Descartes' project

In 1641, at the age of 45, Descartes published the *Meditations on First Philosophy*. First philosophy is another name for metaphysics, the study of the basic principles of everything there is. Descartes understood metaphysics to ground all other knowledge, of the self, of God, and of the natural world; and he intended his *Meditations* to enable its readers to discover the one true metaphysics for themselves. It was a very ambitious work.

The *Meditations* describes itself as a work on "God and the soul" (7:1). And indeed it argues that God exists and that the soul or mind is distinct from the body. In preparation for these arguments, it raises and then overturns skeptical challenges to the very possibility of knowledge. On the surface, it appears to be a work about the possibility of knowledge concerning theological topics.

But if we look more deeply, we find that Descartes' aims were far from traditional. In letters to his friend Marin Mersenne, he secretly confided (3:298) that this

work contained "all the principles" of his physics (3:233). His talk of God and the soul was interlaced with metaphysical foundations for a revolutionary new physics or natural philosophy. His aim was to overturn the prevailing theory of the natural world, which put humankind at the center of things, and replace it with a radically new vision of nature as a grand but impersonal machine. Because he wanted his revolutionary intentions to remain hidden from first-time readers, no part of his book is labelled "principles of physics" or "theory of the natural world." We shall have to uncover his radical agenda for ourselves – an agenda that had tremendous influence on the subsequent history of philosophy and science.

To understand what Descartes wanted to do in the *Meditations*, we need to place that work in the context of his life and other writings. His intellectual career did not begin with aspirations in metaphysics but in mathematics and natural philosophy. His earliest efforts in those fields encouraged him to believe that he had discovered a special method. His thoughts on method changed and developed as he gained interest in metaphysics. These changes contributed to his ambitious vision for the *Meditations*.

After reviewing Descartes' intellectual projects and their results in this chapter, we will consider the structure and method of the *Meditations* as a philosophical text in the next. In Part II, we will examine the six Meditations, one by one. Finally, in Part III we will consider his revolution in science as supported by the *Meditations*, and sum up his philosophical legacy for us today.

Education

Descartes' education in a Jesuit school introduced him to the philosophical tradition he reacted against in his own philosophy, the Aristotelian tradition as interpreted by the scholastic philosophers of the Roman Catholic universities of Europe. As it happens, the Jesuits were excellent teachers of mathematics, and the rigor of that discipline inspired Descartes' initial thoughts of rebellion in philosophy. Not long after completing his schooling, he discovered some mathematical results for which he is justly famous. But from his schooldays the model of clarity found in elementary mathematical works had

made him want to challenge philosophy. He decided that by comparison with such clarity, philosophy was badly in need of reform, and he was the person for the job.

Descartes was born in 1596 in the Poitou region of France, near Tours in the small town of La Haye (now named "Descartes"). His father, the son of a physician, was a member of the landed gentry and a councillor in the parliament at Rennes. His mother, who came from a family of land-owning merchants, died in childbirth thirteen months after Descartes was born. The young René lived with his maternal grandmother, together with his older brother and sister. As was common for the sons of the gentry, he went to boarding school, attending the Jesuit college at La Flèche, in Anjou, from 1607 to 1615. The college had been established in 1604 by Henry IV, the former leader of the Calvinist Huguenots, who nominally converted to Catholicism in 1593 to undermine Catholic opposition to his kingship. In 1594, following an assassination attempt by a Jesuit student, Henry expelled the order from Paris and closed their colleges in other French cities. After reconciliation in 1603, he donated the palace and grounds at La Flèche to the Jesuits for a new college.

The Jesuits are a Roman Catholic religious order, known formally as the Society of Jesus, founded in Spain in 1539 by Ignatius of Loyola. Their mission was to improve the spiritual character of humankind, with a special emphasis on education. The order founded new colleges and universities and assumed control of many existing schools in France and elsewhere throughout the seventeenth and into the eighteenth century.

Jesuit schools, renowned for their quality, drew students of various backgrounds and aspirations, including prospective clergy, students preparing for law or medicine, and future civil servants, military officers, and merchants. The first six years of study focused on grammar and rhetoric. Students learned Latin and Greek and studied selections from classical authors, especially the ancient Roman orator Cicero, whose works were read as models of style and eloquence but also contained surveys of philosophical positions. Many of Descartes' fellow students left after the first six years, some entering society and some transferring to university, where after completing the arts curriculum they could continue directly into the higher faculties of

law, medicine, or theology. Those who remained at La Flèche, including Descartes, completed the mathematical and philosophical portion of the arts curriculum in their final three years. Descartes was apparently satisfied with his choice of school, for later in life he advised an inquiring father that none offered better philosophical instruction, even for those wanting to transcend traditional philosophy (2:378).

The early modern arts curriculum was not confined to the medieval "seven liberal arts." Those seven arts consisted of the "trivium" (grammar, rhetoric, and logic), which except for logic were covered in the first six years ("grammar school"); and the "quadrivium" (geometry, arithmetic, astronomy, and music), taught at La Flèche in the final three years. The primary curriculum for the arts degree, earned in the final three years of instruction, consisted in the branches of philosophy: logic, natural philosophy (also called physics), metaphysics, and morals.

The official Jesuit curriculum required that philosophical instruction follow Aristotle. The study of logic, physics, metaphysics, and morals drew upon Jesuit commentaries on Aristotle's texts, or on independent treatises (including simplified textbooks) that covered the Aristotelian subject areas. These commentaries and treatises sometimes departed significantly from Aristotle and the major medieval Christian interpreters, such as Thomas Aquinas and John Duns Scotus, although most of them contained core areas of agreement. Descartes knew such commentators both from school and from later reading; he explicitly mentioned (3:185) Francisco Toledo, Antonio Rubio, and the Coimbran commentators (who included Peter Fonseca). He also knew the work of Francisco Suarez (7:235) and admired the philosophy textbook of Eustace of St. Paul (3:232), a member of the Cistercian Order and so not a Jesuit. He studied Aristotelian philosophy intensively during his final three years of college, and up to 1620 (3:185).

All the same, Descartes' studies in philosophy were not limited to the Aristotelian variety. The early study of Cicero introduced him to ancient atomists, Plato and Aristotle, skeptics, and Stoics. The Aristotelian commentaries of Toledo, Rubio, the Coimbrans, and others discussed a variety of positions, including atomistic physics

and Platonic theories of knowledge, as well as the various Neoplatonic, Islamic, and Latin commentators on Aristotle. Although rejecting Platonic theories of knowledge, they described in some detail the view that knowledge arises from the purely intellectual apprehension of Forms distinct from the sensory world. Descartes' mature theory of knowledge was closer to Plato than to Aristotle. But while he was in school the conflicts among philosophical positions made them all appear merely probable; since none achieved the "certainty" and "self-evidence" of mathematics (6:7), he treated them all as if false (6:8).

Jesuit school mathematics comprised the abstract branches (geometry and arithmetic) and various applied branches, including not only astronomy and music (from the quadrivium), but also optics and perspective, mechanics, and civil or military architecture. In Descartes' time, the ancient sciences of astronomy and optics were undergoing radical revision. The sixteenth-century astronomer Nicholas Copernicus opposed the previous geocentric astronomy by hypothesizing that the Earth moves around the Sun. A moving Earth would violate Aristotle's physical principle that all earthly matter naturally strives to reach the center of the universe, making the Earth a unique central globe around which all other heavenly bodies revolve. Galileo Galilei, using the newly invented telescope, discovered moons around Jupiter in 1610, challenging Earth's uniqueness. Descartes took part in a celebration of this discovery at La Flèche in 1611. Johannes Kepler published works in mathematical optics in 1604 and 1611 that contradicted ancient theory by showing that the eye forms an image on the retina; Descartes was familiar with these results by the 1620s.

