
THE CARTESIAN ALTERNATIVE TO SUBSTANTIAL FORMS: TOWARDS A MECHANICAL PHYSICS

A ALTERNATIVA CARTESIANA ÀS FORMAS SUBSTANCIAIS: RUMO A UMA FÍSICA MECANICISTA

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Abstract:

*The objective of this paper is to show how Descartes worked out his mechanical philosophy. So the first step to reach this goal led Descartes to criticize and to abandon the obscure notion of 'substantial form', which was widely employed by the Scholastics to explain all events concerning natural beings in a qualitative way. Having rejected the substantial forms, the next step would be to establish a new subject matter for natural philosophy, which he found in the material body (*res extensa*) and its geometrical properties. Finally, we will see that from these modifications introduced by Descartes in the object of study of natural philosophy will also emerge a new method of investigating and explaining natural phenomena based on the principles of mechanics and mathematics. Nonetheless, we will conclude by claiming that nothing of this will suffice to exclude substantial forms from natural philosophy and that is why metaphysics will play a fundamental role in Descartes' philosophical system.*

Keywords: *Descartes, Scholasticism, Natural philosophy, Substantial form, Res extensa*

Resumo:

O objetivo desse artigo é mostrar como Descartes elaborou sua filosofia mecanicista. O primeiro passo para atingir esse objetivo levou Descartes a criticar e a abandonar a obscura noção de 'forma substancial', que era amplamente empregada pelos Escolásticos para explicar todos os eventos referentes aos seres naturais de uma maneira qualitativa. O próximo passo após rejeitar as formas substanciais seria estabelecer um novo objeto de investigação para a filosofia natural, o qual ele encontrou na matéria corpórea (*res extensa*) e suas propriedades geométricas. Enfim, veremos que dessas modificações introduzidas por Descartes no objeto de estudo da filosofia natural vai emergir um novo método de investigar e explicar os fenômenos naturais baseado nos princípios da mecânica e da matemática. Todavia, nós concluiremos afirmando que nada disso será suficiente para excluir as formas substanciais da filosofia natural e é por isso que a metafísica desempenhará um papel tão importante no sistema filosófico de Descartes.

Palavras-chave: *Descartes, Escolástica, Filosofia natural, Formas substanciais, Res extensa*

In his *Discourse on method*, which can be read as a kind of intellectual biography, Descartes tells us that he was very upset by the education he received in his early ages. In fact, he esteems that there is little worth in the studies he had made in his youth:

From my childhood they fed me books, and because people convinced me that these could give me clear and certain knowledge of everything useful in life, I was extremely eager to learn them. But no sooner than I had completed the whole course of study that normally takes one straight into the ranks of the learned I completely changed my mind. For I found myself tangled in so many doubts and errors that I came to think that my attempts to become educated had done me no good except to give me a steadily widening view of my ignorance (DESCARTES, 1996, p. 4 [AT 6])¹.

Descartes studied at *La Flèche*, a Jesuit school of great prestigious at his time. Indeed, in his own opinion *La Flèche* was “[...] one of the most famous colleges in Europe” (DESCARTES, 1996, p. 5 [AT 6]), where he believed he would find “wise men” (*ibidem*). In this school the bulk of the curriculum was based on Aristotle’s works and it was taught through Thomas Aquinas’ commentaries on them². Accordingly, since Aristotle’s system of thought had occupied a central place in his education, Descartes blamed him as the main source of his scholar frustration. That is why throughout his whole career Descartes will be fighting against the Aristotelian scholastic philosophy. In fact, the main goal of the philosophy he will be building over the years of his maturity is to undermine the Peripatetic thought in western culture. It was exactly for this reason that he wrote the *Principia philosophiae*, a compilation of his whole philosophy intended to replace the scholastic textbooks in the schools and universities.

¹ ‘AT’ refers to Rene Descartes, *Oeuvres de Descartes*, 11 volumes, Charles Adam and Paul Tannery, eds. Paris: J. Vrin 1996.

