Stephen Gaukroger, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity, 1210–1685*, Clarendon Press, Oxford 2006, ix + 563 pp.

If one looks at how the history of philosophy is taught in high schools and the majority of universities, one's impression is that a gap exists between Thomas Aquinas and Descartes. Students hear something about the contention between realists and nominalists, Marsilio Ficino's Neoplatonism and Pico della Mirandola's humanism, the famous "Scientific Revolution" that began with Copernicus, the infamous trial of Galileo, and the apple that fell on Newton's head. This gap results from a conception of the Renaissance as a period deprived of deep philosophical insights, originality and methodical rigor. This predominantly negative view owes much (if not everything) to Hegel. In his *Vorlesungen über die Geschichte der Philosophie*, whose section on Renaissance philosophy forms part of the chapter on medieval philosophy, Hegel describes Renaissance thinkers (in particular Pomponazzi, Gassendi and Reuchlin) as men who excelled more in literary and educational pursuits than in philosophical endeavors: "From those aspirations we can learn nothing new," concludes Hegel.[1] This negative picture of Renaissance philosophy started changing after Hegel; the most significant mileposts on this road to rehabilitation are Burkhardt's *Die Kultur der Renaissance in Italien* (1860) and Cassirer's *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit* (1906), which finally prepared the ground for the more systematic and detailed twentieth-century study of Renaissance philosophy.

In the course of the twentieth century, one particular problem has been singled out as *the* most relevant issue in Renaissance philosophy, and has thus become the central focus of Renaissance scholars. This is the problem of the origin of modern science and the Scientific Revolution. Butterfield, who introduced the concept of the Scientific Revolution in his influential book *The Origins of Modern Science*, declares that it is "the real origin of both the modern world and the modern mentality", and that it "outshines everything since the rise of Christianity".[2] One question immediately arises: how much, and in what way, is seventeenth-century science indebted to previous, i.e. late medieval and Renaissance, philosophical systems and concepts?

[1] G.W.F. Hegel, *Vorlesungen über die Geschichte der Philosophie* (Frankfurt am Main: Suhrkamp, 1986) vol. 20, p. 12.

[2] Herbert Butterfield, *The Origins of Modern Science* (London: G. Bell and Sons Ltd, 1949) p. vii.

Butterfield, who was probably influenced by Hegel at least in his periodization, did not think highly of the Renaissance in this regard: "[the Scientific Revolution] reduces the Renaissance and Reformation to the rank of mere episodes, mere internal displacements within the system of medieval Christendom".[3] But only 15 years later Kristeller writes: "Modern science […] is not a product of the Renaissance, although *it surely had some of its roots in the Renaissance*, and especially in the sixteenth century".[4] Since that time, the origins of modern science in the Renaissance have become ever more widely studied and discussed. One particularly interesting problem for scholars is whether it was Renaissance Platonism or Renaissance Aristotelianism from which modern science sprang. (Besides Kristeller's book, noteworthy works on this topic have been written by John H. Randall Jr., Charles Schmitt, Ernesto Grassi, Eckhard Kessler, Hans Blumenberg and others.)

Gaukroger's book fits nicely into this series of works which examine the period before the seventeenth century in searching for the origins of modern science. Gaukroger is known as one of the foremost specialists in the history of science, especially that of the seventeenth-century, and his monograph on Descartes has received much scholarly attention. In the present book, he likewise devotes the most attention to seventeenth-century thinkers: Bacon, Galileo, