this common way of speaking is unacceptable because it gives as the cause of one's action something that exists only after that action is complete: the mass only occurs after the woman has arrived at the church, so it cannot be the cause of her having gone to the church. Hence, Buridan argues, the woman should instead say, as in Carlin's passage, that she goes to the church because she "intends" to hear the mass (Pasnau 2001, 317; cf. Maier 1955, 311, Lagerlund 2011, 598). The intention precedes and so causes the action that brings her to hear the mass. By insisting that the woman change the way she speaks about the cause of her action, Buridan seeks to push that cause into an incorporeal rational realm.

Buridan thus rejects the naturalism at the base of Alexander's Aristotelian animism, and he instead embraces the Neoplatonic identification of telic power with an incorporeal rationality. According to Maier, the fundamental ground for Buridan's rejection of animism was his idea that striving (*appetere*) for an end entails cognizing (*cognoscere*), and this is possible only for an intellect (Maier 1955, 313). Buridan thus rejects Aristotle's claim that telic power can operate non-rationally. Because nature is not rational, an explanation for telic natural motion must be found in the supernatural realm of incorporeal rationality.

Buridan thus maintains the authority of Christianity over natural reason. Despite the fact that Alexander's naturalism is best supported by the methods of natural philosophy, an ontological account of the soul will reject naturalism in favor of a view of the soul as incorporeal. Of course, this ontological distinction between body and soul brings its own problems, best known in relation to Cartesian mind–body dualism. How does an incorporeal soul join to a corporeal body? In response, Buridan writes: "I reply with certainty that it is miraculous, because the human soul inheres in the human body in a miraculous and supernatural way" (cited in Lagerlund 2004, 384). As Jack Zupko observes, with this move Buridan pushes the question of mind–body relations "beyond the domain of psychology and into that of theology" (Zupko 1997, 306). Yet, strictly as a natural philosopher, Buridan "suggests that

appealing to the miraculous is not only unphilosophical, but also base and unlearned" (Zupko 1993, 215). Hence natural philosophy has its limits when it comes to understanding telic power. For Buridan, telic power should be assimilated to an incorporeal and rational – a supernatural – intellect, in step with Neoplatonic theology.

Does this ontological prescription also amount to a reduction of final causes to efficient causes, as Carlin suggests? For Aristotle, the efficient cause is the moving cause, while the final cause is the directing cause. On its own, an efficient cause only incites movement without direction. Yet, *pace* Carlin, the churchgoing woman's intention not only incites her movement, but also the direction of her movement toward the church. Understood in step with the original Aristotelian distinction, going to church is caused by a combination of efficient and final causes. If one instead insists that the efficient cause alone causes the woman to go to church, then one has not so much eliminated final causes as altered the sense of "efficient cause" to now include a meaning that had once belonged only to "final cause." Under this new meaning, the term "efficient cause" becomes a repository not only for movement, as such, but also for those regularities or patterns of movement that occur without deliberation. Such operations will now be viewed as exclusively efficient, and so will no longer be counted as telic.

That such a shift in perspective occurred between Aquinas and Buridan is suggested by their divergent explanations for the same physical phenomenon – projectile motion. Recall Aquinas's claim that "things without knowledge [*cognitione*] also act for the sake of an end, ... they are able to strive [*appetere*] out of natural appetite for the good" (Aquinas 1990, 95 [ch. 24]). Once imprinted in things by God, this appetite inheres in them by nature, much like an arrow, once imprinted with trueness by the archer, possesses an *impressio* that carries it toward its target. For Aquinas, this impression is an inherent telic power, possessed by things without knowledge, that allows things to strive for an end. Hence, for him, telic power does not entail deliberation. God stamps natural things with an inherent non-rational power to pursue goals.

As we have just seen, Buridan argued that to strive for an end entails cognizing, deliberation, the presence of a rational soul. He thus rejects Aquinas's claim that non-cognizers may possess telic power. For Buridan, an arrow cannot strive for a target because arrows are not rational beings. And yet, Buridan also argues that a projectile, once imprinted by its initial mover, moves on the basis of its own internal power, a power Buridan calls *impetus*. Hence, the arrow, once it has left the bow, flies to its target under the power of an impetus it has received from the archer. As Maier notes, Buridan thus viewed impetus as an "intrinsic principle" regulating the movement of a self-sufficient or "separated projectile" (Maier 1951, 225, 216). Maier also argues that Buridan thought impetus was probably a "quality with the function [*Funktion*] to move the body in which it has its place" (Maier 1951, 226). That Buridan's impetus concept may have denoted functional, and not just random motion, suggests that it combines meanings earlier separated between efficient and final causes.

