Introduction

René Descartes gives few philosophical arguments to directly support his rejection of forms in favor of mechanisms. Moreover, the scattered reasons he offers in his corpus are cryptic and hard to unpack. Hence I will draw on Descartes' intellectual context to reconstruct his reasoning and shed light on his historic elimination of Scholastic Aristotelian substantial forms from the physical world. Given that Descartes continues to call the soul a substantial form, my focus will be on his rejection of material substantial forms employed in Aristotelian physics (for lack of a better term I will refer to all substantial forms that exist only in matter, i.e., all except the rational soul, as 'material substantial forms').[1] I will not, therefore, examine the viability of his claim that the soul is the substantial form of a human being and instead refer the reader to the body of literature that already exists on this subject.[2] Unlike the rational soul, which was thought to be directly created by God and to survive the body, material substantial forms were widely held to be educed from pre-existing matter, and to exist only in matter. It is only by familiarizing ourselves with contemporaneous arguments for and against such forms and the philosophical issues at stake in this debate that we can fully understand and appreciate Descartes' contribution to their ultimate elimination from physics. We are all familiar with the Cartesian rhetoric against substantial forms. It is my hope to penetrate beyond this rhetoric to the philosophical developments and arguments that underpin his vehement denunciations of this key Scholastic principle.

[1] For an in-depth discussion of the Cartesian soul as a substantial form and its relation to Scholastic substantial forms see Marleen Rozemond, *Descartes' Dualism* (Cambridge, MA: Harvard University Press, 1998).

[2] See, e.g., Paul Hoffman, "The Unity of Descartes' Man," *Philosophical Review* 95 (1986), pp. 339–370, and "Cartesian Composites," *Journal of the History of Philosophy* 37 (1999), pp. 251–270; and Rozemond's alternative view in *Descartes' Dualism*.

In May of 1643, responding to charges by Gijsbert Voetius, Dutch theologian and rector of the University of Utrecht, Descartes writes of Scholastic philosophy that it is

> merely a collection of opinions that are for the most part doubtful, as is shown by the continual debates in which they are thrown back and forth. They are quite useless, moreover, as long experience has shown to us; for no one has ever succeeded in deriving any practical benefit from 'prime matter,' 'substantial forms,' 'occult qualities,' and the like.[3]

As indicated by this quote, when early modern philosophers railed against Scholasticism one of their prime targets was the material substantial forms of Aristotelian physics. Diehard Scholastics like Voetius strove in turn to defend and preserve them. Despite the fact that the substantial form is never explicitly mentioned by Aristotle, it remained a cornerstone of Scholasticism from the moment that St. Thomas Aquinas injected it into medieval Latin philosophy. In the late sixteenth and early seventeenth centuries, it stood at the center of the battlefield where warring philosophical factions collided.[4]

The substantial form is the essential act constituting the 'whatness' (*quidditas*) or individual being of a composite substance, e.g., the particular animal soul that makes Fido not just a dog, but this dog, Fido, and the material form holding together the mixture that is this chrystal. It fulfills several important functions within Scholastic Aristotelian philosophy. First since the substantial form is the stable bearer and uniter of the multitude of accidental properties a created substance acquires and loses over time, it supplies the crucial link between a substance's essence (the unchanging realm of metaphysics) and its accidental properties (the changing realm of physics). At the metaphysical level the substantial form

[3] René Descartes, *The Philosophical Writings of Descartes,* vol III, trans. John Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny (Cambridge: Cambridge University Press, 1985–91), (henceforth CSMK), "Letter to Voetius, May 1643," p. 221. When my own translations differ in a non-trivial manner, I will cite the Adam and Tannery edition (*Oeuvres de Descartes*, ed. Charles Adam and Paul Tannery, 12 vols. [Paris: Vrin, 1996]); otherwise I will cite the standard English translations of Descartes' works by Cottingham *et al.* and cross-refer to the Adam and Tannery edition as follows: AT VIIIB, p. 26.

