Divine will and the mechanical philosophy

Gassendi and Descartes on contingency and necessity in the created world

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CAMBRIDGE
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK
40 West 20th Street, New York NY 10011–4211, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa

http://www.cambridge.org

First published 1994
Reprinted 1998
First paperback edition 2002

Typeface Sabon.

A catalogue record for this book is available from the British Library

ISBN 0 521 46104 9 hardback
ISBN 0 521 52492 X paperback

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Introduction

> Just as the poets suppose that the Fates were originally established by Jupiter, but that after they were established he bound himself to abide by them, so I do not think that the essences of things, and the mathematical truths which we can know concerning them, are independent of God. Nevertheless I do think that they are immutable and eternal, since the will and decree of God willed and decreed that they should be so.
>
> *René Descartes, "Replies, V"*[1]

> If some of the natures [of things] are immutable and eternal and could not be otherwise than they are, God would not have existed before them. Otherwise such things would not be natures . . . The thrice great God is not, as Jupiter of the poets is to the fates, bound by things created by him, but can in virtue of his absolute power destroy anything that he has established.
>
> *Pierre Gassendi, Disquisitio metaphysica*[2]

This book is about ways of understanding contingency and necessity in the world and how those ideas influenced the development of philosophies of nature in the seventeenth century. Is the world contingent on forces beyond the possibility of human understanding and control? Or

1. René Descartes, "Fifth Set of Replies," in *The Philosophical Writings of Descartes* (hereafter *PWD*), translated by John Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny, 3 vols. (Cambridge University Press, 1984, 1985, 1991), vol. 2, p. 261, *Oeuvres de Descartes,* edited by Charles Adam and Paul Tannery, 11 vols. (hereafter AT) (Paris: J. Vrin, 1897–1983), vol. 7, p. 380.
2. Pierre Gassendi, *Disquisitio metaphysica seu dubitationes et instantiae adversus Renati Cartesii metaphysicam et responsa,* edited and translated into French by Bernard Rochot (Paris: J. Vrin, 1962), pp. 480–1; in Pierre Gassendi, *Opera omnia,* 6 vols. (Lyons, 1658; facsimile reprint, Stuttgart-Bad Cannstatt: Friedrich Frommann Verlag, 1964), vol. 3, p. 377. All translations are mine unless otherwise noted.

does the world necessarily conform to rationally intelligible principles? The interplay between these conceptions goes back to both the Greek and the Hebrew sources of Western thought, forming an important strand in the long history of the relationship between Athens and Jerusalem. The themes of contingency and necessity appear in various guises throughout the intellectual history of the West. In this study, I discuss the role they played in the seventeenth-century debates about the choice of a new philosophy of nature to replace the Aristotelianism that had dominated natural philosophy for many centuries.

Classical Greek ideas about chance and reason, about the intransigence of matter and the intelligibility of Pythagorean harmonies and Platonic forms expressed these themes.[3] To the extent that the gods were subject to the fates, reason was limited by the irrational, logical necessity by contingent fact. The same themes of contingency and necessity arose within the Hebrew tradition. In his argument with God about why piety does not guarantee prosperity and well-being, Job sought an explanation of his misfortunes, assuming that the world is a rational and just place in which the good are rewarded and the wicked are punished. Instead of receiving a satisfying answer, he found himself confronted with Jahweh's demand for uncomprehending obedience. In this way, Job discovered the absolute contingency of the world in terms of its dependence upon an omnipotent God whose actions do not necessarily conform to human standards of rationality and justice. "I know you can do all things and nothing you wish is impossible" (Job 42:1).[4]

Ideas about contingency and necessity – cast in terms of the possibilities and limits of human understanding – are closely tied to ideas about causality. Is the course of natural and human events ineluctably determined? or do some events happen by chance or coincidence, apparently free from the shackles of causal necessity? Such considerations are incorporated into scientific discourse in underlying assumptions about causality and the epistemological status of our knowledge of the natural world. These assumptions comprise the conceptual framework within

