Book Review

Descartes, the Pioneer of the Scientific Revolution

Reviewed by Michel Serfati

Descartes: A Biography
Desmond Clarke
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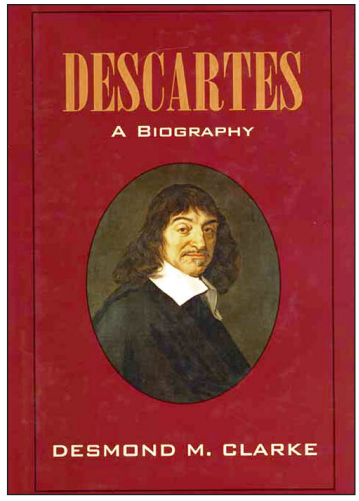
Since Father Adrien Baillet's sometimes unreliable biography of 1691, Descartes has been captivating the commentators; hundreds of books have been devoted to details of his life, published not only in France, where Descartes is considered a national hero, but abroad as well. A difficulty lies in the outstanding variety of Descartes's interests. A careful biographer should develop extensive background in mathematics, physics (theoretical and experimental), metaphysics, physiology and medicine, philosophy, and theology. Clarke, a professor of philosophy at the University of Cork, has done a remarkable job in the history of ideas and philosophical biography. I nevertheless regret his too-short treatment of Cartesian mathematics. I will examine first the most important phases of Descartes's life and thought following Clarke's book. In a separate article in this issue of the *Notices*, I shall propose a brief study of Descartes's mathematics.

Clarke, a learned Descartes scholar, excels at picking out meaningful quotations scattered among the eleven volumes of the renowned Adam-Tannery edition of Descartes's works[1], giving excellent translations from the sometimes difficult seventeenth-century French. He presents a constellation of secondary characters—Beeckman, Bérulle, Mersenne, Huygens, Morin, Chanut, Guez de Balzac, van Schooten, etc.—Descartes's correspondents, friends, acquaintances, and opponents.



Descartes's Youth

Born in 1596 at La Haye en Touraine on the border of Poitou, René Descartes was the third surviving child of Joachim Descartes and Jeanne Brochard. He studied at the college of La Flèche, near Le Mans. The mathematician Christopher Clavius had in 1599 supported educational reforms (*Ratio Studiorum*) in the Jesuit Colleges to reinforce the importance of mathematics, for which the young Descartes conceived a very strong attraction "because of the certitude and clarity of its grounds" (*Discourse on Method* = ATvi, 7). Nevertheless, after his studies at La Flèche Descartes's knowledge of mathematics was quite rudimentary—he was unaware of Cardan's solution for the cubic (1545), for instance.

Descartes then took a degree in law at Poitiers and traveled to Holland to enlist under Maurice of Nassau to fight in what is now called The Thirty Years' War. At Breda in November 1618 he met Isaac Beeckman in front of a poster displaying a mathematical problem, which Descartes solved

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[1] *Hereafter [ATz] where "z" is the Roman number of the volume.*

straightaway. It was the beginning of a strong friendship. The Dutch scientist, eight years older than Descartes, was impassioned with "physico-mathematics", a new concept with a name coined by him. Descartes was pleased to discover in him a perspective on science different from contemporary esoteric theories such as those of Ramon Llull or the Rosicrucians, which had hitherto attracted his attention. Descartes gave Beeckman his first scientific work, the Compendium of Music (1618). On March 26, 1619, Descartes enthusiastically sent Beeckman an important letter in which he concluded that "there is almost nothing left to discover in geometry" and wrote that he possessed the elements of "a completely new science" and had discovered "a light to dispel the deepest darkness" (ATx, 157–158). When Descartes met Beeckman again ten years later in Dordrecht, he regretted his youthful enthusiasm and broke with him brutally.

Descartes then went to Germany, to the Duchy of Neuburg. On the night of November 10, 1619, shut in a heated room (an "oven"), he had three dreams, which he later declared to be decisive in determining his scientific vocation and his Method (Clarke, 58–62, Rodis-Lewis1971, 50–55). The central question of the dreams came from the title of a poem by the late-Roman poet Ausonius: "What path shall I follow in life?" The dreams marked a turning point in Descartes's life.

Having left his "oven", Descartes decided to make a radical change in his way of life and to "get rid of his prejudices" (Baillet, 1), that is, of scholastic philosophy. He undertook "nine years of exercise in the Method", (Rodis-Lewis1971, 57) during which he made no attempt at publication. In the *Discourse on Method*, he explains that he had wanted to devote these years not to writing and publishing, but to learning daily life "in the great Book of the World" (*Discourse on Method* = ATvi, 9; cf. Clarke's Chapter 3, "Magic, Mathematics, and Mechanics, Paris: 1622–1628", describes this period well).

Following his return to Paris in 1625, he was a member of the Mersenne group until the death of the latter in 1648. Marin Mersenne, a member of the Order of the Minims, was a recognized scholar in mathematics as well as in music, acoustics, and optics. The "reverend father", competent and clever, was for a long time the "secretary of European science", a scientific intermediary between scholars, and the "ambassador in Paris of M. Descartes". More than a hundred letters between Descartes and Mersenne show their relations were significant, warm, and continuous. Mersenne asked Descartes many questions on widely different topics: mathematical, philosophical, sometimes purely practical (e.g., "how does phosphorus burn?"). Descartes's life cannot be separated from his friendship with Mersenne.

During these years of study (1619–1628), Descartes wrote the *Rules for the Direction of the Mind* (hereinafter *Regulae*),[2] a text that was discovered and published only posthumously yet fundamental, in my opinion, for the epistemology of mathematics and the exact sciences (cf. Lebesgue's and Hadamard's comments on this subject). Clarke does not seem to recognize its full importance. Proceeding from mathematics and abstracting, through a close inspection of its objects and proofs, the general and simple mechanisms of rigorous thought in sciences: this was Descartes's approach in the *Regulae*—in other words, this is the very constitution of his Method. (Serfati1994, 69–75). As an example, the *Geometry* depends directly on it—much more than it depends on the *Discourse on Method* itself. Descartes's objective was not, however, the advancement of mathematics, but a description of the physical world using the Cartesian *Mathesis Universalis*.

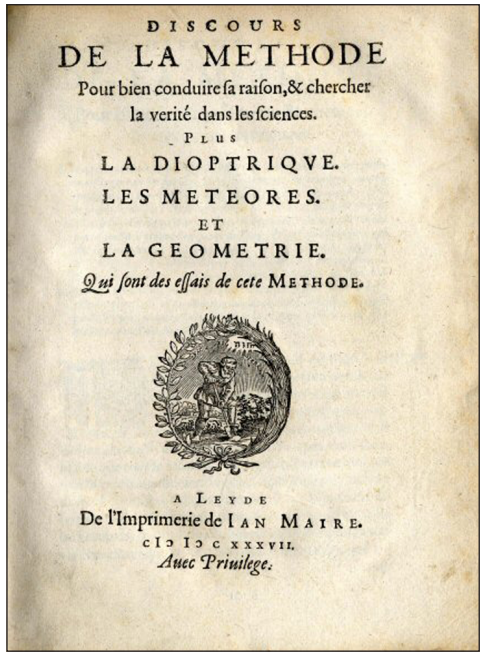
DISCOURS
DE LA METHODE
Pour bien conduire sa raison, & chercher
la verité dans les sciences.
PLUS
LA DIOPTRIQVE.
LES METEORES.
ET
LA GEOMETRIE.
Qui sont des essais de cette METHODE.
A LEYDE
De l'Imprimerie de IAN MAIRE.
cIↃ IↃ c XXXVII.
Avec Privilege.

Figure 1. Title page of the *Discours*. Reproduction from the original edition = ATvi, XIII.

This period of study came to an end probably through a meeting in Paris with Cardinal Bérulle. Descartes decided to write a book of physics—the second turning point in his life—and also to emigrate to Holland, where he spent nearly all the rest of his life, frequently changing address, first in big towns (Amsterdam, Utrecht, Leiden) then in more and more isolated and modest places (Egmond). Clarke rightly explains the reasons why Descartes desired isolation. From 1628 on, Descartes returned to France only briefly and for particular events.

The World

One cannot understand Descartes's life and personality without keeping in mind the conditions in which he wrote his book *The World, or, A Treatise on Light* and what it meant for him to be forced to abandon its publication (Chapter 4, "A Fabulous World"). Clarke's insistance on this aspect is doubtless a novelty as well as a peculiarity of

[2] *According to the standard translation of the Latin title. Strangely enough, Clarke chooses the translation* Rules for Guiding One's Intelligence.