After La Flèche, Descartes studied law at the University of Poitiers, graduating in 1616. His father wanted him to pursue law, so that the family could gain a title of nobility (which they finally received in 1668), but Descartes was reluctant, and after turning twenty-one he enlisted in the army.

Gentleman soldier and mathematical scientist

In 1618, Descartes joined the forces of Maurice of Nassau, Prince of Orange, general of the army of the United Provinces (the Dutch

Netherlands), who had been supported intermittently by the French in struggles against the Spanish Netherlands. When Descartes joined the army at Breda, the United Provinces were in the ninth year of a twelve-year truce with Spain. Breda was located just north of the border with the Spanish-held provinces of the Netherlands (present-day Belgium) and was the residence of Maurice as well as his mathematicians and engineers. In July, Maurice led part of the army north to Utrecht and its environs to intercede for one Calvinist faction against another. As part of the defensive force arrayed against the Spanish, Descartes stayed in Breda and did not see military action.

While garrisoned outside Breda, Descartes met the Dutch natural philosopher Isaac Beeckman, an event that changed his life. The two first conversed on 10 November 1618 in front of a placard stating a mathematical problem. Descartes was already interested in applied problems in mathematics and may well have been studying military architecture. Both men were happy to find someone else who spoke Latin and knew mathematics. Beeckman was soon challenging Descartes with problems in mathematics, musicology, kinematics, and hydrostatics. These problems encouraged Descartes to think of material things as composed of small round spheres, or atoms, of matter. Some short writings remain (*10:67–74*) in which Descartes took this "atomistic" approach (later rejected in favor of infinitely divisible corpuscles). In December 1618 he completed his first book, the *Compendium on Music*, written in Latin and dedicated to Beeckman (published posthumously in 1650).

A new method

Early in 1619, Descartes solved the long-standing mathematical problem of trisecting an angle, using a proportional compass of his own devising, and he discovered algebraic solutions to several classes of cubic equations. This work gave him new insights into the relation between geometrical constructions and algebraic equations. His proportional compass was constructed of rigid straight edges that hinged and slid over one another to create fixed proportions (in a continuous manner, as the device opened and closed). Descartes saw that his compass could represent algebraic equations, including cubic

equations (involving a cube root in relation to other terms, such as $x^3 = ax^2 + b$). By treating the lengths of the arms and cross-pieces as values of the constants and unknowns in an equation, he could treat the curves traced by their interaction as values of equations expressing those constants and unknowns. These techniques for treating algebraic equations as relations among straight lines became the basis for analytic geometry.

Descartes excitedly proclaimed to Beeckman on 26 March 1619 that he now envisioned a "completely new science" for solving "all possible equations" (10:156–7). He contrasted his project with the *Ars brevis* ("Compendium on Method") of Ramon Lull, a thirteenth-century Majorcan knight turned monk. Lull claimed that his method, which manipulated words or concepts organized under headings, could solve problems of any kind. Descartes considered it a sham (6:17, 10:164–5). His own new method would be limited to relations of quantity. By combining lines representing continuous or discrete quantities, it would solve "all possible equations involving any sort of quantity" (10:156–7).

There is no evidence that Descartes had originally intended to find a new method of any sort. He and Beeckman were working on very specific problems. "Mathematical sciences" such as optics and astronomy had existed from ancient times, as had many of the problems in pure mathematics that Descartes solved. His discoveries typically extended previous mathematical methods involving proportions, making them more general. But this initial breakthrough foreshadowed a lifetime of fascination with method (shared by his contemporaries), eventually extending beyond mathematics to philosophy and metaphysics.

Descartes' early work in mathematics did not rely on the syllogistic logic he learned in school. Mathematics typically was not formulated using syllogistic logic. Geometrical works stated axioms, definitions, and postulates, from which theorems were proved. Proofs took the form of instructions for constructing figures using compass and straight edge. The rules of inference included "common notions" such as "If equals be added to equals, the wholes are equal" but did not involve the statement of specifically logical axioms. At this time, there was no thought that logic formed the core of mathematics (that was a

nineteenth-century idea). Algebra and arithmetic proceeded by using equations constructed with arithmetic operators. Equations were not part of the structure of syllogistic logic. (Syllogisms and mathematical demonstration are discussed in the Appendix.) Descartes considered the syllogism too cumbersome for original reasoning, though useful for presenting known results (e.g., 6:17). Sometimes syllogisms were used in presenting mathematical results, although Descartes did so only rarely (10:70), and not in his famous *Geometry*.

A mission in life

Despite his achievements in mathematics, Descartes remained uncertain where "fate" would lead him (10:162). He wrote to Beeckman in April 1619 that he planned to join the army in Germany (10:162), where developments were leading toward the Thirty Years' War. Calvinist Protestants in Bohemia (now in the Czech Republic) had challenged the authority of their Catholic prince, Ferdinand, who had become Holy Roman Emperor in March. On arriving in Germany, Descartes joined the Catholic army of Maximilian I (Duke of Bavaria, ally of France, and supporter of the new emperor) and was present in Frankfurt-on-Main for Ferdinand's coronation in September. In the meantime, the Protestant Frederick V had been crowned king of Bohemia by the Calvinist nobles, and war was brewing.

Descartes was returning to the army in Bavaria after the coronation when winter caught him in Neuburg, a peaceful Catholic principality on the Danube north of Munich. While there, he settled on a new course in life. In the *Discourse on the Method* he recalls his interrupted travel and reports that "finding no conversation to divert me, and otherwise, fortunately, having no cares or passions that troubled me, I stayed all day shut up alone in a stove-heated room where I had complete leisure to converse with myself about my thoughts" (6:11*). His reflections convinced him that he should extend the clarity of his new science of proportion to the other sciences (6:20–1). He would now seek clear and distinct connections among ideas in other fields to match the perspicuity of algebra and geometry (6:19–20). Because the principles of other sciences "must all be

derived from philosophy" (including natural philosophy), he resolved first "to try and establish some certain principles" in that field (6:21–2).

His decision to reform the sciences was partly inspired by three dreams during the night of 10 November 1619. We know their content primarily through Adrienne Baillet's 1691 biography of Descartes (but see 10:216). The dreams were complex, involving whirling wind, a melon, acquaintances he passed without greeting, thunder, sparks, pain in the side, disappearing books, and the title of a poem by Ausonius, "What road in life shall I follow?" Descartes interpreted them as commanding him to reform all the sciences, that is, all organized knowledge. As we've seen, he decided to begin with philosophy. By his own account, it was nine years before he discovered a new foundation for philosophy (6:30).

His early notebooks offer some hints about his philosophical ideas near the time of the dreams. He favored a sense-based epistemology. ("Epistemology" means theory of knowledge, which in Descartes' day encompassed descriptions of the cognitive faculties of the mind, such as the senses or intellect.) Contrary to his later views, he wrote that "man has knowledge of natural things only through their resemblance to the things which come under the senses" (10:218). Indeed, he thought it best to conceive even "spiritual things" by making use of "certain bodies which are perceived through the senses, such as wind and light" (10:217). As he explained, "wind signifies spirit," and "light signifies knowledge" (10:218). The comparison of spirit with wind or fine matter was similar to the ancient philosophies of Democritus, Epicurus, and the Stoics.