² Ariew (1992, p. 60) describes in more detail what the curriculum in a Jesuit school in the seventeenth century looks like: “At *La Flèche*, as in other Jesuit colleges of the time, the curriculum in philosophy would have lasted three years (the final three years of a student’s education, from about the age of fifteen on). It would have consisted of lectures, twice a day in sessions lasting two hours each, from a set curriculum based primarily on Aristotle and Thomas Aquinas. During Descartes’ time, the first year was devoted to logic and ethics, consisting of commentaries and questions based on Porphyry’s *Isagoge* and Aristotle’s *Categories*, *On Interpretation*, *Prior Analytics*, *Topics*, *Posterior Analytics*, and *Nicomachean Ethics*. The second year was devoted to physics and metaphysics, based primarily on Aristotle’s *Physics*, *De Caelo*, *On Generation and Corruption* book I, and *Metaphysics* book I, 2 and II. The third year of philosophy was a year of mathematics, consisting of arithmetics, geometry, music and astronomy [...]”.

Among the courses Descartes took at *La Flèche* that which he was most dissatisfied with was the scientific teaching, that is to say, the natural philosophy or physics he studied there. So it comes as no surprise that the scholastic physics will become the main target of Descartes' critiques. This scholastic science seems to have made no great progress over the Middle Ages. In fact, as asserted by Gilson (1951, p. 143), the scholastic natural philosophy Descartes had learned at *La Flèche* was almost the same that was taught in the French universities of the thirteenth and fourteenth centuries. In other words, the conceptual and philosophical system used to explain the way nature operates bequeathed by the Middle Ages was still at work in early modern age. Paradoxically enough, at this same time, due to the work of men like Copernicus (1473-1543), Kepler (1571-1630) and Galileo (1564-1642), we will be watching the spread of the Scientific Revolution of which Descartes will be a central figure.

The scholastic natural philosophy as well as its ontology were clearly a development of Aristotle's theories about the nature of substance put forward in his *Metaphysics* (book Δ, cap. 18, 1022a 13-23) and in his *Physics* (book II, 194b 23). The Aristotelian doctrine of hylomorphism postulated that all substance was composed by matter and form. The form, the principal component of the substance in Aristotle's view, had two main functions. First, the form had the metaphysical function of determining the unity and identity of the substance. In other words, in the metaphysical sense 'form' indicates what substance is, what is its essence. Second, the form was also responsible for all changes or movements – κίνησις, in Aristotle's terminology (*Physics*, book II, 1, 192b12-15) underwent by "the beings which exist by nature" (τὰ φύσει ὄντα)³. This so-called 'physical sense of form' is the cause behind all the operations and actions happening in the substance. Therefore, it was by the notion of form that Aristotle explained not only the metaphysical structure of substances, but also their way of functioning and operating.

³ "Τῶν ὄντων τὰ μὲν ἐστὶ φύσει, τὰ δὲ δι' ἄλλας αἰτίας, φύσει μὲν τὰ τε ζῷα καὶ τὰ μέρη αὐτῶν καὶ τὰ φυτὰ καὶ τὰ ἀπλᾶ τῶν σωμάτων, οἷον γῆ καὶ πῦρ καὶ ἀήρ καὶ ὕδωρ" [Among the beings some exist by nature and others exist through different causes. By nature exist the animals and their parts, the plants and the simple elements of the bodies, like earth, fire, air and water]. Aquinas is in plain agreement with this Aristotelian conception (cf. AQUINAS, *Commentaria in libros physicorum*, II, l. 1, n. 8).