[4] See, e.g., J. A. van Ruler's excellent discussion of the controversies between Voetius and Dutch Cartesians in *The Crisis of Causality: Voetius and Descartes on God, Nature and Change* (Leiden: Brill, 1995). This indicates that Bob Pasnau, while correct in saying that "it begins to look as if formal explanation was already undergoing a shift in focus during the Middle Ages, and by the Renaissance had reverted to something much more like a material mode of explanation," is mistaken in his judgment that the substantial form was "scorned and ignored by anti-Aristotelians" and "at the same time ineptly defended by late Scholastics." Robert Pasnau, "Form, Substance and Mechanism," *Philosophical Review* 113/1 (2004), pp. 46, 72.

accounts for the individuation of substances, and their identity over time. At the physical level, it explains the actions of a substance and the fact that certain accidental properties with no other apparent connection are inextricably linked in particular substances. For example, milk always possesses both the accidental forms of whiteness and sweetness when fresh, and darkens and turns sour when the underlying substantial form supporting both accidental forms of the fresh milk is gradually destroyed by an external cause. Second, the substantial form constitutes the bridge between the physical nature that is the source of all natural causality and the logical essence that links the premises to the conclusion in an Aristotelian syllogism. St. Thomas Aquinas makes this clear in Book VII, lesson 8, of his *Commentary on Aristotle's* Metaphysics, where he explains Aristotle's words as follows:

> Hence it is evident that, just as in syllogisms the basis of all demonstrations "is substance," i.e., the whatness (for demonstrative syllogisms proceed from the whatness of a thing, since the middle term in demonstrations is a definition), "so too in this case," namely, in matters of operation, processes of generation proceed from the quiddity.[5]

Not surprisingly then, when Aristotle's logic came under violent attack by Renaissance humanists, it had serious implications for the doctrine of substantial forms, and, via this portal, for the whole structure of Aristotelian physics.

When Descartes and other proponents of the new science eventually eliminated material substantial forms from physics, the metaphysical grounding these forms had provided for both the existence and scientific demonstration of real natural causes proved difficult to replace. Over time, accounts of real, extra-mental causal interactions gave way to Leibniz's pre-established harmonies, Hume's constant conjunctions and Kant's *a priori* concepts. Hence Descartes' replacement of the hylomorphic model with the mechanistic model stands at the crossroads of an historic transition that forever changed our conceptions of causality and scientific explanation. Over the last few centuries, this has had serious ramifications for both science and theories of human agency and moral responsibility. The wide-ranging effects of this conceptual revolution are well studied. The underlying philosophical concerns and arguments that prompted it remain, for the most part, as hidden and mysterious as the alleged 'occult qualities' of the Scholastics.

[5] St. Thomas Aquinas, *Commentary on Aristotle's* Metaphysics, trans. John P. Rowan (Notre Dame, IN: Dumb Ox Books, 1961), p. 484, sec. 1450. (Henceforth *CAM*).

The philosophical, scientific, and historical factors driving the shift from hylomorphism to mechanism are exceedingly complex, and a study of this length could certainly not do them justice. Instead I propose to bring this complex, blurry landscape into focus by employing two lenses. The first lens, intended to narrow our focus and bring into relief a part of the larger landscape, limits my discussion of the Scholastic background to Descartes' mechanism to philosophical arguments pertaining to material substantial forms. My choice of this lens is motivated by the central place the substantial form occupies both within late Scholastic natural philosophy and attacks launched against it by Descartes and other critics. While studying such a fundamental concept has the advantage of illuminating the larger philosophical picture, the fact that it lies at the center of the Scholastic web also has the potential to blur the line between matters bearing directly on the substantial form and interconnected concerns about causation, scientific demonstration, matter, form, and substance in general. Therefore, I will address such related concerns only to the extent necessary to clarify the arguments for and against material substantial forms, rather than giving them full coverage.

While the first lens narrows our focus, the addition of a second lens is meant to lengthen our view. As Descartes states in the letter quoted above, the ultimate rejection of substantial forms was the product of "long experience." It is, therefore, not possible to understand the philosophical reasoning at play by restricting ourselves to the few derisive comments scattered around Descartes' corpus, or even by juxtaposing them with what Descartes was taught about substantial forms by his staunchly Aristotelian Jesuit teachers. These are excellent starting points, but they cannot convey the arduous philosophical process by which substantial forms were gradually undermined, to the point where Descartes could confidently pronounce them of "no practical benefit" to Voetius. While scholarship on the particular brand of Scholastic Aristotelianism that Descartes was taught by the Jesuits has increased in recent times, along with the number of historically informed treatments of Descartes' philosophical doctrines, we are still confronted with large gaps in trying to get from one to the other.[6] In particular, with the exceptions of Isaac Beeckman and Marin Mersenne, there has been little study of anti-Aristotelian philosophers that

[6] The most recent study of late medieval and early modern thinking about the substantial form is the above-cited article by Pasnau (see n. 4). While it identifies the central issues and lays out the views of canonical figures such as St. Thomas Aquinas, Descartes, Boyle, and Locke, as well as mentioning some of the more frequently discussed later Scholastics, it does not address the arguments of any of the minor figures who are likely to have influenced Descartes.

form part of Descartes' intellectual context.[7] Descartes' silence regarding his sources, and his disavowal of any philosophical influences, make it difficult to trace a path from Descartes the schoolboy, imbued with Scholastic Aristotelianism by his Jesuit teachers, to Descartes the virulently anti-Aristotelian father of mechanism.

In actual fact, Descartes was neither the first nor the most virulent opponent of Scholastic Aristotelian substantial forms, nor was he the first to replace them with alternative principles. Some of the philosophers he mentions in a letter of 1630 to his Dutch mentor, Isaac Beeckman (cited below), had already proposed influential alternatives to Scholastic material substantial forms. By 1570 the Italian naturalist philosopher Bernardino Telesio, whose followers included Tommaso Campanella, had replaced them with the principles of hot and cold, characterizing heat, in particular, as both "substance and form."[8] By 1585 Giordano Bruno, the controversial proponent of Copernicanism, infinite worlds, and monism, had published his dialogue on *Cause, Principle and Unity,* in which he argued:

> Now take away that material common to iron, to wood, to stone, and ask, "What substantial form of iron remains?" They will never point out anything but accidents. And these are among the principles of individuation, and provide particularity, because the material cannot be contained within the particular except through some form, and because this form is the constituent principle of some substance they hold that it is substantial, but then they cannot show it physically except as something accidental. When they have finally done all they can, they are left with a substantial form which exists only logically and not in nature. Thus a logical construction comes to be posited as the principle of natural things.[9]

In 1621 the eclectic physician turned philosopher Sebastian Basso renewed the attack against material substantial forms in his *Philosophiae Naturalis Adversus Aristotelem* (Natural Philosophies Against Aristotle), writing:

> And what is in fact mostly deduced from the doctrine of Plato and the Ancients we showed fully by the most certain and clear reasons, that the divine mind, diffused through all things, standing near, gives the proper motion towards the end

[7] E.g., Peter Dear, *Mersenne and the Learning of the Schools* (Ithaca: Cornell University Press, 1988) and the studies of Beeckman by Klaas Van Berkel and Stephen Gaukroger cited below (see n. 17).

[8] I cite from the Latin edition of 1570, included by Bondi alongside his Italian translation. Bernardino Telesio, *La natura secondo i suoi principi* (1570), trans. Roberto Bondi (Florence: La Nuova Italia Editrice, 1999), p. 118. We know that Descartes at least read Campanella, since he mentioned a work by him that he had borrowed from Huygens in a letter dated March 9, 1638.

[9] Giordano Bruno, *Cause, Principle and Unity and Essays on Magic*, trans. Richard J. Blackwell and Robert de Lucca (Cambridge: Cambridge University Press, 1998), p. 60.

to individual things and gives its power to a certain thing and conserves it. Why do they seek individual substantial forms in individual things when one universal cause extending through all things suffices for individual things?[10]

Nevertheless, in the long run, these earlier attempts to displace Aristotelian natural philosophy failed, and by the early seventeenth century many universities were turning back to more conservative Scholastic Aristotelian teachings.[11] The University of Leiden in the Netherlands, the *alma mater* of Beeckman, and one of the Dutch universities where Descartes pursued his medical investigations, is a case in point.[12]