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ce qu'on ma dit, vn arc-en-ciel tellement renuerſé que ſes cornes eſtoient tournées vers en hault, comme eſt icy repreſenté F F. Ceque ie ne ſçaurois iuger eſtre arriué que par la reflexion des rayons du ſoleil donnans ſur l'eau de la mer, ou de quelque lac. Comme ſi venans de la partie du ciel S S, ils tombent ſur l'eau D A E, & delà ſe refleſchiſſent vers la pluie C F, l'œil B verra l'arc F F, dont le centre eſt au point C, en ſorte que C B eſtant prolongée iuſques à A, & A S paſſant par le centre du ſoleil, les angles S A D & B A E ſoient eſgaux, & que l'angle C B F ſoit d'enuiron 42 degrés. Toutefois il eſt auſſy requis a cet effect, qu'il n'y ait point du tout de vent qui trouble la face de l'eau vers E, & peuteſtre auec cela qu'il y ait quelque nuë, comme G, qui empeſche que la lumiere du ſoleil allant en ligne droite vers la pluie, n'efface celle que cete eau E y enuoye. d'où vient qu'il n'arriue que rarement. Outre cela l'œil peut eſtre en telle ſitua-

Figure 2. A page of the Meteors: a scheme for the explanation of the rainbow. Reproduction from page 268 of the original edition = ATvi, 342 = Olscamp, 343.

his biography. Written over a period of four years from 1629 to 1633, *The World* was for Descartes the summit of his physics. Its composition perfectly reveals Descartes at work. To begin with, he devoted himself to an analysis of the appearance of false suns (*parhelia*) observed by Scheiner near Rome on March 20, 1629. To account for this rather surprising but quite specific celestial phenomenon, Descartes undertook a few weeks later to broaden significantly his explicative project. He decided first to undertake a study of meteorology—that is, all sublunar phenomena. One month later, he again expanded his plan: the study was no longer restricted to sublunar phenomena, but, as he wrote to Mersenne, to "all natural phenomena, that is to say, all the Physics." (ATi, 70). This was a considerable mutation that involved collapsing the Aristotelian hierarchy of the cosmos (Blay, 327). The extension of the plan went on by successive steps. First, Descartes incorporated a survey of light and colors, the explanation of which was for him a major part of physics. Later on he wondered: "Has (or has not) the *World* to study generation of animals? Must it (or not) broach the 'nature of man'?" (*idem*, 328). So what began as a way to explain false suns, namely the so-called "fable of the World", became by 1632 a universal Cartesian system for explaining the world.

The second condemnation of Galileo (1633) ruined Descartes's plans to publish *The World*. Descartes had included in his work Galileo's conclusion about the motion of the earth around the sun as an essential element that could not be overlooked. This idea was prohibited by the Church as contrary to Scripture, and following the Council of Trent (1546) the Church reserved exclusive authority to interpret Scripture, even regarding scientific matters. In his private correspondence, Descartes often contested the right of theologians to go against the truths of experience and physical facts. Nevertheless he abandoned any plan to publish *The World*. Against those who would consider Descartes's behavior pusillanimous, Clarke rightly explains the material power of the Church (cf. Bruno, Vanini, Galileo) and its ideological influence, especially on a convinced Catholic like Descartes.

The World displayed all the principles of Cartesian physics, from laws of movement, (including the law of inertia) to the identification of matter and spatiality (that is: where something exists, there must be space, and conversely there is no vacuum). These principles led Descartes on the one hand to a geometrization of the whole of physics, and on the other hand to propose a physical model of the universe composed of "vortices" with no interstitial space between them.

The four years of groundwork were not completely in vain. The scholastics had invented ad hoc justifications for each observed phenomenon, whereas Cartesian physics, the science of "matter in motion", proposed wholly rational explanations based on a few explicit principles. This was the dawn of modern science. Thus Descartes rejected the scholastics' "substantial forms" and "real qualities" as well as their tautological so-called "explanations" (e.g., that a substance burns because of its burning ability). Admittedly Descartes's physics contained mistakes and hasty analogical interpretations. Admittedly too, Descartes's system of the world lost its long struggle against Newton's system. But Descartes's first steps away from antiquated conceptions, scholastic and Aristotelian, cleared the way for Newton's work and from there, for modern physics. One might regret that these critical, yet important, aspects above are not evoked by Clarke, who does not undertake to set Descartes's physics into an historical perspective within the field of history of sciences. Specifically, he does not propose a comparison between Descartes's and Newton's systems of the world.

