Descartes and the Scientific Revolution

David Rosenthal
CUNY Graduate Center
Philosophy and Cognitive Science
https://www.davidrosenthal.org

Contemporary Civilization
November 7, 2018

- My focus will be on aspects of Descartes's thinking that result from, or intersect with, the 16th- and 17th-century scientific revolution that culminated with Galileo.
- I'll begin with some background about the Aristotelian approach to science that the Galilean revolution opposed and overthrew.
  Descartes himself strongly endorsed—and indeed contributed to—the Galilean picture.
- But he also sought to place it within a firm foundation—both in methodology and with a new overall picture of reality.
  Descartes opposed the Aristotelian take on these things—but unlike Galileo did so in a way his contemporaries would find easy to accept and that would have a lasting hold.

Lecture to the Columbia CC
Faculty, November 7, 2018

Overview

I. Aristotle vs. Galileo
II. Descartes's Methodology
III. Descartes's Theory of Reality

I. Aristotle vs. Galileo

- Aristotle distinguished two types of property we perceive objects to have: Proper sensibles, such as color, sound, and odor, are accessed by just one sense modality; they are proper to that modality.
- Common sensibles, like size, shape, and motion, are accessed by more than one modality—and so are common to several.
- This matches Locke's distinction between primary and secondary qualities—but with a different explanation. Also: The common sensibles are mathematically describable.

- Aristotle held that we understand nature (phusis = nature) in terms of the proper-sensible properties of things.
  Why else would we have senses that access those properties? (Descartes, we'll see, offers a variant on that type of thinking.)
- So Aristotle thinks mathematics irrelevant to our understanding of nature:
  Proper sensibles don't lend themselves to mathematical description—only common sensibles are mathematical in character.
- Indeed, Aristotle saw mathematics in what we today call an instrumentalist way:
  He rejected talk about numbers, talking instead only about counting or measuring—and he generally denigrated mathematics.

Descartes and the Scientific Revolution November 7, 2018 5

- This fits with Aristotle's view of scientific methodology. The perceptual soul is so constituted to take on (literally!) the perceptible properties of objects. And the intellectual soul—noûs—is so constituted (again literally) to take on the essences of things. (We'll also come back to that—§III.)
- So mathematics plays no role at all in how we come to understand the natural world. We understand nature by appeal only to nonmathematical essences, which our soul is able to take on from things in nature.
- This Aristotelian picture is meant to reflect common sense—how we ordinarily think about physical reality. But it thereby stifles science—in both theorizing and discovery.

Descartes and the Scientific Revolution November 7, 2018 6

- The Aristotelian view dominated European thought for most of the medieval period—from the disintegration of a unified Roman Empire until after the Renaissance.
- This is partly because Roman Catholic philosophers adapted Aristotle to buttress Church thinking—clear in Aquinas (but not Augustine, a neo-Platonic thinker).

  Diminishing science also fit well with the Church's agenda of controlling independent intellectual activity—which took center stage in the geocentric-heliocentric debate.
- The Galilean revolution is at bottom the recognition that mathematics must play a central role—indeed the central role—in understanding the natural world.

Descartes and the Scientific Revolution November 7, 2018 7

- Thus Galileo: "[T]he universe ... is written in mathematical language" (183). We understand nature by only measuring—and so by describing things geometrically.
- It is plain that Descartes endorsed this: He saw physical reality as consisting solely of extension, and he invented analytic geometry to capture geometry in algebraic terms. That was hugely important in providing a foundation for the Galilean science.
- It is hard to overestimate the importance of the Galilean maneuver: Little in science is possible without being formulated mathematically. That's now central to virtually all theorizing and experiment.

Descartes and the Scientific Revolution November 7, 2018 8

- One's picture of reality must fit with one's methodology in science and thought.
  If, for example, the universe is written in the mathematical language, there will be no nonmathematical essences for the mind to take on in way the Aristotle envisaged.
- One must then rely on common sensibles—which, unlike the proper sensibles, do lend themselves to mathematical treatment.
- And we must then cast physical reality not in terms of commonsense objects and their Aristotelian essences,
  but in terms of systems of objects, among which mathematical relations hold.
  Hence Descartes's taking physical reality to be one single extended substance (M6).

- Galileo was clear about the Aristotelian opposition to our giving mathematics a central place: His Dialogue Concerning the Two Chief World Systems is a debate between his view and Aristotle's.
- But Galileo was impatient with giving a general account of of reality—
  beyond just providing that physical reality is knowable in mathematical terms.
- Thus his brusque treatment of the proper sensibles—colors, sounds, odors, and so forth—since they resist mathematical treatment. Those properties, he urged, do not occur in physical reality, but only in sensing creatures—and he was uninterested in what that might imply about the mind.

- Galileo's Dialogue brought him before the Inquisition. Galileo had been friendly with Pope Urban, who insisted to Galileo that Urban's own arguments appear in the book.
- Galileo put them in the mouth of Simplicio, the defender of Aristotle, and the Pope may have been offended—even though the Church had previously approved the book.
- The details are historically controversial. But Descartes's wish to avoid the Inquisition led to his delaying, and then suppressing, publication of his early work, The Treatise on the World and Light.

  And though it's clear that he endorsed the Galilean mathematical methodology, he doesn't trumpet that—and is even evasive.

Descartes and the Scientific Revolution November 7, 2018 11

- Thus, he wrote in a 1638 letter that he'd never met or been in touch with Galileo—and so couldn't have borrowed from him.
- Still, he also acknowledged reading Galileo in 1634 and 1638 letters—and so he could indeed have borrowed!
  And there's reason to think he read a work of Galileo's that he doesn't mention, and that it influenced what he wrote in his suppressed Treatise on the World.
- How much of Descartes's coyness about what he got from Galileo is due to concern with the Inquisition and how much to wanting to seem original is hard to gauge.

  But that Descartes endorsed and bolstered Galileo's revolution is plain.

Descartes and the Scientific Revolution November 7, 2018 12

II. Descartes's Methodology

- Descartes's methodological injunctions in the Discourse may well strike one as trivial, almost trite: Start with the simplest things, go step by step, divide things into parts, and accept only what one knows—and his odd metaphor of building a house (D2).
- But their significance immediately becomes clear against the contrast between grasping essences and mathematical reasoning.
- All his injunctions are in effect to think as in mathematics. Indeed, mathematical thinking is construction—hence the house.

- The French preface to The Principles echoes all that—and The Principles itself follows the manner of mathematical proofs.
- The emphasis on methodology may in part have been to avoid confrontation with the Inquisition; who could contest the kind of injunctions he proposes? Still, many in the Church were well aware of Descartes as a serious challenge to Church thinking.
- Descartes's early training was strongly scholastic, and he had a keen sense of how hard scholasticism would be to dislodge. And he saw methodology as a promising way to leverage his scientific views without encountering too much opposition.

That strategy was remarkably successful.

- The Principles presents proofs. But how does he get the premises of those proofs?
  The premises, he holds, come from the Meditations. But how does the Meditations do that? What is the methodology there?
- The popular view about this is not quite right. On that view, M1 urges us to doubt everything one can, until in M2 we find one thing we can't doubt—roughly, that we exist. Then that's the premise from which we somehow get the rest—by deduction.
- But if the Meditations were deductive, it would not be very good!
  And Descartes makes completely clear, in both letters and his Replies to Objections, that the Meditations is not at all deductive.

- Rather, it uses a method of discovery—what he calls analysis. It's the stripping down of our beliefs into basics.
- Also: The concern in M1 is not skepticism. That's clear in part because the answers to the doubts in M6 are flimsy—e.g., that we can after all tell when we're dreaming. But if not skepticism, what is the concern?
- It's to experiment with oneself to see how much one can, psychologically, doubt—if one exerts a huge effort in doing so.
  Descartes's idea is that there are things we are psychologically unable to doubt, and that this inability, which stems from how our minds are constituted, will give us reliable premises for, e.g., The Principles.

- Consider the last of the M1 doubts: We can doubt <u>all</u> our mathematical calculations!
  Really?! Descartes thinks yes—<u>if</u> we exert ourselves enough psychologically.
  (Though there's a catch—in a moment.)
- But I can't doubt that I exist—at least not when "I utter it or conceive it in my mind" (64). (This differs from D4 "I think, therefore I am" [18-9], which suggests it's deductive. It isn't; 'therefore' there indicates discovery.)
- My inability to doubt that I exist hinges on my thinking; so Descartes infers in M2 that the thing whose existence he cannot doubt is a thinking thing. (More in §III.)
  More important: The truths of M2 are all clear and distinct—unlike those in M1.

Descartes and the Scientific Revolution November 7, 2018 17

- The crucial move is in M3/D4. Reviewing what he can (M1)—and cannot (M2)—doubt, and why, Descartes writes:
  "I now seem able to posit as a general rule that everything I very clearly and distinctly perceive is true" (M3: 70/D4: 19).
- Can one doubt that 2+2=4? Can one actually think, assertorically, that 2+2=5?
  Descartes thinks the only way one can do so is for <u>what one is thinking or doubting to be unclear or indistinct</u>. That is the only way the extravagant M1 doubts can occur: by their contents being unclear or indistinct.
- All this reflects how mathematical thinking is the model for Descartes's methodology in science and philosophy.

Descartes and the Scientific Revolution November 7, 2018 18

- Getting the content of one's thinking to be clear and distinct is of course crucial for anything in mathematics.
- But more than that—if what we're thinking is clear and distinct, we find that we can't even think that 2+2=5. We can rehearse the words—pretend to think it. But we can't actually form that assertoric thought.

  That's true of mathematical thoughts in general—as long as their contents are clear and distinct (which can be a big challenge with any but the simplest cases).
- So a very dramatic feature of mathematical thinking is the model for Descartes's "general rule" for all thinking.
  And this for discovery—not deduction!

Descartes and the Scientific Revolution November 7, 2018 19

- Descartes famously posited innate ideas. But what they are is often misunderstood, due largely to Locke's having construed them simply as ideas we're born with.
- We are indeed born with them, Descartes thinks. But that's only because they're an aspect of how the mind itself is constituted.
- Ideas are sentence-sized contents—like the content that it's raining. The content that 2+2=4 is innate because we can't mentally deny it—when it's clear and distinct.

  Any content that one literally cannot think the denial of—when it's clear and distinct—is an innate idea. Being innate is a matter of what is possible for the mind to think. (Independently echoed in Chomsky.)

Descartes and the Scientific Revolution November 7, 2018 20

- Even when the content of M1 doubts is unclear and indistinct, it takes great effort actually to doubt. Doubting that one is awake or that one's calculations are ever correct never comes easily.
- This need for great effort is crucial. The idea that 2+2=4 is innate because when the idea occurs clearly and distinctly one cannot mentally deny it or doubt it—no matter how much effort one exerts. The mind is so constituted that one can't.
- The huge effort of M1 doubts is in effect a warm up for testing whether one can doubt something that is clear and distinct if one tries as hard as possible. Descartes's view is that one can't if it's true.

- The difference between the content and mental attitude of a thought is crucial here. It's not that one can't form some content that 2+2=5. It's that one can't hold toward that content a mental attitude of assertion.
- One might overlook this distinction. One might see asserting as the default, and so not distinguish simply forming a content from asserting it. The M1 doubting serves to underscore the role of mental attitude: Doubting is in no way a default.
- M3 and D4 have proofs that God exists and is not a deceiver. But God is eliminable. Not being a deceiver means that God would not create minds that can't reach the truth; Descartes needs only that minds can do so.

- The trick is to determine how to use one's mind so as to get at the truth and avoid error. Descartes's answer: Use the mind as one would in mathematics.
- Recall: Galileo was dismissive of Aristotle. Descartes's solid scholastic training led him to appeal to that tradition—and to convert it to the new science. So he often casts things so as to be inviting to scholastics.
- Aristotle held that the mind is so constituted as to take on the essences of things it perceives. Descartes also relies on the mind's being so constituted as to reach the truth—not in taking on essences, but in thinking mathematically. Descartes in effect combines Galileo with Aristotle.

Descartes and the Scientific Revolution November 7, 2018 23

- Descartes knows his scholastic readers will expect, given their Aristotelian training, an appeal to how the mind is constituted. He delivers, but adapts it to the mathematical thinking of the new science. The mind in effect takes on mathematical essences.
- Aristotle took the proper sensibles—color, sound, and so forth—to be essential to understanding physical nature. Why else would we have the special senses?
- Descartes uses similar reasoning, but to a different effect. Why would we have the ability to think mathematically—perhaps even a bit surprising—except as a model for thinking generally? And his appeal to God here echoes Aristotle's appeal to teleology.

Descartes and the Scientific Revolution November 7, 2018 24

- But if God is no deceiver—i.e., our minds can arrive at the truth—why is it that we do sometimes fall into error? That's M4.
- Descartes sees the faculty of the will as generating mental attitudes, and the faculty of understanding as generating the contents towards which one holds mental attitudes (Rosenthal 1986). And he urges that the faculty of will is more powerful than the understanding—so we can hold attitudes even toward poorly formed contents.
- To review: When I think or doubt that it's raining, my thinking or doubting is the mental attitude; the content is that it's raining. Error come from our mentally affirming contents that we shouldn't.