Descartes reports that in the stove-heated room he worked out the provisional moral code set down in Part Three of the *Discourse*. A source for part of the code has recently been discovered. A copy of Pierre Charron's *Traité de la sagesse* ("Treatise on Wisdom"), found in Neuburg, was inscribed to Descartes by a Jesuit father during the winter of 1619. Charron was a philosophical skeptic, who said he knew nothing. He recommended that in one's state of ignorance, one should simply obey the laws and customs of the country in which one lived. Descartes' first moral precept is a version of this advice, "to obey the laws and customs of my country" (6:22–3).

Although familiar with the revival of philosophical skepticism, Descartes was not inclined toward becoming a skeptic. He treated many of his opinions as doubtful, as skeptics also do. But his aim was to eradicate incorrect opinions by retaining only those that were certain. In uprooting his errors, he says, "I was not imitating the skeptics, who doubt only for the sake of doubting, and pretend to be always undecided; on the contrary, my whole aim was towards certainty" (6:29*). True skeptics don't simply have doubts about whether they know some particular item of knowledge. They seek to use various arguments to place themselves in a state of sustained doubt, in which they suspend judgment about any theoretical knowledge going beyond mere appearances. Descartes was not troubled or challenged by such skepticism. He used the skeptical technique of suspending judgment in order to bracket, for further investigation, areas of potential knowledge now lacking the clarity and evidence found in mathematics.

The method made general

The *Discourse* reports that, upon leaving his warm room, for "the next nine years" (1619–28) he did nothing but "roam here and there in the world, trying to be a spectator more than an actor in all the comedies that play there" (6:28*). In fact, he did not merely roam. During 1620, he continued to work on scientific and mathematical problems. He may have visited Ulm (west of Neuburg on the Danube, in present-day Wurttemberg) and consulted with the mathematician Johannes Faulhaber, who taught at the military college. He may also have been present at the Battle of White Mountain in November, when Frederick was defeated and forced into exile at The Hague, where Descartes later (in 1642) befriended his daughter, the Princess Elizabeth (only two years old in 1620). After visiting France in 1622 he spent two years in Italy, 1623–25. Upon his return (or just prior to leaving in 1622), he fought a duel (disarming but sparing his foe) and perhaps composed his lost treatise on fencing near that time. He continued to study philosophy, for he later recalled examining works by Tomaso Campanella around 1623 (2:659) and not being much

impressed. In any case, by 1630 he knew of the Italian anti-Aristotelian innovators of the time, including, besides Campanella, Sebastian Basso, Giordano Bruno, Bernardino Telesio, and Lucilio Vanini (1:158).

During these nine years, he worked intermittently on a book on "universal mathematics," which was to present his new method. The uncompleted manuscript, published in Latin in 1701 as the *Rules for the Direction of the Mind*, contained twenty-one out of a projected thirty-six Rules. In it, he did indeed seek to extend a method like that in mathematics to "any subject whatsoever" (10:374*). He now claimed that all mathematical sciences could be recast as a single discipline with "order or measure" as its subject matter (10:378), to be investigated using his new science of proportion. He further claimed that all the sciences in general depend on certain "pure and simple natures," which any investigator should seek first (10:381). This search for simple natures or simple ideas lay at the heart of his generalized method, extended beyond mathematics.

The generalized method of the *Rules* was later summarized in the *Discourse*, now distilled into only four rules:

> The first was never to accept anything as true if I did not have evident knowledge of its truth: that is, carefully to avoid precipitate conclusions and preconceptions, and to include nothing more in my judgments than what presented itself to my mind so clearly and so distinctly that I had no occasion to doubt it.
>
> The second, to divide each of the difficulties I examined into as many parts as possible and as may be required in order to resolve them better.
>
> The third, to direct my thoughts in an orderly manner, by beginning with the simplest and most easily known objects in order to ascend little by little, step by step, to knowledge of the most complex, and by supposing some order even among objects that have no natural order of precedence.
>
> And the last, throughout to make enumerations so complete, and reviews so comprehensive, that I could be sure of leaving nothing out. [6:18–19]

The first rule states a general standard of clarity and certainty. The second and fourth read as a summary of procedures that might be followed in solving a problem in algebra (e.g., dividing the problem into various simpler equations and checking over one's work); but they also portray a more general strategy of fully analyzing problems into their elements, so that nothing relevant is overlooked. The third states a more general principle of method, to start with simple and easily known objects and to think of the complex objects as knowable through the simple ones.

Both the *Rules* and the *Discourse* assert that knowledge in all fields can be resolved down to certain "simple natures" (10:381) or "simple things" (6:19) known with mathematical clarity and self-evidence. What are these simple natures? Rule Six says that the qualities of such natures include being "independent, a cause, simple, universal, single, equal, similar, straight, and other qualities of that sort" (10:381), but it does not offer examples of the natures themselves. Rule Eight outlines the steps for solving a problem in optics and alludes to the notion of a "natural power" without revealing what such a power is (10:395). Rule Twelve finally provides examples of three sorts of simple nature: things known by the mind about the mind, such as the notions of knowledge, doubt, ignorance, and volition or willing; things known as present in bodies, such as shape, extension, and motion; and things common to minds and bodies, such as existence, unity, and duration (10:419). This at least suggests a basic division of the simple natures into mental and bodily or corporeal (we might now say "physical"). But in that work Descartes does not claim that bodies have *only* the properties of spatial extension, such as shape and motion, as he would claim later.

Descartes' hope for extending the clarity and certainty of mathematics to other topics depended on finding simple constituents everywhere. In elementary mathematics, we follow the method of the *Rules* when, in adding large numbers, we resolve the computation into smaller ones whose truth we can grasp intuitively, such as $2 + 3 = 5$. The generalization of this method requires that other fields be reducible to correspondingly simple ideas and entities. If complex things are in fact constituted through combinations of basic entities, we might comprehend those things by isolating in our

thought the simple ideas of such entities and then combining them so as to reflect the composition of things in the world. A nice method, if we can find the simple ideas, and if they and their combinations actually fit the way the world is.

When Descartes returned to France in 1625, he was freed of his father's demand that he enter civil administration as an attorney. He subsequently remained in Paris until 1628, joining a group of mathematicians and intellectuals that included Marin Mersenne, another advocate of mathematical descriptions of nature, and Guillaume Gibieuf, a theologian at the Sorbonne. During this time, he discovered the sine law of refraction and performed experiments in optics. Rumor of his method spread among French intellectuals, and he endeavored to finish the *Rules*. But he abandoned the work in 1627–28, near the end of the section on algebraic solutions to "perfectly understood" problems and prior to writing any of the projected section on problems "not perfectly understood" (10:429). Perhaps he gave up when the limitations of his scheme to represent all mathematical problems through relations among line segments became apparent. In any event, the thrust of his investigations now turned toward metaphysics and a new science of nature as a whole.