The *Discourse* and the *Essays*

Clarke rightly depicts Descartes's situation and choices after the bitter decision not to publish *The World* had left its painful mark. Since he could not make public all of his philosophy and physics, he decided to publish two "innocuous" scientific chapters of *The World* separately: the *Meteorology*, dealing with meteorological phenomena; and the *Optics*, devoted to vision. He considered them to be applications of his Method, and he called the texts *Essays*. Later (1635) he added to his project a third *Essay*, the *Geometry*, making use of his mathematical discoveries since 1628. This strategy was supposed to shelter him from theological controversy, especially as the text was written in the vernacular French rather than the Latin used by scholars. He decided afterwards to add a preface, the "Discourse on Method" (hereinafter *DM*). And so it happened that one of the landmark texts of modern philosophy was initially conceived merely as a prelude to three scientific works. The (royal) copyright protection for the work was obtained by Mersenne after many difficulties. The *DM* and the three *Essays* were published in sequence in Leiden in June 1637. The *DM* is a celebrated philosophical text in six parts. It contains, besides a substantial autobiography, a description of the four principles of the Method, anchored in the practice of mathematics and based on the primacy of "clear and distinct" ideas. The *Optics* is scattered with woodcuts and deals with light, the eye, and vision. It presents the Law of Refraction, the discovery of which Descartes shares with Snell. The *Meteorology* describes some of Descartes's terrestrial, maritime, and celestial observations and gives a celebrated explanation of the rainbow using refraction. (For the *Geometry*, see my accompanying article in this issue of the *Notices*.)

Figure 3. A celebrated picture of Descartes by Franz Hals (1649, one year before Descarte's death). The portrait can be found in the Louvre Museum in Paris.

The *Meditations* and the *Principles*

Two other important books resulted from the failure of the publication of *The World*. Leaving aside the scientific aspects, Descartes decided to publish first a book of philosophy and metaphysics. He tried once again to avoid quarrels, theological as well as philosophical, but did not succeed, since the first Latin edition of the *Meditations*,[3] published in Amsterdam in 1641, brought him into conflict with Calvinist theologians and made things difficult for him in Holland (Chapter 7, "Metaphysics in a Hornets' Nest"). The book followed a methodical plan with six *Meditations* followed by the *Objections* of various renowned scholars (e.g., Hobbes, Gassendi and Arnauld) and by Descartes's *Responses* to these objections. Descartes soon tired of the objectors, however, since they did not, in his opinion, sufficiently grasp his own views.

The first two *Meditations* did not fail to shock. Descartes developed therein a thoroughgoing skepticism, supposing that he might doubt of everything sensible. It might happen for instance, he says, that he is misled by a Deceiving God so that "I am wrong when I believe I have a body or hands" (ATvii, 17–18). This part of the book raised accusations of atheism and heresy against him. But his "hyperbolic" doubt had a purely rhetorical purpose, which was to establish the single Cartesian certainty: whatever I may doubt, *I think, therefore I am (Cogito, ergo sum)*. From then on Descartes, equipped with this certainty as with Archimedes's lever, and freed from his prejudices, could reconstruct the world and a new philosophy. The following *Meditations* could then deal with the immortality of the soul, two proofs of God's existence, and mind-body dualism (a central point of Cartesian metaphysics).

After metaphysics, Descartes hoped to return to the abortive project of "his Physics" (*The World*) while expanding the *Meditations* at the same time. The *Principles of Philosophy*, published in Latin in Amsterdam (1643), was a voluminous book with four parts and 324 pages, an authentic treatise of Cartesian physics. The first part (*The Principle of Human Knowledge*) "represents a second attempt to provide a metaphysical foundation for Descartes's system of philosophy" (Clarke, p. 291). The second part (*The Principle of Material Things*) deals with the "fundamental laws by which changes in material things occur" (*idem*, 292). It includes a study of magnetism and the laws of collision and

[3] Meditations on First Philosophy: In Which the Existence of God and the Distinction of the Soul from the Body Are Demonstrated.

movement (including inertia) (cf. Shea, 279–315). The major difficulty was in the third part (*The Visible World*), where Descartes wanted again to avoid conflict with Rome over heliocentrism, and succeeded, but only by artifice (Clarke, p. 294). The book ends with repeated proclamations of submission to the Church.

In spite of his precautions, Descartes could not help encroaching on the theological domain. His philosophy soon spread throughout Holland and raised followers (such as Regius, to begin with) and a school, but it also found critics and fierce enemies, such as Voetius, rector of Utrecht University. The quarrel with Voetius, the "Utrecht Controversy", is broadly detailed by Clarke (Chapter 8, "The French Liar's Monkey and the Utrecht Controversy"), with its developments, its cliques (for Descartes and against him), and its betrayals. The new Cartesian philosophy and science were the objects of virulent attacks from Dutch Calvinist theologians, while Descartes did not receive the counterbalancing support that he might have expected from French Jesuits. At one point he could even fear an Inquisition case against him.... The quarrel finally raised controversies amongst the Dutch themselves so that, as a policy of appeasement, the trustees of Leiden wisely put an end to the dispute.