3. For a discussion of these ideas in an ethical context, see Martha C. Nussbaum, *The Fragility of Goodness: Luck and Ethics in Greek Tragedy and Philosophy* (Cambridge University Press, 1986). See also Richard Sorabji, *Necessity, Cause, and Blame: Perspectives on Aristotle's Theory* (Ithaca, N.Y.: Cornell University Press, 1980).
4. Stephen Mitchell, *The Book of Job* (San Francisco: North Point, 1987), p. 88. The more familiar King James version of this passage reads, "I know that thou canst do every thing, and that no thought can be withholden from thee."

which science is constructed. During the early seventeenth century, many natural philosophers were explicitly engaged in formulating a new conceptual framework to replace Aristotelianism, which they considered intellectually bankrupt in light of the Renaissance revival of ancient philosophies of nature, the Reformation, the skeptical crisis, and the Copernican revolution.[5] Although philosophers debated the merits of many alternative philosophies of nature, eventually the mechanical philosophy – the view that all natural phenomena can be explained in terms of matter and motion alone – was adopted as the conceptual framework for natural philosophy.

Aristotelianism had served as the conceptual framework for science since the translation of Aristotle's works from Arabic into Latin in the thirteenth century.[6] Because the various comp nents of Aristotelianism were so closely knit, the heliocentrism of Copernicanism threatened the entire philosophy, not just its geocentric cosmology. This challenge was intensified by the realist interpretation that Copernicus, Kepler, and Galileo gave to astronomical theory, meaning that for the first time since Greek antiquity, the conclusions of physics and astronomy were relevant to each other.[7] By removing the Earth from the center of the universe, the Copernicans undermined Aristotelian physics to which the assumption of

5. As a matter of historical fact, a viable Aristotelian tradition continued to develop well into the seventeenth century. See Charles B. Schmitt, *Aristotle and the Renaissance* (Cambridge, Mass.: Harvard University Press, 1983), p. 7. See also Edward Grant, "Celestial Perfection from the Middle Ages to the Late Seventeenth Century," in *Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall* (Cambridge University Press, 1985), pp. 137–62; and Edward Grant, "Ways to Interpret the Terms 'Aristotelian' and 'Aristotelianism' in Medieval and Renaissance Natural Philosophy," *History of Science, 25* (1987): 335–58.
6. See Edward Grant, "Aristotelianism and the Longevity of the Medieval World View," *History of Science, 16* (1978): 93–106.
7. For a discussion of realism and instrumentalism in the history of astronomy, see Pierre Duhem, *To Save the Phenomena: An Essay on the Idea of Physical Theory from Plato to Galileo,* translated by Edmund Doland and Chaninah Maschler (Chicago: University of Chicago Press, 1969; first published, 1908). Not all Copernicans were realists. See Robert S. Westman, "Three Responses to the Copernican Theory: Johannes Praetorius, Tycho Brahe, and Michael Maestlin," in *The Copernican Achievement,* edited by Robert S. Westman (Berkeley: University of California Press, 1975), pp. 285–345; and Robert S. Westman, "The Melancthon Circle, Rheticus, and the Wittenberg Interpretation of the Copernican Theory," *Isis, 66* (1975): 165–93.

a geocentric cosmos was intrinsic. Galileo's new science of motion further eroded the essentialism of Aristotelian matter theory by making it impossible to infer the nature of a body from its motions.[8] Because the motions or other perceived qualities of bodies no longer revealed the essences of the bodies in question, observation alone could not lead to knowledge of forms. In this way, the foundations of Aristotle's theory of scientific knowledge were undermined.