Although, unlike Aristotle, Aquinas stresses the role played by matter in the process of individuation of substance, the scholastic natural philosophy will be built undoubtedly on the Aristotelian teachings about the nature of substance. According to the scholastic ontology, the world was constituted by a large number of substances, each of them having its own essence and properties. As held by Aristotle, these essences and properties were determined by a ‘formal’ element, which was responsible for the structure, actions and accidental features of the substance. This is exactly what sustains Thomas Aquinas: “Every natural body has some determined substantial form. Since the accidents follow upon the substantial form, it is necessary that determinate accidents should follow upon a determinate form” (AQUINAS, *Summa theologiae*, I, q. 7, art. 3.). This means that all characteristics as well as all intrinsic events relating to the natural beings should be assigned to their formal element. Thus, in explaining a natural phenomenon we should indicate what is the form which is causing it. Therefore, physics must investigate the true nature of each being, i. e. its form, in order to understand the way nature acts. The following example shows how substantial forms were used to account for the happenings of natural phenomena: “[...] As heat is an active quality consequent on the substantial form of fire, so light is an active quality consequent on the substantial form of the sun [...]” (AQUINAS, *Summa theologiae*, I, q. 67. Art; 3)⁴.

So the scholastic physics Descartes was taught at *La Flèche*, in its deep agreement with the thought of Aristotle, had as its main task to identify and to classify the substantial forms of the natural beings, as well as their accidental forms or real qualities through which they manifested their action⁵. In fact, it was by describing the

⁴ As we will see below, in his struggle against the qualitative method employed by the scholastic physics, Descartes will use the same examples as Aquinas did in order to show the clarity and evidence of his corpuscular-mechanistic physics in comparison with that of his adversaries.

⁵ ‘Real qualities’ or ‘accidental forms’ are contingent properties that inhere in substances, such as color, weight, temperature, etc. For instance, the whiteness of milk and the coldness of water, according to Scholastics, were due to their substantial forms.

qualities that bodies happen to have by virtue of their substantial forms that scholastics explained natural phenomena⁶.

Therefore, the scholastic natural philosophy was a taxonomic and qualitative science which explained physical phenomena by the notion of substantial form. That is why it is to “[...] all the qualities and forms [he] hate[s] [...]” (DESCARTES, 1996 [AT 2], p. 74) that Descartes will address his most severe critique, for it was on them that the scholastic physics had been built. In refusing the substantial forms, Descartes would also be undermining the scholastic natural philosophy altogether. Consequently, the Cartesian physics that is supposed to replace that old science will be shaped by all that criticism. In fact, Descartes considered the physics he was taught conceptually meaningless and useless in its application to solve real problems. For him, a science based on a principle such as that of substantial form had no capacity whatsoever to explain or predict natural phenomena, since “[...] the Form becomes a kind of invisible screen between the observer and the object of his study, which prevents him from grasping and measuring and weighing it” (ALLAN, 1970, p. 115). In Descartes’ view, on the contrary, natural science requires an approach which focuses not on qualitative descriptions of phenomena, but rather in the objective, quantitative features of nature, those that allow the scientist to measure and to quantify with precision what he is investigating. Thus, from this standpoint, substantial forms and real qualities will be replaced by what Descartes call *res extensa*, that is to say, pure matter and its geometrical properties (breadth, length and depth).

In his work *The World or Treatise on light* Descartes puts forward his new conceptions concerning natural philosophy, which means “[...] a fully mechanist alternative to Aristotelian system, one which effectively derives heliocentrism⁷ from

⁶ As Hattab explains, it was precisely the existence of these properties in substances that led scholastics to postulate substantial forms as its cause (cf. HATTAB, 2009, p. 24).

⁷ When he knew about Galileo’s condemnation by the Inquisition, Descartes wrote to Mersenne and explained him to what extent his system was committed to Copernicus’ astronomical views: “[...] If it [heliocentrism] is false, so are all the foundations of my philosophy. For it [heliocentrism] is evidently demonstrated by them. And it [heliocentrism] is so closely connected to all the parts of my treatise, so

first principles, which offers a novel and apparently viable conception of matter [*res extensa*] and which formulates fundamental laws of motion⁸ – laws which are clearly open to quantitative elaboration” (GAUKROGER, 2002, p. 18.). From the very beginning of *The World* we also find Descartes’ critique of substantial forms. For him, substantial forms are the stumbling block which had prevented natural philosophy from becoming a true science. For this reason, he refuses to account for natural phenomena by meaningless notions such as ‘form’, ‘quality’, ‘action’ and so on, as Aquinas did. In his view, a genuinely scientific physics should aim at analysing natural phenomena through the constituting parts of matter and its motion. The practical application of the principles of this new mechanical physics Descartes proposes – and the way in which they serve to overcome the scholastic natural philosophy – can be exemplified by a flame that is burning a piece of wood:

When it [the flame] burns the wood or other similar material we can see with our eyes that it moves the small parts of the wood, separating them from one another, thereby transforming the finer parts into fire, air, and smoke, and leaving the larger parts as ashes. Someone else [that is, the scholastic thinker] may if he wishes imagine the ‘form’ of fire, the ‘quality’ of heat, and the ‘action’ of burning to be very different things in the wood. For my own part, I am afraid of going astray if I suppose there to be in the wood anything more than what I see must necessarily be there, so I am satisfied to confine myself to conceiving the motion of its parts” (DESCARTES, 1996 [AT 11], p.7).

It is thus that the Cartesian corpuscular-mechanistic physics, on the one hand, opposes the obscure reasons that Aristotle had advanced in order to explain natural phenomena – which were widely and systematically employed by scholastic thinkers – and, on the other hand, tries to establish a new model of natural philosophy relying only on what he thinks to be clear and evident principles. In other words, Descartes endeavors to investigate nature grounded just in measurable and tangible principles as a geometer, like Euclides or Pappus, would do. Since, from his standpoint, physics must study nothing but material bodies, Descartes justifies this new approach to the study of nature by claiming that he had found out that “[...] absolutely nothing belongs to the

that I cannot give it [heliocentrism] up without ruining my treatise altogether” (DESCARTES, 1996 [AT 1], p. 271.

⁸ See DESCARTES, 1996 [AT 11], pp. 38 e 41 e DESCARTES, 1996 [AT 8], pp. 62-66.

nature of body except that it be a thing that has length, breadth and depth and is capable of various shapes and motions; and these shapes and motions are merely modes of bodies, which no power can cause to exist apart from them” (DESCARTES, 1996 [AT 7], p. 440). Therefore, for Descartes, physics must be concerned with the study of nature just to the extent that it is understood as a geometrical issue, stripped of all soul or animated principle. In place of the scholastic substantial forms, Descartes will postulate extended matter and the primary qualities inherent to it as the only possible way of explaining natural phenomena. Henceforth, nature will become a mechanical machine.

One of the most important outcomes produced by this new Cartesian mechanical physics lies precisely in the method of explaining natural phenomena. As we have seen, the scholastics supposed that movement and change as well as the properties of physical beings stemmed from within the body itself caused by an inner principle which they called substantial form. As a consequence of this assumption, the scholastic natural philosophy was required to postulate as many substantial forms as the natural phenomena they were supposed to explain. In other words, there should be one substantial form assigned to each particular phenomenon. The mechanical model proposed by Descartes, on the other hand, held that movement, and change as well as the properties of natural beings should be explained by nothing else except the interactions or shocks among the bodies and their constituent parts. Thus, for Descartes, the causes of natural phenomena should be assigned to external agents, because bodies have no internal power to act by themselves. This assumption, i. e., that matter is passive, allowed Descartes to elaborate a set of physical laws which could be applied to explain a wide range of phenomena. Therefore, from this pattern of mechanical causality it follows that all phenomena should be explained according to a rigorous procedure of cause and effect, empirically verifiable and above all mathematically measurable. And even though we have to grant that “[...] Descartes is no more able to perceive the particles in motion that he takes to give rise to certain sensible properties of a body than the scholastic is able to perceive the real quality of heaviness or the substantial form of a body” (HATTAB, 2009, pp. 19-20), by advancing a mechanical method, a new conception of matter and a new understanding of nature he has unquestionably given a great contribution to overcome the qualitative way of

explanation conveyed by the Aristotelian scholastics and this way he has put natural philosophy on the secure path of modern science.