During this period, Descartes kept moving in Holland, going farther north to more isolated places. He continued to receive supportive correspondence from Mersenne and from Constantijn Huygens (the father of the mathematician Christiaan), who since 1632 had been helping Descartes as much as he could in his capacity as a diplomat. The year 1640 saw the death of Descartes's daughter Francine, "the greatest regret he has ever known" (Baillet, 90; cf. Rodis-Lewis, 1995, 195–198).

Descartes and Elisabeth

Clarke's Chapter 9, "Descartes and Princess Elisabeth", depicts very lucidly the correspondence between the philosopher and Elisabeth, Princess of Bohemia, that began in 1643. The correspondence began with mathematics, specifically Apollonius' Problem (constructing a circle tangent to three given circles), which Elisabeth solved by a different method from Descartes's. The latter, feeling safe with her, started a long philosophical correspondence in which he was altogether Elisabeth's teacher, advisor, and friend. Clarke accurately depicts the asymmetrical exchange between a well-known scientist and philosopher still searching for social support, and an intelligent, sensitive, psychologically frail, but eager-to-learn, young princess. The two correspondents were thus equally interested in this exchange, which gave rise directly to Descartes's last important book *The Passions of the Soul*, published in 1649 and dedicated to Elisabeth. Descartes, following his systematic mind, tried to list *all* the passions (the word must be understood in its seventeenth-century *passive* meaning). Elisabeth was amazed when he described the six primitive passions—wonder, love, hatred, desire, joy and sadness—which combine, he said, to produce all the other passions.

Death in Sweden

In his last chapters, Clarke depicts how much Descartes, preoccupied with his age and health and reluctant to leave Holland, nevertheless accepted the invitation of the very young queen of Sweden (Christina was 23) to join her at her court. She wanted Descartes to give her lessons in philosophy. Descartes rightly was not sure that his philosophy could interest the queen durably and was afraid her invitation might be a caprice. But after the Utrecht crisis, he badly needed support. So he finally accepted the invitation, though with reluctance and delays. Since he decided to leave Holland only in the fall (of 1649), he had to endure the hard winter of Stockholm. Christina seldom called for him, but when she did it was at five in the morning. He caught cold on one of these occasions, initially refused to be treated, and died as a pious Catholic on February 10, 1650, at the age of 54. The documents he brought with him to Sweden make up the "Stockholm Inventory", which includes the manuscript of the *Regulae* of his youth.

After Descartes's death, his philosophy became widespread in Europe during the second half of the seventeenth century and attracted the followers of a "Cartesian school". Clarke stresses that in spite of Descartes's precautions when he was alive, he could not prevent the Roman Holy Office's posthumous prohibition of some of his works, including the *Meditations* and the *Passions*, in 1663.

Conclusion

Descartes is without a doubt the genuine pioneer of the Scientific Revolution in the seventeenth century, which overturned ancient and mediaeval scientific conceptions in natural sciences as well as in mathematics (see my accompanying article in this issue of the *Notices*) and paved the way for the modern era. Descartes himself was fully aware of his epistemological innovations, the originality of his theories, and the disruption he was bringing to the scholastic vision of the world and to Scriptural dogmas. But he was torn between the proud, absolute certainty of being the bearer of the truth, which spurred him on to publish, and the fear, if he did publish, of being misunderstood and held in contempt by the (mediocre) established philosophers or worse still, of being branded a heretic by the theologians, Calvinist and Catholic alike. Descartes felt threatened. From that feeling followed some of the defensive and quarrelsome

aspects of his character, which Clarke analyzes correctly without condemning him.

I recommend Clarke's book, which is one of the best Descartes biographies I have read.[4] It is clearly written. Clarke is a careful historian and a rigorous philosopher. Each of his important interpretations is supported by an adequate quotation. He knows well how to grasp the episodes of a history of ideas, as well as some contradictory aspects of Descartes's personality. This biography would be fascinating even for a naive reader. Some philosophers might nevertheless rightly regret that the book does not sufficiently set Descartes's philosophy into a historical perspective, for instance in comparison with Leibniz's philosophy. On the other hand, the book has an excellent bibliography which includes various English translations of significant works by Descartes. I regret, however, the brevity of the index.

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