

Descartes' *Dioptrics*

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The *Dioptrique*, often translated as the *Optics* or, more literally, as the *Dioptrics* is one of Descartes' earliest works. Likely begun in the mid to late 1620's, Descartes refers to it by name in a letter to Mersenne of 25 November 1630 (AT I 182; CSM(K) III, 29). Its subject matter partially overlaps with Descartes' more foundational project *The World or Treatise on Light* in which he offers a general mechanistic account of the universe including the formation, transmission, and reception of light. Although Galileo's condemnation by the Church prompted Descartes to abandon, in 1633, his plans for publishing *The World*, he continued in the ensuing years to vigorously pursue a number of scientific projects, including projects related to his work in optics. He was eventually persuaded to publish three essays highlighting some of his discoveries together with an introductory essay concerning "the method for rightly directing one's reason and searching for truth in the sciences" (AT VI 1; O 3). As one of those essays, Descartes' *Dioptrics* finally appeared in print together with the *Discourse on Method*, the *Meteorology* and the *Geometry* in the summer of 1637 in a French language edition. It was republished in a Latin edition (without the *Geometry*) in 1644.

The subject matter of the *Dioptrics* may be thought of as covering three main topics and is formally divided by Descartes into ten chapters or "discourses". The first main topic concerns the nature of light and the laws of optics. In the first discourse, Descartes invites his readers to "consider light as nothing else ... than a certain movement or action, very rapid and very lively, which passes toward our eyes through the medium of the air and other transparent bodies" (AT VI 84; O 67). In the second discourse, Descartes attempts to derive the law of reflection (known since antiquity) and the law of refraction (first published in the *Dioptrics*) through a series of ingenious, mechanistic analogies to the behavior of tennis balls reflecting off of hard surfaces and puncturing thin sheets of cloth.

The second main topic of the *Dioptrics* concerns human vision. In the third discourse, Descartes offers an anatomical description of the parts of the eye, including the pupil, the interior "humours," and the optic nerve.

In the fourth, he provides an account of the senses in general, explaining “how the mind, located in the brain” comes to receive “impressions of external objects through the mediation of the nerves” (AT VI 109; O 87). The fifth discourse explains how light enters through the pupil of the eye, is refracted by the interior humours, and forms an inverted image on the retina at the back of the eye. The sixth discourse identifies various qualities by which objects of sight are apprehended, provides an account of our visual perception of distance, and highlights several ways in which human vision is systematically prone to error.

The third main topic of the *Dioptrics* concerns the improvement human vision. In the opening paragraph of the seventh discourse, Descartes notes that the quality of human vision depends on three “principles,” namely visible objects, external organs, including all bodies “that we can place between the eye and object,” and interior organs such as the brain and nerves (AT VI 147-148; O 114). Prudently focusing his attention on how our external organs might be supplemented to maximize the distinctness, size, strength, and range of visual images, Descartes offers in the eighth discourse an account of “the shapes that transparent bodies must have in order to divert rays through refractions in every way that is useful to sight,” while in the ninth discourse he puts those results to practical use in explaining how our visual faculties may be extended through the construction of microscopes and telescopes (AT VI 165; O 127). Finally, the tenth discourse describes an ingenious, if ultimately impractical, method for cutting lenses, and intriguingly suggests that while telescopes may be esteemed insofar as they “promise to lift us into the heavens,” microscopes may in fact prove more useful since “by means of them we will be able to see the diverse mixtures and arrangements of the small particles which compose the animals and plants, and perhaps also the other bodies which surround us, and thereby derive great advantage in order to arrive at the knowledge of their nature” (AT VI 226; O 172).

Due to an indiscretion by Jean de Beaugrand, then secretary to the French chancellor, a copy of Descartes’ *Dioptrics* was passed onto Pierre Fermat and other critics prior to its being licensed to appear publicly (Clarke 2006, 169). It can thus be said that Descartes’ masterpiece of geometrical optics has inspired praise, analysis, and disparagement since even *before* its (official) publication. Today, scholars continue to wrestle with Descartes’ account of light and his derivations of the laws of reflection and refraction (Shapiro 1974, Schuster 2000). There is great interest in his account of the physiology of vision, how that account fits into his larger philosophical system, and its influence on later thinkers such as Nicholas

Malebranche and George Berkeley (Wolf-Devine 1993, Atherton 1990). Finally, scholars have continued to return to Descartes' *Dioptrics* for insight into his multifaceted understanding of the relationship between method, theory, and practical application (Garber 1993, Ribe 1997).

For Further Reading

- Buchwald, J. Z. 2007. "Descartes's Experimental Journey Past the Prism and Through the Invisible World to the Rainbow," *Annals of Science* 65 (1): 1-46.
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- Wolf-Devine, C. 1993. *Descartes on Seeing, Epistemology and Visual Perception*. Carbondale, IL: Southern Illinois University Press.

Related Entries

Color; *Discourse on Method*; Experiment; Explanation; *Geometry*; Hydrostatics; Laws of Nature; Light; *Meteorology*; Method; Perception; Physics; Rainbow; *Treatise on Light*; Fermat, Pierre de; Galilei, Galileo; Golius (Jacob Gool),

Huygens, Constantijn and Christiaan; Kepler, Johannes; Mersenne, Marin;
Mydorge, Claude; Newton, Isaac; Regius, Henricus (Henri le Roy)

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Clarke, D. 2006. *Descartes, A Biography*. Cambridge: Cambridge University Press.

Garber, D. 1993. "Descartes and Experiment in the *Discourse* and *Essays*," in Stephen Voss, ed., *Essays on the Philosophy of Science of René Descartes*. Oxford: Oxford University Press, 288-310. Reprinted in D. Garber, 2001, *Descartes Embodied, Reading Cartesian Philosophy through Cartesian Science*. Cambridge: Cambridge University Press, 85-110.

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