Regardless of the prevailing trend of seventeenth-century universities, the extent of the influence of earlier anti-Aristotelian philosophers on individual early modern proponents of the new science is unclear. Whereas the influence of Telesio on Thomas Hobbes has been documented, Descartes disavows any such influences in his 1630 letter to Beeckman:[13]

As for mere opinions and received doctrines, such as those of the philosophers, simply to repeat them is not to teach them. Plato says one thing, Aristotle another, Epicurus another, Telesio, Campanella, Bruno, Basson, Vanini, and the innovators (*novatores*) all say something different. Of all these people, I ask you, who is it who has anything to teach me, or indeed anyone who loves wisdom?[14]

Of course, we must take Descartes' disavowal with a healthy pinch of salt, since the overall purpose of the letter is to defend himself against mounting suspicions that he stole much of his natural philosophy from Beeckman. Descartes cites these earlier philosophers to support his final claim that no one, not even Beeckman, has anything to teach him. Given the well-established importance of Beeckman's *physico-mathematics* to Descartes' early physics, the fact that Descartes draws a parallel between his relationship to the teachings of the above-cited philosophers and those

[10] Sebastian Basso, *Philosophiae naturalis adversus Aristotelem* (Geneva, 1621), Bk. III on Form, Int. 1, a. 5, 267. Again, there is evidence that Descartes had read Basso.

[11] Edward G. Ruestow, *Physics at Seventeenth- and Eighteenth-Century Leiden: Philosophy and the New Science in the University* (The Hague: Martinus Nijhoff, 1973), p. 12.

[12] Theo Verbeek notes that what passed for 'Aristotelianism' in the early years of the university was rather a mix of Ramism and works in natural philosophy by Romans like Lucretius, Pliny, Seneca, and Virgil. However, in 1582 six students, backed by theology professors, made a plea to the Senate for a return to Aristotle's texts and the teaching of metaphysics. Hence during the first three decades of the seventeenth century there was a return to Scholastic Aristotelianism at Leiden. Theo Verbeek, *Descartes and the Dutch Early Reactions to Cartesian Philosophy, 1637–1650* (Carbondale and Edwardsville: Southern Illinois University Press, 1992), p. 6.

[13] Karl Schuhmann, "Telesio's Concept of Matter," *Atti del Convegno Internazionale di Studi su Bernardino Telesio*, 13 March 1989 (Cosenza: Academia Cosentina, 1989), pp. 115–134; Cees Leijenhorst: *The Mechanisation of Aristotelianism: The Late Aristotelian Setting of Thomas Hobbes' Natural Philosophy* (Leiden: Brill, 2002).

[14] To [Beeckman], October 17, 1630, CSMK, pp. 26–27; AT 1, p. 158.

of Beeckman tends to confirm their influence on him, rather than deny it. However, as Descartes points out, even though he may have reached similar results to prior philosophers, that does not mean that his philosophical ideas are directly borrowed from them, for he claims to have reached these conclusions through the application of his own philosophical method. While earlier philosophers, most notably Telesio and Francis Bacon, had also appealed to a new method to support the introduction of new principles of natural philosophy, Descartes' method is sufficiently distinct from these earlier ones to make the resulting principles of his physics significantly different.[15]

Setting aside the thorny question of the extent to which Descartes' actual physics conforms to and is the product of his philosophical method, one substantive difference between Descartes and these earlier opponents of Scholastic substantial forms is that none of their attacks implies the complete elimination of the matter/form ontology, and the associated substance/accident distinction, whereas Descartes' later works do. Telesio goes the furthest, denying that hot and cold are accidents, and turning the material substratum into a *quasi* substance, which unlike the prime matter of the Scholastics has bulk and mass. However, for Telesio, heat becomes the active, physical instantiation of form which gives rise to the qualities matter can take on, whereas cold, as the passive principle that can resist the action of heat, becomes the stand-in for Aristotle's privation. As the above extract implies, Basso replaces individual forms with one universal form which he equates with the divine Mind, the Neoplatonic World Soul, and in its physical manifestation, with the Stoic ether. This ethereal universal form insinuates itself in between Basso's Democritean atoms, setting them in motion and determining the structure of macroscopic objects; hence, it simultaneously fulfills the roles of both the formal and the efficient causes. Basso may have, in part, been inspired by Bruno's Neoplatonism, which embraces the World Soul, a universal form of matter:

> We now know how to distinguish matter from form, as much from the accidental form (whatever it may be) as from the substantial form. We must still look into its nature and its reality. But first, I would like to know whether, in view of the great union that this world soul and universal form has with matter, one could not admit the other mode of philosophizing, belonging to those who do not separate the act from the essence of matter, and who understand matter as a divine thing, and not as something so pure and formless that it cannot form and clothe itself.[16]

[15] Unlike Descartes, both Bacon and Telesio base their methods on sensory observation.
[16] *Bruno, Cause, Principle and Unity*, p. 62.

In short, whereas this first generation of anti-Aristotelians embraces alternative theories of matter, and is thereby forced to redefine the matter/form relationship, in doing so, it does not eliminate the substantial form altogether, but rather reifies it, turning it into a universal form of matter, whether it be Telesio's heat, Bruno's World Soul, or Basso's universal Mind/Soul/Ether. I will show that Descartes initially also presents his new theory in terms of the matter/form distinction, treating the configurations of material particles as the forms of different types of material substances. However, he eventually eliminates the traditional matter/form and substance/accident distinctions altogether, replacing them with a substance/mode ontology. This makes Descartes' rejection of material substantial forms more firmly grounded and thoroughgoing than previous attempts, which could account for its success. And yet, the substance/mode ontology Descartes adopts is not entirely original, for I will show that it has strong affinities with the metaphysics of the Dutch atomist, David Gorlaeus.

In what follows, I examine probable sources for Descartes' arguments against substantial forms so as to elucidate the steps by which he gradually came to eliminate them from the physical world. In so doing, I also show that Descartes' mechanistic alternative to substantial forms represents neither a complete break from the past nor an outgrowth from one particular philosophical movement of his day. To assume that Descartes must have either reinvented philosophy *de novo* or been influenced by one particular school of thought is a false dichotomy that oversimplifies the complex philosophical landscape of early seventeenth-century Europe and the range of philosophical traditions with which Descartes came into contact. Instead I show that Descartes' mechanistic alternative to hylomorphism, like most original theories, is best understood as a creative response to a variety of pre-existing problems and solutions he encountered in his immediate intellectual circles. Textual evidence internal to Descartes' *corpus* and historical evidence drawn from his intellectual environment indicate that developments in both Aristotelian and anti-Aristotelian philosophy played vital roles in shaping his philosophical enterprise. In particular, I will show, on both textual and contextual grounds, that Descartes' reasons for rejecting hylomorphism in favor of mechanism are illuminated by the interplay among the following four philosophical developments:

1. Francisco Suarez's influential defense of the substantial form which, unlike that of St. Thomas Aquinas, emphasizes empirical over metaphysical arguments;

2. skeptical humanist arguments against the very possibility of scientific knowledge in the Aristotelian sense;
3. the rise of the mixed mathematical Aristotelian science of mechanics and its implications for scientific objects and demonstrations; and
4. the revival of atomist physics and Gorlaeus' replacement of an Aristotelian substance/accident/mode ontology with a substance/mode ontology.

By highlighting these four factors as important to our understanding of Descartes' eventual elimination of substantial forms I do not intend to rule out other factors that played a significant role in the development of his mechanistic philosophy. In particular, Descartes' indebtedness to Beeckman's mathematical approach to physical problems, his theory of matter, and his formulation of the principle of inertia, along with their early discussions on certain problems in hydrostatics, has been documented.[17] However, rather than duplicate the extensive research already accomplished in this domain, I focus more narrowly on the philosophical problems and resources that explain Descartes' replacement of substantial forms with mechanical principles at the metaphysical level.