Metaphysical turn

In 1628 and 1629, Descartes again reformulated his intellectual agenda. Late in 1627, he attended a public lecture by a chemist named Chandoux, which had been arranged by the Papal Nuncio in Paris. The lecturer criticized Aristotle's natural philosophy and proffered a chemically based natural philosophy. Those in attendance all applauded, except Descartes. Cardinal Bérulle – the founder of the Parisian Oratory and a disciple of Augustine of Hippo's Neoplatonism – wanted to know why Descartes disapproved. In answering, Descartes praised the speaker's rejection of Aristotle's philosophy but chastised him for offering merely probable opinions in its place. He proclaimed that he himself possessed a universal method for separating the true from the false with certainty. Bérulle called upon him to give the fruits of his method to the world (1:213; see *Meditations*, 7:3).

As it happens, Descartes devoted the rest of his life to intellectual pursuits. He eventually published four major books – covering geometry, optics, the physical world, the human body and human emotions, and metaphysics – and others were left unpublished when he died in 1650. In the course of his development, he retained his method of searching for simple notions, but his account of the cognitive basis for his method changed.

Prior to his return to the Dutch Netherlands late in 1628, his work had focused on mathematics (pure and applied) and method. Now he undertook for the first time a sustained investigation of metaphysical topics. During his first nine months in the Netherlands he worked on nothing else. In April 1630, he wrote to Mersenne about the results of this work. He said he had discovered "how to demonstrate metaphysical truths in a manner which is more evident than the demonstrations of geometry" (1:144*). For someone who previously regarded mathematics as providing the ultimate standard of certainty, this statement marks a significant change. The letter also reports that metaphysical investigations concerning God and the self (the soul or mind) had led him to discover "the foundations of Physics" (1:144). Although it is unclear whether Descartes was at this time closely familiar with the Augustinian philosophical theories embraced by Bérulle, in saying that he came to knowledge of first principles by turning first to God and the soul, he echoed Augustine's procedure in the *Confessions* (ch. 7). We shall soon see evidence that by 1629 he had rejected the sense-based epistemology of 1620 and adopted a position closer to the Platonic theory that primary truths are known through purely intellectual (non-sensory) contemplation.

The same letter announces the radical metaphysical thesis (later published in the Objections and Replies to the *Meditations*) that "the mathematical truths, which you call eternal, have been established by God and are entirely dependent on him, just as are all his other creations" (1:144–5). By this he meant that the mathematical truths are free creations of God, dependent on God's will, and that God could have willed them otherwise. In other words, God might have made it that the three angles of a triangle do not equal two right angles, or that $2 + 3 \neq 5$ (further discussion in Chapter 9). This position differed both from the scholastic Aristotelian view that the

eternal truths are grounded in the essence of God, either in his very being or in his intellect, and from the properly Platonic view that the eternal truths are independent of God and are grounded in eternal Forms that determine the rational structure of thought and all existent things – which copy (or dimly reflect) those Forms.

During these nine months, Descartes drafted an early version of his metaphysics (see 1:350) containing the "first meditations" that the *Discourse* (6:30–40) dates to this time, and to which it ascribes the basic ideas found later in the *Meditations*.

A unified physics

Descartes' metaphysical musings were interrupted in summer 1629 by a scientific problem. In April, Christopher Scheiner had observed an impressive set of false suns, or parhelia, near Rome. A report circulated among natural philosophers. When Descartes learned of it, he immediately set to work to explain this optical phenomenon. Parhelia are now known to be caused when ice crystals in the upper atmosphere reflect and refract the sun's light. Descartes advanced the theory that the highest clouds are made of ice crystals and snow, which circular winds melt and refreeze so as to form a solid, transparent ring of ice that acts as a lens to produce the parhelia (6:355).

Although this solution is fanciful (a solid lens is not formed in the sky), the attempt to explain this complex natural phenomenon drew Descartes into general physics more fully than before. He soon wrote to Mersenne that completion of his work on parhelia would be delayed about a year, since "instead of explaining a single Phenomenon, I am determined to explain all the Phenomena of nature, that is, the whole of Physics" (1:70*). One year became three. Since at this time "physics" meant the study of all of nature, including living things, Descartes had indeed expanded his project greatly, beyond optics and atmospherics to include all chemical, mineralogical, geological, biological, and even psychological phenomena.

The project developed into a major work, which Descartes modestly entitled *The World*. It was to have three parts: a treatise on light (which would contain a general physics), a treatise on man (covering human physiology), and a treatise on the soul or mind. Only

the first two parts are extant (the third was either never written or has been destroyed). These two parts contain a new comprehensive vision of material nature.

In Descartes' youth, the accepted opinion remained that the Earth holds a unique place at the center of the universe, with the Sun and planets traveling around it. Natural processes, such as growth and decay, or even the freezing and thawing of water, were considered to take place only on or near the Earth. Some theories posited a crystalline sphere to carry the Moon around the Earth, and to separate the sublunary region of change from the immutable heavens. On this view (explained more fully in Chapter 9), terrestrial and celestial physics are fundamentally different. In overturning this picture, Descartes went far beyond the Copernican hypothesis that our Sun lies at the center of the universe with the Earth moving about it. He contended that the Earth is one among many planets, revolving around many different suns distributed throughout the cosmos. He further proposed that the whole universe is made of one kind of matter, which follows one set of laws. He invented the concept of a single universe, filled with matter having a few describable properties and governed by a few laws of motion.

While others, including ancient atomists and Stoics, had sketched part of this new picture, Descartes' vision of a unified physics governed by a few laws of motion was far richer and more detailed. Its combination of breadth and unity was unprecedented in his earlier work with Beeckman, or in the works of Copernicus, Galileo, or Kepler. This unified vision set the framework for Newton's subsequent unification of mechanics and astronomy. To explain Descartes' expanded vision we can look to the metaphysical researches of 1629, which yielded "foundations of Physics." These foundations supported his picture of a universe governed throughout by a few natural laws and underwrote his claim to know the nature of all the material substance in the universe.

In a chapter of *The World* entitled "The Laws of Nature of this new world," Descartes related the laws of motion to the activity of God. He composed the entire work as a fable, in which God creates a new universe "like ours" (and clearly intended actually to be ours) beyond the boundaries of the Aristotelian universe of his school-

books (11:31–2). In this "new" world, God creates a single uniform matter that has only the properties of size, shape, and motion (11:33–4), and he imparts a certain fixed quantity of motion to this matter. Because God is immutable, he preserves the same quantity of motion in the world from creation onward. Descartes explains how an immutable God can govern the motions of a changing world:

> If God always acts in the same way and consequently always produces the same effect, many differences in this effect occur, as if by accident. And it is easy to accept that God, who is, as everyone must know, immutable, always acts in the same way. Without going any further into these metaphysical considerations, however, I will set out here two or three of the principal rules by which we must believe God to cause the nature of this world to act, and these will be enough, I believe, to acquaint you with all the others. [11:37–8]

He then sets out three rules or "laws of nature," which depend "solely on God's conserving each thing by a continuous action" (11:44*). These laws, which include a near counterpart to Newton's law of inertia, are examined more fully below (Chapter 9).

Besides these three laws, Descartes recognizes no other laws in his world "but those that most certainly follow from the eternal truths on which mathematicians have generally supported their most certain and most evident demonstrations: the truths, I say, according to which God Himself has taught us He disposed all things in number, weight, and measure" (11:47). Allusion to the Biblical phrase "but thou hast ordered all things by measure and number and weight" (Wisdom of Solomon, 11.20) was commonplace, but Descartes now explains that God "taught us" these truths by implanting them in the mind or soul.