If this is correct, then Buridan's *impetus* is, in this specific way, similar to Aquinas's *impressio*. Both concepts pick out a power stamped from without on a projectile, a power which then persists and operates intrinsically in the projectile once that projectile is no longer in physical contact with its original, external "stamper." Furthermore, both Aquinas and Buridan understood this imprint to operate within the projectile in a non-rational way.

What distinguishes Aquinas's *impressio* from Buridan's *impetus*, however, was that the former did, while the latter did not, allow a place for non-rational telic power. In contrast to Avicenna, Aquinas asserts the incorporeality of telic power. Yet he does so without also requiring that telic power be rational. He thus initiates the Neoplatonic migration of final causes from the corporeal to the incorporeal soul, but does not complete that migration. In Buridan, by contrast, the migration is complete, and final causes are both fully incorporeal and fully rational.

Buridan's account of telic power thus reasserts the Neoplatonic distinction between corporeality and rationality that had been obscured by Aquinas. But, as we have now seen, this had the consequence of obscuring the original Aristotelian distinction between efficient and final causes.

Because telic power was now defined as rational, non-rational functions in nature, which had once been viewed in terms of final causes, came to be viewed in terms of efficient causes. A deliberate change in the meaning of "final cause" prompted a non-deliberate change in the meaning of "efficient cause." As we will see, the resulting ambiguity in the concept of an efficient cause can be observed in Boyle's later attempt to explain natural functions in mechanical terms.

7. A parting of the ways in Renaissance psychology

It is now time to re-chart the shifting ground of our contrast space. All four of our protagonists – Boyle, Avicenna, Aquinas and Buridan – recognized a role for explanation #1: telic natural motion is caused by an incorporeal and rational God. Avicenna, Aquinas and Buridan furthermore recognized the view that God impresses a non-rational telic power on corporeal nature. This view is consistent with explanation #3 – Aristotelian animism. While Avicenna affirmed this view, Aquinas and Buridan dismissed it. Boyle, in contrast, neither affirmed nor dismissed it, because he did not recognize it. Nevertheless, he dismissed animism, which he construed in terms of explanation #2 – the attribution of rational telic power to corporeal nature. Avicenna, Aquinas and Buridan, on the other hand, seem not to have recognized this as a possible explanation.

This shift in perspective between Boyle and his predecessors suggests the conceptual entrenchment of the Neoplatonic identification of telic power with rationality. Because Boyle viewed this identification as absolute, explanation #3 fell outside the scope of his understanding. He therefore transposed it with explanation #2, which preserved Neoplatonism but seemed to him absurd. Avicenna, Aquinas and Buridan, in contrast, found a place for explanation #3 in their accounts of telic power. Regardless of whether or not they also affirmed it, none of them dismissed Aristotelian animism as absurd. On these grounds, it is reasonable to doubt Carlin's claim that Boyle held precisely the same account of final causes as did his three predecessors.

Alexander of Aphrodisias was a key ancient exponent of Aristotelian animism. As we have seen, both Aquinas and Buridan rejected Alexander's naturalistic account of the soul and its powers. Central to the views of Avicenna, Aquinas and Buridan was a distinction between Aristotelian natural philosophy, on the one hand, and Neoplatonic theology, on the other. Avicenna viewed these two positions as different but complementary ways of treating the same phenomena. Aquinas, in contrast, tried to integrate natural philosophy into theology, and ended up with an obscure account of the soul. For his part, Buridan strictly separated the two domains, and declared Alexander's account sound according to the principles of natural reason. Buridan himself, however, endorsed a theological or "miraculous and supernatural" account of the soul as incorporeal and fully rational.

As noted earlier, Buridan and his students laid the foundation for a concentrated interest in Alexander's doctrine during the Renaissance. This interest grew with the 1495 Latin translation, by the Venetian patrician Girolamo Donato (1457-1511), of Alexander's commentary on Aristotle's doctrine of the soul (Kessler 2011, 26-27). According to Kessler, Alexander's commentary, especially in the hands of the Paduan philosopher Pietro Pomponazzi (1462-1525), inspired a natural philosophy that "emancipated itself from metaphysics in the form of both the Neoplatonic 'metaphysics of mind' and of the occult sciences based on it; and it also liberated itself from the authority of theology" (Kessler 2011, 67).