However, despite all Descartes' efforts to overcome the scholastic natural philosophy with his mechanical alternative to substantial forms, it was not enough. Of course, in order to refute the scholastic physics one should propose a new scientific model which were able to provide better and sound explanation for the phenomena it was supposed to account for. Descartes believed he had done that. Nonetheless, since the old Aristotelian physics espoused by the Scholastics was grounded in the ontological doctrine of hylomorphism, it will also require a metaphysical argument to be completely defeated. That is, it was no doubt necessary, but not sufficient to just establish a scientific alternative to replace the scholastic natural philosophy; for in this case we would have two scientific theories competing for explaining the same set of phenomena at the same time without one eliminating the other. So it was required to advance a metaphysical argument which could undermine the hylomorphic ontology presupposed by substantial forms as well. And so did Descartes.

The most thorough metaphysical attack Descartes delivered against the Aristotelian hylomorphism and consequently against the scholastic substantial forms is hidden under his thesis about the mind-body dualism or 'Real Distinction Argument', as it is also called. In effect, the target of Descartes' dualism thesis is often misunderstood. It is commonly believed that in the radical distinction made in the *Second Meditation* between mind and body Descartes is primarily concerned with the mind (ROZEMOND, 1998, p. 64), since it is through the act of thinking performed by the mind that the first metaphysical certainty – "I think, therefore I am" – is stated. According to this interpretation, which suits pretty well Descartes' proclaimed intentions, his main goal in that meditation would be to demonstrate that the human soul is not only a purely immaterial entity, but also that it is completely independent of the body. So goes the story Descartes wanted the theologians of the Faculty of Paris to believe in, above all in what concerns its implications for the immortality of the human soul. But Descartes was actually more interested in the scientific than in the metaphysical consequences of his dualism. In fact, through the mind-body distinction his true aim was actually to show, in

frank opposition to what was defended by the scholastic natural philosophy, that the body is purely material and can exist by itself without any soul or form attached to it.

It is thus that Descartes justifies metaphysically his new mechanistic physics, which has as its object just the material extension and its geometrical properties. In other words, more than to bring about a metaphysics based on the certainty of the self and on the existence of God, through the mind-body distinction Descartes launched the foundations of his mathematical physics. In fact, were Descartes' main concerns to really deepen his knowledge about the human soul or even about God, as it is clearly stressed by him in the title of the *Meditations*, he would have tried to work out at length a rational psychology or a philosophical theology. However, it is not the case. On the contrary, after stating the real distinction between mind and body and giving his proof of God's existence, he always goes on to deal with issues related to scientific matters. It is so not only in the *Meditations*, but also in the *Discourse on method* and in the *Principles of philosophy*. In the *Meditations*, his masterpiece, he makes it clear that before starting solving any scientific problem it was necessary to metaphysically refute the Aristotelian scholastic ontology and to establish a new object for physics. So Descartes employs his dualist argument in order to show that soul and body are two distinct and independent entities that can exist by themselves. It is thus that he dismisses the Aristotelian hylomorphic ontology. By the same token, since substantial forms were thought as a kind of soul that 'animated' matter, so to speak, Descartes could also deny the necessity of them in science. Henceforth, matter alone, conceived as a true substance, should be used in natural philosophy explanation. It is on this principle that Descartes will built his mechanical physics.

From this renovated metaphysical and physical framework, finally stripped of all substantial forms, will emerge a mechanical universe constituted solely by physical matter. This new Cartesian picture of the universe has only place for extended matter and its geometrical properties – shape, motion, and seize. So Descartes' physics will takle just and exclusively the primary qualities of material bodies. That is why we say that Descartes reduced physics to geometry. So by mixing up the principles of geometry and mechanics Descartes was able to articulate an alternative model to the scholastic

natural philosophy. Nonetheless, it was not enough to eliminate the core notion of that medieval science. Only through his dualist metaphysics he definitely found out how to banish substantial forms from the realm of physics. It is for this reason that Descartes claims that his physics is grounded in his metaphysics and so we clearly understand why Descartes' metaphysics is so important to his mechanical philosophy.

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