- And the general rule tells us which contents one shouldn't mentally affirm:
  One should withhold affirmation from any contents that are not clear and distinct.
- Mathematics works that way: Basic truths are those we can't mentally deny when the ideas are clear and distinct. And withholding affirmation from unclear or indistinct contents motivates the D2 maxims.
- But how does that work with the everyday objects that populate our commonsense world—those that concerned Aristotle?

  If, when thinking about ordinary physical objects, we withheld assent from any contents that aren't fully clear and distinct, might we not assent to anything at all?

III. Descartes's Theory of Reality

- M1 and D4 question whether the senses deceive us about ordinary physical objects by misrepresenting them—an issue not resolved in the Meditations until M6.
- One remark in M6 needs emphasizing:

  "I find in myself faculties for certain special modes of thinking, namely, the faculties of imagining and sensing" (96).
- So sensing is a type—a mode—of thinking.

  And this is key to whether, and if so how, the senses represent objects accurately.

- In regarding sensing as a type of thinking, Descartes again upends Aristotle, whose account of thinking casts it instead as in effect an abstract form of perceiving.
- Sensing involves two aspects: sensory input, and also the conceptualizating of whatever it is that we sense. And that conceptualizing is a form of thinking.
- Aristotle's reliance on the proper sensibles, such as color, sound, and taste, requires sensory input to be primary—the aspect of sensing that's independent of thinking.

  But if we understand reality mathematically, thinking must be more basic than sensing, since the senses can at best give us only a kind of picture of mathematical reality.

- Descartes's treatment of sensory input is controversial, and needn't concern us here. What matters is that the conceptualizing that figures in sensing is a form of thinking.
- And Descartes holds that the senses will not mislead if we stick with the thinking aspect of sensing. That's the aspect that can handle mathematics—and so can aspire to clarity and distinctness.
- Descartes accepts that when sensory input differs in color, sound, odor, taste, and so forth, it is natural to conclude that there are corresponding differences in physical objects.
  But those sensory inputs "do not resemble" the physical differences (98).

- We know those physical differences from our conceptualizong things. But because of the lack of resemblance, sensory inputs distort. We can rely on the thinking aspect of sensing, not on the sensory-input aspect.
- The contrast between common and proper sensibles is again crucial.
  Sensory input of color, sound, taste, and odor do not resemble anything in sensed physical objects. So they mislead us about the nature of those objects.
- But we also perceive things in respect of their common-sensible properties—shape, size, number, location. And since these properties are mathematical, we can can access them conceptually—by thought.

- So perceiving the common sensibles can reveal the nature of physical objects.
- Again: Physical reality is, on Descartes's view, pure extension, independent of any common-sensible properties, such as color.

  Descartes argues this in M2: A piece of wax can change in color, sound emitted, odor, and taste, but be the same thing. The only thing the wax has through these changes, Descartes concludes, is its being extended. Extension is its essence (67-69).
- This argument should again be congenial to scholastic readers, who see essence as what survives change—
  even though the upshot is that physical essence is mathematical.

Descartes and the Scientific Revolution November 7, 2018 31

- Today we follow Galileo and Descartes in seeing mathematical description as basic to all science, especially physics (Feynmann).
- But positing pure extension overshoots: It turns out we need for physics, in addition to extension, something corresponding to Newton's mass. And Descartes's having only extension undermined his physics.
- All this is fine for physical reality—but how about the mental, ignored by Galileo? Many today hold—with Hobbes—that the mental is just a special case of the physical.

  Descartes emphatically denies that.
  He espoused a dualism of substances:
  The physical is extended substance; minds are unextended, thinking substances.

Descartes and the Scientific Revolution November 7, 2018 32

- It's important to distinguish two issues. Descartes argues in M2/D4 that he is a thinking thing. That's because he shows he exists only by appeal to his thinking. "'I am, I exist' is necessarily true every time I utter it or conceive it in my mind" (64).
- It's necessarily true in the M5 sense that my mind is so constituted that if I am thinking I exist, I cannot doubt or deny it. Thinking is one's essence, since it's only in virtue of thinking that one can determine that one exists.
- Still, as Hobbes noted in his Objections to the Meditations, the thing that thinks might for all that also be a thing that walks—that is, a special kind of physical object.