> The knowledge of these truths is so natural to our souls that we cannot but judge them infallible when we conceive them distinctly, nor doubt that if God had created many worlds, they would be as true in each of them as in this one. Thus those who know how to examine the consequences of these truths and of

> our rules sufficiently will be able to recognize effects by their causes, and, to express myself in scholastic terms, will be able to have *a priori* demonstrations of everything that can be produced in this new world. [11:47]

The relevant scholastic meaning of the term "*a priori*" in this context is "reasoning from cause to effect." Such reasoning need not rely on experience of the causes and effects, for in this context what is "natural" to our souls is innate. We have seen that Descartes considered the eternal truths of mathematics to be free creations of God. Perhaps a further metaphysical insight of 1629 was that God, in freely decreeing those truths, also made them true in the world he created and implanted knowledge of them in the human mind, thereby explaining our capacity to discern the true foundations of physics by discerning the mathematical essence of matter (as Descartes believed he was the first to do).

After three years of work, Descartes had produced (at least) the first two parts of his *World*, the general physics and the treatise on man. The second of these ambitiously offered (or promised) entirely mechanistic explanations of human physiology and parts of human psychology. In connection with this work, Descartes visited butchers' shops to watch animals being slaughtered and took home animal parts for dissection (1:263, 523; 2:525). The resultant theories are discussed in Chapters 8 and 9.

Late in 1633, Descartes learned that Galileo had been condemned by the Roman Catholic Inquisition for defending the Copernican hypothesis that the Earth moves around the Sun. Since he affirmed that hypothesis in his *World*, he suppressed the work. He was loyal to the Church but also concerned at being made "a criminal" for affirming the theory; he considered burning all his papers (1:270–1). The extant parts of the work were published posthumously in 1664 (in French), as *The World, or Treatise on Light*, and the *Treatise on Man*.

The *Discourse* and the method

After the Galileo affair, Descartes did not give up his project of reforming the sciences. In 1637, he tested the response to his new ideas

by offering a sampler, the *Discourse on the Method* together with essays on *Dioptrics*, *Meteorology*, and *Geometry*. These works were also written in French, making them accessible to literate people outside the universities, including artisans, people at court, and "even" women (1:560). (Descartes held that all human beings, irrespective of gender, possess the same intellectual power [see 6:1–2].) At this time, Latin was the universal language of learning in European universities, and the language of nearly all philosophical works, but some philosophical and scientific authors, including Francis Bacon and Galileo as well as Descartes, had begun to publish in their native languages (English, Italian, and French).

Descartes used the *Discourse* to introduce his program of scientific work to the public, to sketch some metaphysical results, and to ask for money to support the empirical observations needed to decide among his own rival scientific hypotheses (6:65). (Although publication was anonymous, the identity of the author was soon known.) The metaphysical discussions, found in Part Four, include the skeptical dream argument, the famous *cogito* argument ("I think, therefore I am"), an argument that mind and body are distinct, a proof for the existence of God, and an argument that the clear and distinct perceptions of reason are true (6:31–40). These arguments will be considered primarily through their fuller (and sometimes significantly different) counterparts in the *Meditations*.

After the *cogito* argument appeared in the *Discourse*, Mersenne and others (2:435, 3:247) asked about its similarity to a passage in Augustine's *City of God* (Bk 11, ch. 26). As we will see in reading the *Meditations*, Descartes' philosophy has affinities with Augustine's. Nonetheless, Descartes replied to his correspondents that he was (in 1637–38) unfamiliar with Augustine's works (*1:376*, 2:535). He promised to consult them, which he had done by 1640 (3:247). Assuming that in 1637 he did not know Augustine's works directly, he might have become familiar with their content through the Augustinians Bérulle and Gibieuf. (Although Bérulle died in 1629, Descartes maintained contact with Gibieuf [1:16–17, 153; 3:184, 237].) Another argument in the *Discourse* – starting from his ability to conceive of something more perfect than himself and concluding that only an actually perfect being, God, could have given him this ability (6:33–5)

– also echoes Augustine. Descartes might have gleaned this argument from his Augustinian contacts or read in Cicero a similar argument due to the ancient Stoic Chrysippus.

The essays attached to the *Discourse* were supposed to exhibit the results of his method, and in fact they offered several bits of his physics (although not the whole of his *World*). The *Dioptrics* sketched his physics of light, explicated the laws of reflection and refraction, described the gross anatomy and physiology of the senses and eye (including the formation of the retinal image), gave explanations for the perception of light, color, size, shape, and distance, and described lenses for correcting vision and for telescopes, as well as a machine for cutting them. The *Geometry* presented his solution to an ancient problem in mathematics, the "Pappus locus problem" – to describe a set of points (a locus) in relation to four (or more) given lines, such that from the points four lines can be drawn to intersect the four given lines at equal angles, with the newly drawn lines standing in a certain given ratio among themselves. In working out his solution, Descartes developed the basis for algebraic or "analytic" geometry, including what later became the Cartesian coordinate system. (He soon abandoned "abstract geometry" in favor of geometry as used in natural philosophy [2:268].) The *Meteorology* began from certain "suppositions" or hypotheses that stated his basic assumptions in natural philosophy – that "the water, earth, air, and all other such bodies that surround us are composed of many small parts of various shapes and sizes, which are never so properly disposed nor so exactly joined together that there do not remain many intervals around them; and that these intervals are not empty but are filled with that extremely subtle matter through the mediation of which, I have said above, the action of light is communicated" (6:233*). Using these assumptions, the work offered explanations for atmospheric, mineralogical, and visual phenomena, including the bands of the rainbow. (Descartes later wrote [1:559] that this explanation of the rainbow provided the only full example of his method in the *Discourse* and essays.) Taken together, the *Dioptrics* and *Meteorology* offered a mechanistic, corpuscular explanation of light, color and other "secondary qualities" (as they were later called) in terms of the motion of particles and the effect of those motions on perceivers. Color as experienced

became a perceiver-dependent sensation, by contrast with Aristotelian "real qualities" transmitted from the object to the perceiver's mind.

Although the suppositions in the *Meteorology* laid out the fundamental entities in his physics, in the *Discourse* and essays Descartes did not openly reject other explanatory entities. In particular, he did not explicitly deny the existence of the active principles or substantial forms, and real qualities, of Aristotelian physics. He did, however, signal that such things had no place in *his* physics (6:239). Furthermore, while claiming that he could "deduce" his physical assumptions from his metaphysics, he did not provide the deduction (6:76). For now, the corpuscularian principles of his physics would simply be "proved" through effects, that is, through their ability to explain a wide variety of phenomena, including new empirical observations (see also 1:423–4, 563; 2:199).

Descartes' metaphysics as summarized in Part Four did not mention the claim, crucial for his physics, that the essence of matter is extension. The promised metaphysical foundations for his physics surely must include that claim, as well as the role of God as conserving the quantity of motion in the world.