The Renaissance recovery of classical texts made alternative ancient philosophies of nature available to humanistically inclined natural philosophers. Of particular significance were Plato's dialogues, Lucretius' exposition of ancient atomism in *De rerum natura,* and the Hermetic corpus, all of which had been little known before the fifteenth century.[9] The availability of these alternatives made it easier for natural philosophers to contemplate the abandonment of Aristotelianism in an age when many thinkers considered an ancient model to be a prerequisite for working out a philosophical position.[10] Another factor undermining the authority of Aristotelianism was the skeptical crisis of the sixteenth and early seventeenth centuries.[11] The epistemological issues raised by the Reformation debates over the criterion for a rule of faith, the recovery and translation of the writings of the ancient skeptics, and the psychological impact of the discovery of the New World gave skepticism prominence in the intellectual world.

The mechanical philosophy appealed to the practitioners of the new

8. See Margaret J. Osler, "Galileo, Motion, and Essences," *Isis,* 64 (1973): 504–9.
9. On the recovery of ancient texts, see Anthony Grafton, "The Availability of Ancient Works," in *The Cambridge History of Renaissance Philosophy,* edited by Charles B. Schmitt, Quentin Skinner, and Eckhard Kessler (Cambridge University Press, 1988), pp. 767–91.
10. Although Schmitt wisely emphasized the persistence of Aristotelianism in the Renaissance, he acknowledged that "several of the major philosophers and scientists of the generation of Bacon and Galilei on to that of Hobbes and Descartes sealed the fate of Aristotelianism as a coherent philosophy, at least from an intellectual if not wholly from a historical point of view." Charles B. Schmitt, *Aristotle and the Renaissance,* p. 5.
11. The key study here is Richard H. Popkin, *The History of Scepticism from Erasmus to Spinoza,* revised edition (Berkeley: University of California Press, 1979). For the origins of the skeptical crisis, see esp. chaps. 1 and 2. On the revival of Academic skepticism, see Charles B. Schmitt, *Cicero Scepticus: A Study of the Influence of the* Academica *in the Renaissance* (The Hague: Martinus Nijhoff, 1972).

natural philosophy. Galileo held such ideas,[12] as did the very influential, though unpublished, Isaac Beeckman.[13] So did Gassendi and Descartes, both of whom created systematic mechanical philosophies.[14] One reason for its popularity was its apparent compatibility with recent developments in astronomy, the science of motion, and physiology.[15] These developments appeared to Hobbes and other seventeenth-century natural philosophers as a new beginning:

> I know . . . that the hypothesis of the earth's diurnal motion was the invention of the ancients; but that both it, and astronomy, that is celestial physics, springing up together with it, were by succeeding philosophers strangled with the snares of words. And therefore the beginning of astronomy, except observations, I think is not to be derived from farther time than from Nicolaus Copernicus; who in the age next preceding the present revived the opinion of Pythagoras, Aristarchus, and Philolaus. After him, the doctrine of the motion of the earth being now received, and a difficult question thereupon arising concerning the descent of heavy bodies, Galileus in our time, striving with that difficulty, was the first that opened to us the gate of natural philosophy universal, which is the knowledge of the nature of *motion*. So that neither can the age of natural philosophy be reckoned higher than to him. Lastly, the science of *man's body*, the most profitable part of natural science, was first discovered with admirable sagacity by our countryman, Doctor Harvey . . . Before these, there