I organize my examination of these four philosophical developments and the role they played in the demise of the substantial form chronologically according to three distinct periods in Descartes' life. In Part I, I determine the extent to which Descartes is attacking the accounts of the substantial form developed by two Scholastic philosophers whose works shaped the Jesuit curriculum of the time: St. Thomas Aquinas and Francisco Suarez. In Part II, I examine the mechanical explanations of Descartes' early scientific works in light of challenges to Scholastic Aristotelian scientific explanations posed by skepticism and Aristotelian mechanics – both were central to Descartes' Parisian intellectual environment in the 1620s. Finally, in Part III, I study Descartes' elimination of material substantial forms in his later works against the background of a Dutch atomist philosophy that he would have encountered during his years in the Netherlands.

[17] See, e.g., Klaas Van Berkel, "Descartes' Debt to Beeckman: Inspiration, Cooperation, Conflict," in *Descartes' Natural Philosophy*, ed. Stephen Gaukroger, John Schuster, and John Sutton (London and New York: Routledge, 2000), pp. 46–59; and Stephen Gaukroger, "The Foundational Role of Hydrostatics and Statics in Descartes' Natural Philosophy," in *ibid.*, pp. 60–80. Henk Kubbinga, "Le Concept d' 'individu substantiel' chez Beeckman et Descartes," in *Descartes et Regius Autour de l'Explication de l'Esprit Humain*, ed. Theo Verbeek (Amsterdam and Atlanta: Rodopi, 1993), pp. 93–103.

I begin, in Part I, by placing Descartes' arguments against the substantial form within the context of Scholastic Aristotelian philosophy, which dominated his intellectual environment during his early education at the Jesuit Collège La Flèche. However, great caution must be used in drawing inferences regarding the influence of Jesuit textbooks in philosophy on Descartes' own philosophical doctrines. First, it is unclear how much Descartes remembered from his schooldays at La Flèche for, in September 1640, he asks Marin Mersenne to recommend some reading so he can refresh his memory of Scholastic philosophy in preparation for objections to the *Meditations.* In the same letter Descartes recalls the commentaries by the Jesuit philosophers Toletus, the Coimbrans, and Ruvius.[18] This has led to a veritable cottage industry of articles and books seeking to relate elements of Descartes' philosophy to textbooks by these authors.[19] But Descartes makes it clear to Mersenne that he has no interest in pouring over "their huge tomes," and instead solicits Mersenne's help in finding a current abstract of all Scholastic philosophy.[20] Hence there is no evidence that Descartes refreshed his fading memory regarding the teachings of Toletus, the Coimbrans, and Ruvius at this stage. He did consult the *Summa Philosophiae Quadripartita* of Eustachius à Sancto Paulo, presumably the abstract that Mersenne recommended, and praises it as "the best book of its kind ever made," something it is most decidedly not.[21] One recent scholar aptly characterized it as "the Cliff's notes of Scholastic philosophy" and indeed, it does not give sufficient detail to fulfill the aims of this study.[22] However, it served Descartes' purposes in 1640 since, at that stage, he was not interested in the subtleties of Scholastic philosophy, proclaiming instead that "It is easy to overturn the foundations on which they all agree, and once that has been done, all their disagreements over detail will seem foolish."[23] In light of this, a second cautionary note is in order. Even if Descartes did remember and

[18] To Mersenne, September 30, 1640, CSMK, pp. 153–154; AT III, p. 185.

[19] See David Clemenson, *Descartes' Theory of Ideas* (London: Continuum, 2007). He argues that commentaries such as those of Toletus, Rubio, and the Coimbrans are more directly relevant to Descartes' philosophy than is Suarez's *Metaphysical Disputations*, for, even though we do not know which texts were used at La Flèche at that time, we know they had to follow Aristotle's texts, and Suarez's text does not. However, this presupposes that Descartes remembered the textbooks of his youth clearly enough to retain the subtle distinctions between their teachings and those of Suarez and others. As we shall see, this is highly unlikely.

[20] CSMK, pp. 153–154; AT III, p. 185.

[21] To Mersenne, November 11, 1640, CSMK, p. 156; AT III, p. 232. Descartes was so enthralled with this work that he initially planned to publish his *Principles of Philosophy* alongside it.

[22] Dennis Des Chene, *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought* (Ithaca: Cornell University Press, 1996), p. 11.

[23] November 11, 1640, CSMK, p. 156; AT III, p. 232.