In 1638, Descartes explained to a Jesuit at La Flèche, Antoine Vatier, that he had omitted the metaphysical proof for his physics because it required the use of skeptical arguments that he "did not dare" put before a general audience – stronger arguments than the dream argument that he had published. These stronger arguments presumably include the hypothesis that God might be a deceiver, which appears in the *Meditations* (7:21). He explained to Vatier that the stronger skeptical arguments were needed to help the reader to "withdraw the mind from the senses" (1:560). The previous year, he told Mersenne that in the *Discourse* he had not fully developed the needed skepticism about the senses because the work was in the vernacular; but he recalled that "eight years ago I wrote in Latin the beginnings of a treatise on metaphysics in which this argument is conducted at some length" (1:350). It is clear, then, that the metaphysical treatise of 1629 used skepticism to divert the mind from sensory matters. Earlier, we saw that the initial metaphysical investigations of 1629 permitted him to discover "the foundations of Physics" (1:144).

We will need to look to the *Meditations* themselves, the successor to the treatise of 1629, to learn more about how one can discover the foundations of physics by withdrawing from the senses.

The *Discourse* invited readers to send their objections to the publisher (6:75), and Descartes was soon writing letters to defend his physical suppositions, his omission of substantial forms and real qualities, and his metaphysics, including mind–body dualism (e.g., 1:353, 2:38–45, 197–201). The Jesuit mathematician Pierre Bourdin attacked the *Dioptrics* in public disputations in Paris during 1640, and Descartes responded with a letter sent via Mersenne (*3:105–19*). He became increasingly concerned about the Jesuit response to his work (3:126, 184, 752), for he wanted them to support, and even to teach, his new philosophy (1:454–6, 2:267–8, 4:122).

The *Meditations*

Soon after the *Discourse* was published, Descartes' correspondents (1:564) began to press him for the metaphysical foundations for physics, as well as the complete version of his physics that had been mentioned. Although at first he was unwilling to comply, in 1639 he promised to publish his metaphysics (2:622), which became the *Meditations on First Philosophy*, published in Paris late in 1641. The work consisted of the six Meditations together with Objections by philosophers and theologians and Descartes' Replies.

As a named field of study, "first philosophy" was invented by the ancient Greek philosopher Aristotle. It included study of the highest being, which Aristotle called "god." Because first philosophy extended beyond physics, Aristotle's followers called it "metaphysics," which literally means "that which is beyond physics." Aristotelian metaphysics studied being in general, that is, the basic properties of everything there is. Aristotle's medieval followers disagreed on whether metaphysics could provide the first principles specific to the other sciences, but they agreed that metaphysical principles are the last things learned, since they must be "abstracted" from experience and are the most abstract principles of all. Descartes, by contrast, held that metaphysics contains first principles specific to the other sciences, that these principles could be known *a priori* (without appeal

to experience), and that they should be discovered first, to guide further investigation. In a later work he compared all knowledge to a tree, with metaphysics as the roots, physics as the trunk, and medicine, mechanics, and morals as limbs (9B:14).

Although in publishing his metaphysics Descartes was fulfilling a promise to provide foundations for his physics, he did not advertise that fact in the published work, and he asked Mersenne to keep quiet about it. Furthermore, the first edition carried the subtitle "In Which the Existence of God, and the Immortality of the Soul Are Demonstrated," and the dedicatory Letter presented the work as focusing on these two topics, as areas in which philosophy could support religion (7:1–2). As the Synopsis observes, the work does not in fact offer a demonstration of immortality (7:12–13); the subtitle to the second edition (of 1642) accurately reflects this fact by describing the book as one "In Which the Existence of God, and the Distinction of the Human Soul From the Body, Are Demonstrated."

Despite what the Letter says (7:2), the main aim of the work was not to support religious truths in the face of "unbelievers." As we have seen, Descartes revealed its primary aim in writing to Mersenne that "the little Metaphysics I am sending you contains all the Principles of my Physics" (3:233*). And yet it remains the case that no part of the *Meditations* openly promulgates principles of physics. Descartes explained this fact in another letter to Mersenne:

> I will say to you, just between us, that these six Meditations contain all the foundations of my Physics. But, please, you must not say so; for those who favor Aristotle would perhaps have more difficulty in approving them; and I hope that those who will read them will unwittingly become accustomed to my principles, and will recognize the truth, before they notice that my principles destroy those of Aristotle. [3:297–8*]

He was worried about the approval of "those who favor Aristotle." Partly this meant the approval of Church authorities, who might otherwise block publication given the close connection at this time between Aristotelian philosophy and Christian theology (among both Catholics and Protestants). We have just seen that he hoped the

Jesuits, who favored Aristotle, would eventually be willing to teach his philosophy.

Such political strategizing does not tell the whole story. As we will see in Chapter 2, Descartes had good methodological reasons, connected with his "analytic" method and with the textual organization of the *Meditations* into six Meditations, for not directly confronting his largely Aristotelian audience by introducing his fundamental principles up front. Moreover, although his emphasis on God and the soul in the dedicatory Letter surely was intended to win favor from theologians, we have seen that Descartes earlier described contemplation of God and the soul as leading him toward the foundations of his physics. The connections among his various claims about God and the soul, skepticism toward the senses, and physics will become apparent in Chapter 2 as we examine the methodological structure of the *Meditations*.

Subsequent works

Descartes began but left unfinished a dialogue entitled *The Search for Truth* (perhaps written while he waited for the *Meditations* to appear). The dialogue included a scholastic philosopher (Epistemon, or "knowledgeable"), an untutored man of good sense (Polyander, or "everyman"), and a stand-in for Descartes (Eudoxus, or "famous," although etymologically suggesting "good opinion"). It reprises arguments from the *Meditations* (up to Meditation 2).

Although Descartes considered the metaphysical investigations portrayed in the *Meditations* and *Search* to be important, he did not think readers should devote constant attention to them. In 1643, he wrote to Princess Elizabeth of Bohemia (daughter of Frederick V) "just as I believe that it is very necessary to have properly understood, once in a lifetime, the principles of Metaphysics, because they are what gives us knowledge of God and our soul, I also believe that it would be very harmful to occupy one's intellect frequently in meditating upon them, because this would impede it from properly attending to the functions of the imagination and the senses" (3:695*). Those functions guide practical action and aid the investigation of nature.

In the very letter informing Mersenne that he was sending him a draft of the *Meditations*, Descartes told him he was planning a textbook covering his entire philosophy, including the long-awaited physics (3:233, 272). He hoped that his Latin *Principles of Philosophy* would replace the prevailing Aristotelian curriculum in colleges and universities, at least in metaphysics and physics. His plan initially called for publishing the textbook together with an Aristotelian one, Eustace of St Paul's *Summa philosophiae* ("Compendium of Philosophy"), with annotations revealing the comparative advantage of his views (3:232). But he soon abandoned that plan, believing that his principles so obviously destroyed any opposing ones that direct refutation was unnecessary (*3:470*).

When the *Principles* appeared in 1644 it had four parts. The first reviewed the metaphysics of the *Meditations*. The second explicitly revealed the fundamental principles of physics, including the equating of matter with extension, the denial of a vacuum, and his three laws of motion. The third described the formation of solar systems and the transmission of light. The fourth concerned the formation of the Earth and the explanation of various physical phenomena. He had intended to add fifth and sixth parts, covering biological phenomena, including plants, animals, and the human animal, but he ended up simply appending to the fourth part a discussion of the human senses and sensory nerves (8A:315–23).