12. Galileo, *The Assayer*, in *Discoveries and Opinions of Galileo*, edited and translated by Stillman Drake (Garden City, N.Y.: Doubleday Anchor, 1957), pp. 275–8. See also Pietro Redondi, *Galileo Heretic*, translated by Raymond Rosenthal (Princeton, N.J.: Princeton University Press, 1987). Redondi clarifies the relationship between an endorsement of atomism and its bearing on the explanation of the Eucharist, esp. in chaps. 7 and 9.
13. Although Beeckman's journal was not published in toto before the twentieth century, extracts from it were published in 1644 in *D. Isaaci Beeckmanni medici et rectoris apud Dordracenos mathematico-physicarum meditationum, questionum solutionum centuria* (Utrecht, 1644). See R. Hooykaas, "Science and Religion in the Seventeenth Century: Isaac Beeckman (1588–1637)," *Free University Quarterly*, 1 (1951): 169; and R. Hooykaas, "Beeckman, Isaac," in *Dictionary of Scientific Biography*, edited by Charles Coulton Gillispie, 16 vols. (New York: Scribner, 1972), vol. 1, p. 566.
14. E. J. Dijksterhuis, *The Mechanization of the World Picture*, translated by C. Dikshoorn (Oxford University Press, 1961), pp. 70–6.
15. For example, Descartes considered Harvey's proof of the circulation of the blood as "much easier to conceive" if understood in mechanical terms. See René Descartes, *Discourse on the Method of Rightly Conducting One's Reason and Seeking the Truth in the Sciences*, in *PWD*, vol. 1, pp. 132–9; AT, vol. 6, 41–55.

was nothing certain in natural philosophy but every man's experiments to himself.[16]

It seemed quite plausible to advocates of the mechanical philosophy to construct a physics of the heavens that regarded planets as material objects whose motions in space were amenable to mathematical description. A world consisting only of matter and motion appeared to be accessible to both observation and mathematical analysis, while the substantial forms and occult qualities of the Aristotelians had come to seem obscure. Moreover, a mechanical philosophy of nature described a homogeneous universe, all the parts of which were governed by the same laws of nature, a uniformity of nature throughout space that Koyré called "the destruction of the Cosmos."[17]

The first half of the seventeenth century witnessed the development of a community of thinkers who shared a fairly explicit concern to formulate a mechanical philosophy to provide metaphysical foundations for these developments in natural philosophy. Important members of this group included Isaac Beeckman (1588–1637), Marin Mersenne (1588–1648), Thomas Hobbes (1588–1679), Pierre Gassendi (1592–1655), René Descartes (1596–1650), Sir Kenelm Digby (1603–65), and Walter Charleton (1620–1707). These men knew each other personally and reacted to each other's work.[18]

16. Thomas Hobbes, *Elements of Philosophy: The First Section, Concerning Body* (1655), translated into English, in *The English Works of Thomas Hobbes of Malmesbury*, edited by Sir William Molesworth, 11 vols. (London, 1839–45; reprinted, Aalen: Scientia, 1962), vol. 1, pp. viii–ix.
17. Alexandre Koyré, "Galileo and Plato," in *Metaphysics and Measurement: Essays in the Scientific Revolution* (London: Chapman & Hall, 1968), p. 19; first published in *Journal of the History of Ideas*, 4 (1943): 400–28. See also Jean Jacquot, "Harriot, Hill, Warner, and the New Philosophy," in John W. Shirley, *Thomas Hariot: Renaissance Scientist* (Oxford University Press, 1974), p. 108.
18 For the relations among these people, see Robert Hugh Kargon, *Atomism in England from Hariot to Newton* (Oxford University Press, 1966), chaps. 6-8; Samuel I. Mintz, *The Hunting of Leviathan: Seventeenth Century Reactions to the Materialism and Moral Philosophy of Thomas Hobbes* (Cambridge University Press, 1969), chap. 1; Robert Lenoble, *Mersenne ou la naissance du mécanisme*, 2d edition (Paris: J. Vrin, 1971), chap. 1; Michael Foster, "Sir Kenelm Digby (1603-1665) as Man of Religion and Thinker– I. Intellectual Formation." *Downside Review*, *106* (1988): 101–25; and Lindsay Sharp, "Walter Charleton's Early Life, 1620–1659, and the Relationship to Natural Philosophy in mid-Seventeenth Century England." *Annals of Science*, *30* (1973): 311–40.