According to Jill Kraye, Pomponazzi read Alexander in Latin in 1495 (Kraye 2000, 13). Both Pluta and Lagerlund have noted the continuity between Buridan's and Pomponazzi's treatment of Alexander, with Pluta arguing that the divergence between "Christian belief and natural reason" was "even more sharply expressed" in Pomponazzi (Lagerlund 2004, 386 n.60; Pluta 1986, 53). Church leaders clearly felt threatened by this increasing secularism, and, in 1513, Leo X issued a papal bull to the eighth session of the Fifth Lateran Council, seeking to restrict the autonomy of natural philosophy vis-à-vis church doctrine. This decree, writes Lorenzo Casini, made "the

unprecedented request" that philosophers reject, in the words of the bull, the "extremely pernicious error" that, according to reason, the soul is corporeal, and also that they "devote their every effort to clarify … the truth of the Christian religion" (Casini 2007, 134). In the two centuries following the bull, the incorporeality of the soul became "a critical and pressing philosophical problem" (ibid.).

Kessler describes the 1513 bull as the culmination of an "alliance of Neoplatonism and the church" (Kessler 1988, 494-5). Indeed, Leo X was the son of Lorenzo de' Medici, who was in turn the patron of Marsilio Ficino, Latin translator of Plato and his Neoplatonist followers. Leo X appointed one of Ficino's students to sit on the commission that drafted the bull (Kraye 2000, 11-12).

Pomponazzi reasserted the autonomy of Aristotelian natural philosophy with the 1516 publication of his *Tractatus de immortalitate animae*, which went through three printings before his death in 1525 (Pluta 1986, 50). Leo X issued a warning to Pomponazzi, demanding that he conform to the 1513 bull (Casini 2007, 147). Pomponazzi dug in with his 1518 *Apology*, which the pope demanded he retract. According to Martin, Pomponazzi ignored the pope without repercussion, perhaps because his former student, Pietro Bembo, was a cardinal and secretary to Leo X (Martin 2014, 65).

Kraye argues that Pomponazzi's campaign was largely successful, leading to a "parting of the ways" between Aristotelian natural philosophy and Neoplatonic Christian theology on the question of the corporeality of the soul (Kraye 2000, 14-15). Yet, as Kessler notes, this "divorce" meant increased freedom not only for natural philosophers, but also for Christian philosophers. With less pressure to get Aristotle right, they could now more easily integrate Aristotelianism into Christianity: "the point was not to explain Aristotle but to rationalise Christian doctrine" (Kessler 1988, 8).

The newly formed Jesuit order seized this opportunity by affirming the 1513 papal bull, and developing an ambitious educational strategy that sought to erase Pomponazzi's influence and elevate Aquinas as the reigning authority on Aristotle. Their strategy bore fruit with the Jesuit-trained Descartes, who wrote in the preface to his 1614 *Meditations on First Philosophy*:

> And as regards the soul, although many have considered that it is not easy to know its nature, and some have even dared to say that human reasons have convinced us that it would perish with the body, and that faith alone could believe the contrary, nevertheless, inasmuch as the Lateran Council under Leo X (in the eighth session) condemns these tenets, and as Leo expressly ordains Christian philosophers to refute their arguments and to employ all their powers in making known the truth, I have ventured in this treatise the same task. (Descartes 1969, 134)

What Buridan had called supernatural and miraculous, known only by faith, Descartes now ventured to prove by reason. The controversy that enveloped Descartes's resulting mind–body dualism, a controversy that continues today, is well known. This was the state of play when Boyle stepped onto the field.

8. Persistent animism in Boyle's mechanical philosophy

Recall from earlier Anstey's argument that Boyle's mind–body dualism was heavily indebted to Descartes, with Boyle adopting Descartes's psychology wholesale. Like Descartes, Boyle viewed the soul as both fully incorporeal and fully rational. We can now see how Boyle's psychology follows along a thread of Neoplatonic Christian philosophy that rejected the naturalistic Aristotelianism of Alexander, Buridan and Pomponazzi.

I have suggested that the completion of the Neoplatonic migration of the soul and its powers from associations of corporeality/non-rationality to those of rationality/incorporeality affected the

distinction between efficient and final causes. Because telic power was now defined as fully rational, those non-rational functions in nature that had once been viewed in terms of final causes were now quietly absorbed into efficient causes. The meaning of "efficient cause" thus became obscure, with the implied effect of an efficient cause equivocating between random and regulated motion.

This equivocation can be found in Boyle's discussion of projectile motion. Near the end of Section II of *A Free Enquiry*, Boyle writes that, "when a Man shoots an Arrow at a Mark, so as to hit it, though the Arrow moves towards the Mark, as it would if it could and did design to strike it, yet none will say, that this Arrow moves by Law, but by an External, tho' well-directed, Impulse" (Boyle 2000a, 458). Here Boyle acknowledges that an arrow in flight appears to strive for its target. Yet this apparent striving should not be construed as law-like because "'tis plain, that nothing but an Intellectual Being can be properly capable of receiving and/acting by a *Law*" (Boyle 2000a, 457). Instead, he seems to suggest that the telic motion of the arrow is caused by the external impulse of the archer. This may prompt the question of how the external impulse can continue to causally influence the arrow once the arrow is in flight, growing ever more distant from the source of that impulse.