During the 1640s Descartes engaged in polemic over the religious orthodoxy of his philosophy. The trouble began with disputations organized and published at the University of Utrecht in 1641, in which an early follower of Descartes, Henry le Roy (or Regius), defended mind–body dualism and the mechanistic view of matter and rejected Aristotelian substantial forms. The Calvinist theologian Gisbert Voet (or Voetius) replied that mind–body dualism makes a human being into an accidental collection of two different kinds of thing, rather than a genuinely unified being, and that denying that the human soul is the substantial form of the body might result in denying altogether that humans have a soul. In January 1642, Descartes advised Regius to reply that human beings are unified beings composed of body and soul (3:508) and to refrain from denying substantial forms outright; it would be enough to say that

they are not needed in mechanistic explanations (3:501–7). Regius' response to Voetius was confiscated by the municipal authorities of Utrecht upon publication. Descartes now entered the fray directly, defending Regius in the second edition of the *Meditations* (Letter to Dinet). The controversy widened, and in 1643 Descartes published a 200-page book in Latin, *Letter to Voetius* (8B:1–194). He narrowly avoided condemnation by the Calvinist authorities. When Regius broke ranks and published a brief attack on the *Principles* in 1647, Descartes responded with *Comments on a Certain Broadsheet* in 1648, reaffirming mind–body dualism and his proofs of God's existence.

In the meantime, Descartes' works were being vigorously discussed at the University of Leiden. In 1646, theology professor Jacob Trigland complained that other professors were allowing students to defend Descartes' philosophy, which he considered blasphemous and atheistic. Adrian Heereboord, a professor of logic who subsequently authored several books on Cartesian philosophy, defended Descartes in public disputations and orations. In May 1647, Descartes protested the charges against him in letters to the university curators (5:1–15, 35–9). Despite continued disputes and complaints, Leiden became a center for teaching, studying, and writing Cartesian philosophy and remained so for over fifty years.

At this juncture, Descartes had realized his ambitions in metaphysics and general physics, but not in medicine or morals. He had boasted earlier that he would discover a health regimen to extend his own life by a century (*1:507*), although as he grew older he moderated such claims (2:480, 4:329). In the mid-1640s, he returned to his physiological studies with the aim of covering everything from embryology to human psychology. In 1647–48, he worked on but left unfinished his *Description of the Human Body* (published posthumously in 1664, in French). The final work published in his lifetime, *The Passions of the Soul* (1649, in French), contained Descartes' theory of the emotions and his moral psychology. It responded to queries from Princess Elizabeth, who had also plied him with metaphysical questions concerning mind–body union and interaction.

In mid-April 1648, the young Frans Burman, son of a Protestant minister, visited Descartes in his house in Egmond (Dutch Netherlands) armed with questions about his published works. He

posed eighty questions about specific passages, forty-seven on the *Meditations* alone, the rest mainly on the *Principles* and *Discourse* (in Latin translation). He apparently took notes on Descartes' replies during the interview and four days later prepared a manuscript record of the discussion, aided by Johann Clauberg. Although this record was written by Burman, not Descartes, it affords valuable information on Descartes' own interpretation of key arguments in the *Meditations*.

In 1649, Descartes accepted the invitation of Queen Christina of Sweden to become a court philosopher in Stockholm. He died of pneumonia early the next year (11 February 1650). His followers published many of his letters (1657–67), which contained philosophical, mathematical, and scientific discussions, as well as pharmaceutical and medical advice for his friends.

Reception and influence

Descartes drew both followers and opponents in the second half of the seventeenth century. His philosophy was condemned by the theological faculties at Louvain and Paris, by the Jesuits, and by the Augustinians of the Parisian Oratory. His works were banned from teaching even at Leiden and Utrecht, but the ban was routinely ignored by the magistrates who pronounced it, and by the numerous Cartesian professors they appointed. Despite such controversy, his name was soon added to lists of great philosophers, from which it has never disappeared. His *Discourse* and *Meditations* remain among the most widely read of all philosophical texts.

Over the centuries, opinions have changed about what is valuable and controversial in Descartes' philosophy. Such change should be expected, for the assessment of past thinkers is often influenced by current knowledge and interests.

Throughout the seventeenth century Descartes' scientific concepts exerted the widest influence. His vision that the material world is composed of small corpuscles of homogeneous matter, and that all the properties of material things can be explained through the interaction of such corpuscles, captured the imagination of many followers. Textbooks of Cartesian physics were published, as were medical

works in Cartesian physiology. His physics was taught at universities in the Dutch Netherlands, England, Sweden, and Italy, and in public lectures in France. From 1699, Cartesians were admitted to the Royal Academy of Sciences in Paris, the primary home of French scientific thought. The young Isaac Newton was reading and criticizing Descartes' *Principles* in 1664 as he formed the philosophical outlook that framed his later work. Descartes' account of momentum and impact was studied in relation to those of Newton and G.W. Leibniz well into the eighteenth century. At Newton's own Cambridge the Cartesian *Treatise on Physics* of Jacques Rohault was taught into the 1740s; in France and Germany, Cartesian physics was debated for twenty years beyond that.

Descartes' rationalist project of discerning the foundations of physics and philosophy through reason alone was disputed by other seventeenth-century philosophers, who believed that all knowledge arises through sensory experience. Among his empiricist opponents, the French atomist Pierre Gassendi shared the mechanistic conception of matter, but he held that matter is constituted from indivisible atoms as opposed to the infinitely divisible extension of Descartes, and he affirmed the existence of a vacuum, which Descartes considered to be impossible. The Irish chemist Robert Boyle remained agnostic on atoms versus infinite divisibility (and on the vacuum), as did the philosopher John Locke (who, however, argued for the vacuum); they joined Descartes in affirming a corpuscular philosophy against the Aristotelians, while rejecting his rationalism. The English philosopher Thomas Hobbes adopted corpuscular mechanism but rejected Descartes' dualism in favor of the materialist theory that thoughts are nothing but matter in motion. Descartes' Aristotelian opponents were also empiricists of a sort, as they held that sensory experience is required for knowledge; but they also held that the intellect is able to extract the real essences of things through sensory experience, in this way differing from the other empiricists mentioned. In any case, partly as a result of Descartes' efforts and those of the new empiricists, scholastic Aristotelian philosophy was fading throughout the seventeenth century.

Writing in the second half of the seventeenth century, Benedict Spinoza and Leibniz shared Descartes' rationalist approach to meta-

physics but reached different metaphysical conclusions. Spinoza held that there is only one substance, of which mind and body are aspects. Leibniz held that there are many individual substances, all mind-like, so that even the constituents of matter are simple substances that perceive or represent the world from a material perspective without themselves being truly extended.

In the course of the eighteenth century, interest in the particulars of Descartes' scientific vision faded (even as the mechanistic approach to nature waxed), but discussion of his skeptical arguments and his emphasis on reason over sensory experience continued. The Scottish philosopher Thomas Reid blamed Descartes for abetting the skeptical philosophies of George Berkeley and David Hume. (Whether Berkeley and Hume really were skeptics remains a matter for debate.) Reid thought that Descartes' claim to know the contents of his own mind best of all, and the related claim that the immediate objects of knowledge are "ideas" in the mind, effectively cut the mind off from the world by placing it behind a "veil of perception." He and others, including the empiricist Hume, rejected Descartes' claims that our intellectual ideas directly reveal things as they are in themselves.