Despite considerable differences in political context and religious affiliation, these mechanical philosophers formed a European community that crossed both national boundaries and confessional lines. Beeckman, a member of the Dutch Reformed church, was a school rector in the Netherlands.[19] Mersenne, Gassendi, and Descartes were all Catholics living in the France of Louis XIII and the Fronde. Both Mersenne and Gassendi were priests. Charleton, personal physician to Charles I, was a Royalist and an Anglican and probably spent the early 1650s in France.[20] Digby was an English Catholic who spent time in Paris.[21] Hobbes, born into a Protestant family and educated at a Puritan college at Oxford, had a reputation as a materialist and possibly an atheist. He served as tutor to the son of William Cavendish, in whose household he mingled with many of the central figures of the "new philosophy."[22] He spent many years in Paris, where he was personally acquainted with Mersenne, Gassendi, Descartes, and Digby.[23]

Whatever their differences in politics, nationality, and faith, these men formed an international, self-consciously intellectual community. Although all of them were educated in Aristotelianism, they were united in their opposition to it and in their support of a mechanical philosophy to replace it. They shared an admiration for Galileo and a commitment to the "new science" more generally. With the exception of Beeckman, each published at least one major work, spelling out his own version of the new philosophy.[24] Despite many important differences in detail, these books resemble each other in important ways. They defended the mechanical philosophy and argued against Aristotelian and occult alternatives. They included sections describing the ultimate components of the world, matter

19. Hooykaas, "Beeckman," p. 566.
20. Sharp, "Walter Charleton's Early Life," pp. 311–27.
21. Foster, "Sir Kenelm Digby," pp. 42–3.
22. Mintz, *Hunting of Leviathan,* pp. 3–5. On the role of the Cavendish circle in English natural philosophy, see Kargon, *Atomism in England,* chap. 7.
23. Mintz, *Hunting of Leviathan,* chap. 1.
24. The works in question are as follows: Marin Mersenne, *Quaestiones celeberrimae in Genesim* (1623), *L'impiété des déistes* (1624), *La vérité des sciences* (1625), and *Traité de l'harmonie universelle* (1627); René Descartes, *Principia philosophiae* (1644); Sir Kenelm Digby, *Two Treatises. In the One of Which, The Nature of Bodies; in the Other, the Nature of Mans Soule; is Looked Into: In Way of Discovery, of the Immortality of Reasonable Soules* (1644); Thomas Hobbes, *De corpore,* Part I of *The Elements of Philosophy* (1655); Walter Charleton, *Physiologia Epicuro-Gassendo-Charltoniana, or a Fabrick of Science Natural Upon the Hypothesis of Atoms* (1654); and Pierre Gassendi, *Syntagma philosophicum* (1658).

and motion. They explained various phenomena in mechanical terms, namely, the impact of material particles. They included lists of all the known qualities of bodies and showed how they could be explained in mechanical terms. They devoted considerable attention to explaining human perception. And central to their accounts was the doctrine of primary and secondary qualities, the view that material bodies actually possess only a few primary qualities and that the observed qualities of bodies result from the interaction of the primary qualities with our sense organs. They thus mechanized the natural world and human perception, declaring that qualities are subjective, being relative to the human perceiver. A cursory look at the tables of contents of their expositions of the mechanical philosophy reveals this commonality of concern.

As a community of thinkers, these natural philosophers were struggling with a related set of issues. The skeptical crisis manifested itself in the attention each of them devoted to questions about method. While not all of them were as philosophically imaginative as Descartes in attempting to preserve the traditional certainty of *scientia* or as pragmatically innovative as Gassendi in his "mitigated scepticism," they all considered the epistemological challenge of scepticism.[25] With the possible exception of Hobbes,[26] they all were concerned to avoid the materialism and atheism that was traditionally associated with Greek atomism. Consequently, their treatises on the mechanical philosophy contain sections establishing the existence of God, the nature of his providential relationship to the creation, human freedom, and the immortality of the human soul.