But, in the same passage, Boyle also avers that "God should at the Beginning impress determinate Motions upon the Parts of Matter," and he also mentions the "Powers, which he gave the Parts of Matter." Furthermore, by analogy, clocks and arrows have "a manifest Tendency to particular and predesign'd Ends" (Boyle 2000a, 457). This sounds like Aquinas's *impressio*. Indeed, Shanahan draws a parallel between Boyle and Aquinas, suggesting that both recognized nature as being a secondary cause "concurrent" with God's primary causal power (Shanahan 1988, 560). Anstey, in turn, has "fine-tuned" Shanahan's proposed concurrentism, arguing that, in Boyle's case, final and efficient causes were separated, respectively, between God and nature (Anstey 2000, 161). Anstey thus attributes a "nomic occasionalism" to Boyle, where God is the sole cause of law-like regularity in a self-moving nature (Anstey 2000, 181).

Anstey writes that "Boyle's account of concurrence seems to have arisen from his attempt to reconcile the law-like behaviour of matter with his insistence on the insentience of matter" (Anstey 2000, 181). This may be true, but something similar could also be said of Aquinas, as he too saw nature as insentient. The relevant contrast between Boyle and Aquinas was that Aquinas allowed for non-rational telic power in nature while Boyle did not. Boyle, unlike Aquinas, did not recognize that natural entities may strive for ends without deliberation.

In Section VI of *A Free Enquiry*, Boyle returns to the arrow example.

> And as for the Criterion of Natural/Motion, that, *Its Principle is within the Moving Body*, it may be said, that all Bodies, once in the State of Actual Motion, whatever Cause first brought them to It, are mov'd by an Internal Principle: As, for Instance, an Arrow that actually flies in the Air towards a Mark, moves by some Principle or other residing within itself; for, it does not depend on the Bow 'twas shot out of, since 'twould continue, tho' That were Broken, or even annihilated. (Boyle 2000a, 509)

In this passage, Boyle attributes an internal principle to the arrow in flight, one that persists in the arrow independently of the external source from which it originated. Anstey argues that "the most natural reading of this passage is to take the 'internal principle' as a type of impetus" (Anstey 2000, 134). This would now bring Boyle in line with Buridan.

As we have seen, Buridan explicitly rejected a conceptualization of *impetus* in terms of *appetere*, or a "striving for," because, unlike Aquinas, he understood such striving to entail rationality. In contrast, Boyle often attributes a synonymous concept of "endeavour" to the determinate motions of physical entities, without suggesting the presence of rationality. The passage from *A Free Enquiry* just cited continues, after a few lines, with the following statement.

When in/a Watch that is wound up, the Spring endeavours to unbend or display itself; and when the String of a drawn Bow is broken or let go, the Spring of the former, and the woody Part of the later, does each return to a less crooked Line. And though these Motions be occasioned by the forcible Acts of External Agents, yet the Watch, Spring, and the Bow, have in themselves (for ought appears to those I Reason with) an inward Principle, by which they are mov'd till they have attain'd their Position. (Boyle 2000a, 509)

Both the spring and the bow endeavor toward a less bent position. Once again, this end-directed endeavor or striving is characterized by an internal principle that operates independently of the external cause from which it originated.

Boyle used his interpretation of these observable causal phenomena as a model for his interpretation of those effects caused by unobservable causal phenomena at the corpuscular level. Microscopic corpuscles of air, he suggested, behave like the bow or watch spring – they endeavor to unbend themselves for the sake of a less crooked position. In Experiment I of his 1660 *New Experiments Physico-Mechanical*, Boyle writes:

our Air either consists of, or at least abounds with, parts of such a nature, that in case they be bent or compress'd by the weight of the incumbent part of the Atmosphere, or by any other Body, they do endeavour, as much as in them lies, to free themselves from that pressure, by bearing against the contiguous Bodies that keep them bent. . . . For though these Haires [of wool], and the Aerial Corpuscles to which we liken them, do easily yield to externall pressures; yet each of them (by vertue of its structure) is endow'd with a Power or Principle of self-Dilation. . . . [W]hilst the compression lasts, there is in the fleece they compose an endeavour outwards. (Boyle 2000d, 165)

Here Boyle attributes to air corpuscles a "power" of self-dilation, an "endeavour outward." Boyle argues that, being "of such a nature," an air corpuscle can direct itself outward "by vertue of its structure." Combined with his immediately preceding comments, this suggests that air corpuscles endeavor outward by nature, with this naturally directed motion being caused by an internal principle – a "spring of the air" – that operates independently of its external origin (cf. Kochan 2017, 317-318). As we have seen, Boyle did not recognize this springiness as rational.