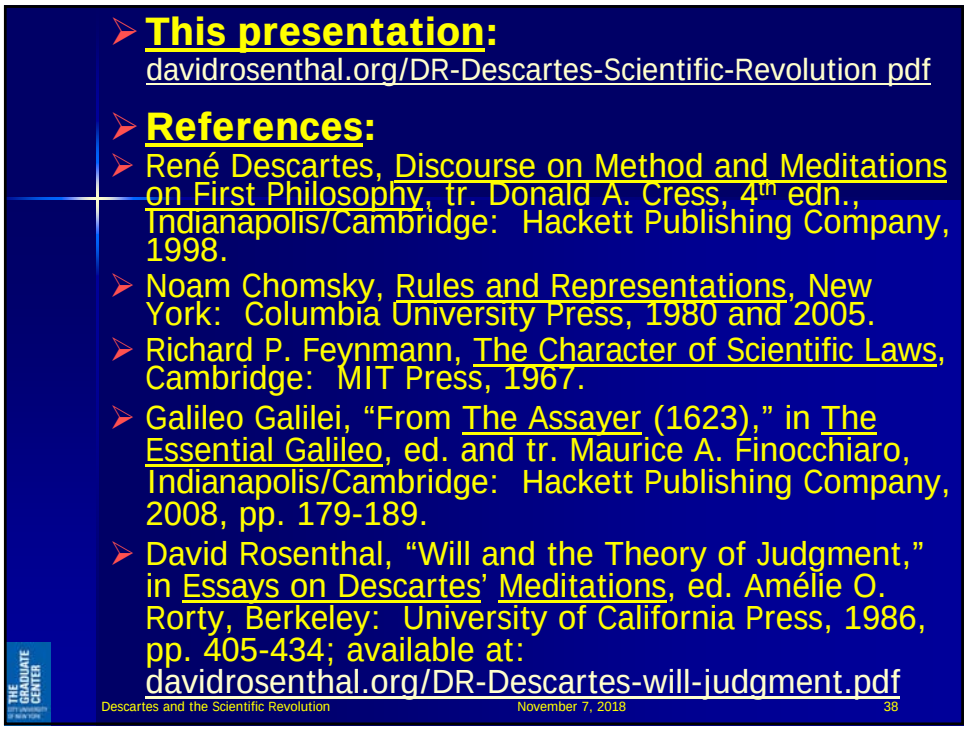
- Descartes acknowledges that, and does not intend the cogito of M2/D4 to establish that the thinking thing is not also a physical object. That the thinking thing is distinct from anything physical—i.e., from anything extended—emerges only in M6.
- The cleanest argument in M6 is that it's in the nature of extension to be indefinitely divisible, at least conceptually—but in the nature of a thinking thing to be indivisible. This relies on taking consciousness to be unified, which some see as controversial.
- Descartes also argues that one can conceive of a thinking thing without thereby conceiving of an extended thing, and conversely.

- But this arguably doesn't show that a thinking thing is not an extended thing.
  The Evening Star = the Morning Star, even though conceiving of one need not involve conceiving of the other.
- But the deeper consideration remains that being a thinking thing does not lend itself to mathematical description, whereas being an extended thing does.
  Since physical reality is in its very nature mathematically describable, as the Galilean revolution showed, thinking, it may seem, must be distinct from anything physical.
- Some today would be unconvinced by that. But it's clear why many at the beginning of Galileo's revolution would have thought so.

Summary

- The scientific revolution, which culminated with Galileo, holds that the Book of Nature is "written in mathematical language." The only essences there are mathematical.
- Descartes led a revolution in philosophy to accommodate that methodologically—and also to make a suitable place for the mind.
- Descartes noted that one cannot doubt clear and distinct truths in mathematics no matter how hard one tries, and took that to reflect the nature of the mind—and in particular the mind's innate ideas.


Thanks for your attention
Descartes and the Scientific Revolution
November 7, 2018
37


This presentation:
davidrosenthal.org/DR-Descartes-Scientific-Revolution pdf
References:
René Descartes, Discourse on Method and Meditations on First Philosophy, tr. Donald A. Cress, 4th edn., Indianapolis/Cambridge: Hackett Publishing Company, 1998.
Noam Chomsky, Rules and Representations, New York: Columbia University Press, 1980 and 2005.
Richard P. Feynmann, The Character of Scientific Laws, Cambridge: MIT Press, 1967.
Galileo Galilei, "From The Assayer (1623)," in The Essential Galileo, ed. and tr. Maurice A. Finocchiaro, Indianapolis/Cambridge: Hackett Publishing Company, 2008, pp. 179-189.
David Rosenthal, "Will and the Theory of Judgment," in Essays on Descartes' Meditations, ed. Amélie O. Rorty, Berkeley: University of California Press, 1986, pp. 405-434; available at: davidrosenthal.org/DR-Descartes-will-judgment.pdf
Descartes and the Scientific Revolution
November 7, 2018
38