In this study I focus on the thought of two members of this group, Gassendi and Descartes, whose solutions to these problems had the greatest influence in the long run.[27] Gassendi and Descartes established two significantly different versions of the mechanical philosophy. Agreeing on the fundamental tenet of the mechanical philosophy – that all natural phenomena can be explained in terms of matter and motion – as well as rejecting the Aristotelian and occult philosophies of the day, they disagreed about virtually everything else: the nature of matter, the episte-

25. Popkin, *History of Scepticism,* chaps. 7, 9, 10.
26. The problem of interpreting Hobbes' theological position is complex. On the relationship between his thought and Reformation theology, see Leopold Damrosch, Jr., "Hobbes as Reformation Theologian: Implications of the Free-Will Controversy," *Journal of the History of Ideas,* 40 (1979): 339–52.
27. Kargon considers Gassendi, Descartes, and Hobbes to be "the three most important mechanical philosophers of the mid-seventeeth century." See *Atomism in England,* p. 54.

mological status of scientific knowledge, and particular mechanical explanations of individual phenomena. Gassendi, following the ancient models of Epicurus and Lucretius, maintained that indivisible atoms and the void are the ultimate components of nature. Atoms possess magnitude, figure, and heaviness, properties that cannot be fully known by reason alone. He advocated an empiricist theory of scientific knowledge, claiming, in addition, that only individuals exist and that it is impossible to have knowledge of the essences of things. Descartes maintained that the universe is a plenum and that the matter filling it is infinitely divisible. According to Descartes, matter is identical with geometrical space, and its only property is extension, an attribute that can be understood rationally, without any appeal to observation or experience.[28] Although his theory of scientific knowledge indeed required appeal to empirical methods, he claimed that the first principles of natural philosophy can be known a priori and can lead to knowledge of the essences of things.

I have chosen to focus on the views of Gassendi and Descartes because of their demonstrably strong influence on the further development of the mechanical philosophy.[29] Although both thinkers advocated the mechanical account of nature, their differences were evident to their contemporaries. The next generation of natural philosophers, who accepted the mechanical philosophy in general, felt that they had to choose between Gassendist and Cartesian versions or find some accommodation between the two.[30] For example, the young Isaac Newton (1642–1727) constructed thought experiments in an attempt to decide between Cartesian and Gassendist explanations of particular phenomena.[31] Similarly, when Robert Boyle (1627–91) claimed to "write for Corpuscularians in general

28. Daniel Garber, *Descartes' Metaphysical Physics* (Chicago: University of Chicago Press, 1992), pp. 117–20.
29. I have included somewhat more material on Gassendi than Descartes in this book because Gassendi's work has been relatively neglected in the scholarly literature.
30. On this debate in the philosophical community, see Thomas M. Lennon, *The Battle of the Gods and Giants: The Legacies of Descartes and Gassendi, 1655–1715* (Princeton, N.J.: Princeton University Press, 1993).
31. Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge University Press, 1980), pp. 96–7. See also Richard S. Westfall, "The Foundations of Newton's Philosophy of Nature," *British Journal for the History of Science, 1* (1962): 171–82. For the full text of Newton's early notebook, see J. E. McGuire and Martin Tamny, *Certain Philosophical Questions: Newton's Trinity Notebook* (Cambridge University Press, 1983).

[rather] than any party of them," he had the Cartesians and the Gassendists in mind as the two main parties of mechanical philosophers.[32]

The differences between these two versions of the mechanical philosophy produced, in the latter part of the seventeenth century, different styles of scientific thought, one emphasizing an empiricist approach to science, the other a more rationalistic, mathematical approach. In this study, I explore in detail and attempt to explain the ways in which Descartes' and Gassendi's versions of the mechanical philosophy differed from each other. I argue that these differences were related to differences in their underlying theological assumptions about God's relationship to the creation,[33] specifically, the issue of how binding God's act of creation is on his future interactions with the world.