Once again, this sounds like Aquinas's *impressio*, which is compatible with a teleological notion of nature as God's vicegerent. Indeed, referring to natural operations, Boyle would write in 1685 that "a great part of the effect is due, not precisely to the external Agent, that 'tis wont to be ascribed to, but in great measure to the action of one part of the body it self (that is wrought on) upon another, and assisted by . . . the more Catholick Agents of Nature" (Boyle 2000e, 256).

Yet we know that Boyle rejected the notion of nature as God's vicegerent. He seems to have been both attracted to and repelled by the Aquinian call to integrate Aristotelian natural philosophy into Neoplatonic theology. Boyle's empiricist instincts persistently pulled away from his theological commitments. The resulting tension is expressed in his ambiguous treatment of telic natural motion, not least the endeavor outward, or spring, of the air (cf. Kochan 2021, 180-181).

As Carlin writes, "even in his employment of 'endeavour,' Boyle seems to be consciously ruling out teleological principles in favor of mechanical, efficient ones" (Carlin 2012, 61). This may be true, but only in the sense that Boyle consciously followed the Neoplatonists in identifying telic power with rationality. Since spring-like endeavor is a non-rational principle for Boyle, it cannot be telic, cannot be final. Therefore, it must be efficient. Yet Boyle's endeavor outward was a natural principle for both motion and direction. The air's spring thus combines efficiency and finality. Hence, to declare endeavor a strictly efficient cause is to obscure the meaning of "efficient." Such obscurity also crops up in more general historical accounts of the Scientific Revolution, for example, in Peter Dear's distinction between operational and teleological explanations (Dear 1995, 157-159; discussed in Kochan 2017, 277-281).

Alan Chalmers calls Boyle's spring of the air an "intermediate cause," that is, an experimentally manifest cause that "lacked an explanation in terms of the ultimate ontology of mechanical philosophy" (Chalmers 2017, 131). Viewed in light of the present discussion, intermediate causes lack an explanation in terms of efficient causes because they are, in part, irreducibly telic. If Chalmers is right to say that intermediate causes are "**the** key to understanding the scientific revolution," then we may question whether the new science really did usher in the demise of natural teleology (Chalmers 2012, 561). *Pace* Chalmers, perhaps mechanism was never – at least never in practice – free from finality (cf. Anstey 2000, 207). This reinforces Westfall's claim, cited in the Introduction of this essay, that "throughout the seventeenth century, mechanistic modes of expression disguised the survival of animistic modes of thought from earlier philosophies of nature," as well as similar claims by Osler with respect to Boyle in particular.

With Aristotle in mind, Monte Ransome Johnson has challenged as "deeply flawed" the assumption that "teleological explanation and mechanistic explanation [are] directly opposed and mutually exclusive alternatives" (Johnson 2017, 125). Boyle, at least in practice, blurred the boundary between these two alternatives. Addressing this tension in Boyle's work, Anstey rightly cautions that "Boyle was unable to resolve this dilemma in his natural philosophy and as interpreters we should not do it for him" (Anstey 2002, 628). This tension, as we have seen, grew slowly and unevenly over a period stretching from Avicenna to Boyle.

Pace Carlin, Boyle did not consciously rule out Aristotelian animism – explanation #3. Instead, he "ruled it out" unconsciously, by mistaking it for explanation #2 – the identification of telic power with rationality. Proximally, this non-deliberate misconstrual of animism resulted from Boyle's adoption of Descartes's psychology. Distally, it followed from the Neoplatonic migration of telic power from associations of corporeality/non-rationality to those of rationality/incorporeality. We have witnessed key moments of this migration in the works of Avicenna, Aquinas, and Buridan, as well as in the developments of Renaissance psychology. Through this conceptual migration, the non-rational operations of natural entities, once viewed in terms of final causes, were, at least in Boyle's case, quietly – unconsciously or non-deliberately – absorbed into efficient causes. We may thus doubt the depth of the anti-teleological and anti-animistic rhetoric that historians often attribute to the protagonists of the Scientific Revolution. Perhaps this rhetoric did not run as deep as has been previously assumed (Kochan 2021, 181-182). Beneath the brilliant surface of the early modern revolution in science, the ancient undertow of Aristotelian animism continued, persistently, to circulate.

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