Near the end of the eighteenth century, Kant summed up the history of philosophy as a struggle between rationalism, which he ascribed to Plato and Leibniz, and the empiricism of Aristotle and Locke. He believed that both positions were partly wrong and partly right. In his view, rationalism fails because the intellect cannot in fact transcend the senses and grasp the essences of things in themselves (whether mind, matter, or God). The empiricists are right that all knowledge arises with sensory experience, but they fail to acknowledge that some of our knowledge – mathematical, natural scientific, and metaphysical – requires a non-empirical framework. Kant believed that principles extracted from this framework, such as the causal law, could be known to hold within sensory experience but could not be used to go beyond sensory experience (e.g., to infer the existence of a god as creator). His criticism effectively ended rationalist metaphysics.

In the nineteenth century, Descartes was treated as a great historical philosopher who influenced both science and metaphysics. His substance dualism was rejected in favor of various substance

monisms (positing only one type of substance), the most common of which was the dual-aspect theory that the mental and material are two aspects of one underlying substance. The English biologist Thomas Henry Huxley praised Descartes' role in the history of physiology, and particularly his view that animal bodies, including the human body, are complex machines.

In the middle of the twentieth century, three aspects of Descartes' work received the greatest attention: his skeptical arguments, his *cogito* argument, and his argument for a mind–body distinction. His new physics was largely ignored in English-language writings after mid-century, although it was known earlier and was emphasized in French and German scholarship. In the last quarter of the century, the history of philosophy underwent a renewal, so that historical texts were interpreted and evaluated on their own terms. This meant asking what past authors had considered important in their philosophy and evaluating their arguments in relation to their actual aims, rather than simply using their texts as foils for recent philosophical positions. Attention returned to Descartes' project of using metaphysics to found a new theory of nature. His doctrine of mind–body unity and his physiological and psychological theories shared equal billing with his mind–body dualism. It became widely recognized that Descartes was not a skeptic but had used skeptical arguments instrumentally, with the aim of achieving metaphysical knowledge.

Reading Descartes today

Descartes' philosophical teachings are so influential that they cannot be avoided, whether one agrees with them or not. The skeptical doubt, the *cogito*, and mind–body dualism continue to function as landmark positions in the geography of present-day thought. Although few now accept his substance dualism, he is often invoked in the philosophy of mind. Some admire and some disparage his realism about the mental. Others blame him for many modern ills, contending that his dualism caused thinkers to devalue the body and emotions.

In this guidebook, we want to get past stereotypes and reputation in order to look at Descartes anew. We have learned that he was an original scientist, mathematician, and metaphysician, who laid the

basis for analytic geometry, published the first unified celestial and terrestrial physics, and proposed new theories of mind, body, and their interaction. These new theories framed Descartes' work on the philosophy and psychology of sense perception and the role of the body in emotion. It is in the context of this larger picture that we will read Descartes' *Meditations*.

There are many reasons for reading Descartes today. Because his positions serve as landmarks, it is useful simply to find out what he said. Moreover, the depth of his argumentation is formidable, even if one disagrees with his premises and conclusions. The *Meditations* was constructed to bring readers to see the conclusions of the arguments for themselves. For this purpose, Descartes adapted a literary form common to the seventeenth century, the meditative mode of writing. His adaptation of form to content is worthy of appreciation in its own right.

In analyzing Descartes' text and arguments, the student will gain skill in analyzing and evaluating texts and arguments more generally. Such skill is one main product of philosophical study, but in order to interpret the text and evaluate the arguments, we will need to understand what Descartes said. To read with comprehension will require learning about the intellectual context within which Descartes wrote, including the Aristotelian philosophers who were his first opponents and initial audience.

In the end, our aims are to understand and evaluate Descartes' project in relation to his context, to appreciate his philosophical influence, and to see what we still find compelling in his work.

References and further reading

There are two recent intellectual biographies of Descartes, S. Gaukroger, *Descartes: An Intellectual Biography* (Oxford: Oxford University Press, 1995), and G. Rodis-Lewis, *Descartes: His Life and Thought* (Ithaca, NY: Cornell University Press, 1998). I have generally followed Rodis-Lewis's dates for events in Descartes' early life. On p. 44, she describes the inscribed copy of Charron's book in support of her thesis that the *Discourse* was strongly (i.e., accurately) autobiographical. The point about obeying the laws of one's country is in

Pierre Charron, *Of Wisdom*, bk 2, ch. 8 (rare early translations of this work exist, but no full translation in the past century). Descartes' dreams are examined in G. Sebba, *The Dream of Descartes* (Carbondale: Southern Illinois University Press, 1987). Baillet's full biography, *Vie de Monsieur Des-Cartes*, is available only in French (originally published in 1691; reprint, New York: Garland, 1987; an abridged edition was translated into English in 1693); the dreams are described in vol. 1, pp. 81–6. Various condemnations of Descartes' philosophy are translated in R. Ariew, J. Cottingham, and T. Sorell (eds.), *Descartes' Meditations: Background Source Materials* (Cambridge: Cambridge University Press, 1998).

The question of Descartes' knowledge of and relation to St Augustine's thought has been much discussed, on which see Gaukroger, p. 207; Rodis-Lewis, p. 69; and also S. Menn, *Descartes and Augustine* (Cambridge: Cambridge University Press, 1998). On Cicero's statement of Chrysippus' argument for the existence of a god, see *De natura deorum*, III.x.

W.R. Shea's extensive scientific biography of Descartes, *The Magic of Numbers and Motion* (Canton, Mass.: Science History Publications, 1991), reviews the limitations to the mathematical representational scheme of the *Rules* that may have led to its abandonment (pp. 140–2).

General books on Descartes' philosophy that take his scientific interests into account include A.B. Gibson, *Philosophy of Descartes* (London: Methuen, 1932), N.K. Smith, *New Studies in the Philosophy of Descartes* (London: Macmillan, 1953), and B. Williams, *Descartes, The Project of Pure Inquiry* (London: Penguin, 1978). The reception of Descartes' thought at Leiden and Utrecht, including the religious controversies, is examined by T. Verbeek, *Descartes and the Dutch: Early Reactions to Cartesian Philosophy, 1637–1650* (Carbondale: Southern Illinois University Press, 1992). On Newton's early reading of Descartes (and other sources), see J.E. McGuire and M. Tamny, *Certain Philosophical Questions: Newton's Trinity Notebook* (Cambridge: Cambridge University Press, 1983). Additional references on Descartes' science and its reception are provided in Chapter 9.

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Seventeenth-Century Philosophy (Cambridge: Cambridge University Press, 1998), and G.H.R. Parkinson (ed.), *The Renaissance and Seventeenth Century Rationalism* (London: Routledge, 1993). The *Cambridge History* contains numerous biobibliographies on major and minor seventeenth-century figures. S. Emmanuel (ed.), *Blackwell Guide to the Modern Philosophers: From Descartes to Nietzsche* (Malden: Basil Blackwell, 2001), provides introductory discussions for major seventeenth- and eighteenth-century philosophers, including Descartes, Hobbes, Spinoza, Malebranche, Reid, and Kant. Kant's summary history of philosophy occurs in the final chapter of his *Critique of Pure Reason*, translated by P. Guyer and A. Wood (Cambridge: Cambridge University Press, 1998). On the history of the term "metaphysics" (which was not invented by Andronicus of Rhodes, Aristotle's ancient editor, despite a widely repeated story to that effect), see T. Ando, *Metaphysics: A Critical Survey of its Meaning* (The Hague: Martinus Nijhoff, 1963).