Is God bound by his creation, or is he always free to change whatever he created in the world? The salient theological assumptions are expressions of the role of contingency and necessity in the universe. The language that Gassendi and Descartes used to articulate answers to these questions was originally developed in the thirteenth and fourteenth centuries as an outgrowth of the reintroduction of Aristotle's works into mainstream philosophical thought. Contingency and necessity had been interpreted at that time in terms of the dialectic between God's omnipotence and his omniscience. There was a delicate balance in medieval theology between the rationality of God's intellect and his absolute freedom in exercising his power and will. Theologians who emphasized God's rationality were more inclined to accept elements of necessity in the creation than those who emphasized his absolute freedom and concluded that the world is utterly contingent. The necessity at stake for these thinkers was both metaphysical and epistemological. Metaphysical necessity is expressed in the relations between the essences and qualities of substances, in the relations between one entity and another, and in the relations between causes and their effects. In this metaphysical sense, the state of one being entails the corresponding state in another. Metaphysical necessity of this kind often provided foundations for epistemological necessity, the capacity to know with demonstrative certainty one state of affairs in the world on the basis of knowledge of another. In the seventeenth century,

32. Robert Boyle, *The Origin of Forms and Qualities According to the Corpuscular Philosophy*, in *The Works of the Honourable Robert Boyle*, edited by Thomas Birch, 6 vols (London, 1772; reprinted, Hildesheim: Georg Olms, 1965), vol. 3, p. 7.
33. On the central role of theology in seventeenth-century natural philosophy, see Andrew Cunningham, "How the *Principia* Got Its Name: Or, Taking Natural Philosophy Seriously," *History of Science*, 29 (1991): 377–92.

these ideas about God's relationship to the creation were transformed into views about the metaphysical and epistemological status of human knowledge and the laws of nature. Necessity found expression in the view that the laws of nature describe the essences of things and can be known a priori, while the empiricist and probabilist interpretations of scientific knowledge provided a way of thinking about the contingency of a world that no longer contained essences in a Platonic or Aristotelian sense.

I begin by examining the sources of these two conceptualizations of divine power, intellectualism and voluntarism, in their thirteenth- and fourteenth-century settings. Briefly, voluntarism is the view that the creation is absolutely contingent on God's will. Intellectualism is the view that there are some elements of necessity in the creation. Whether God created these elements of necessity or whether they exist independent of him, he cannot override them. These are complicated and subtle theological positions, and I discuss them more fully in Chapter 1. I have chosen to use the views of Aquinas and Ockham as paradigm cases of these two theological positions. Following this background, I examine the role of theological presuppositions in the thought of both Gassendi and Descartes in Chapters 2 through 6. The relationship between God and the creation occupied an important place in their writings. Gassendi was a theological voluntarist, and Descartes was a kind of intellectualist. I then proceed in Chapters 7 through 9 to examine the role that these presuppositions played in their respective formulations of the mechanical philosophy. Concepts, originally developed in one area of discourse, theology, were translated or transplanted into another domain, natural philosophy, where they took on a life of their own and had far-reaching ramifications.[34] Gassendi's empiricism and antiessentialism were tied to his voluntarism. The rationalist components of Descartes' theory of knowledge found metaphysical foundations in his intellectualist understanding of the deity. Furthermore, the theory of matter each adopted was intimately related to his epistemological predilections. Descartes equated matter with geometrical extension, endowing it with intelligible properties that can be known in a purely a priori way. By contrast, Gassendi endowed matter with some properties – such as solidity and weight – which can

34. Amos Funkenstein develops the concept of the "dialectical anticipation of a new theory by an old one." He speaks, in this context, of the "transplantation" of existing categories to a new domain. His conceptualization here captures the same idea I am trying to express when talking about the translation of concepts from one domain to another. See Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton, N.J.: Princeton University Press, 1986), pp. 14–17.

only be known empirically. I conclude by suggesting that the two versions of the mechanical philosophy, established by Gassendi and Descartes, respectively, developed later in the seventeenth century into two styles of scientific pursuit, styles that differed in the emphasis they placed on empirical evidence and mathematics and in their interpretations of mechanical models of natural phenomena.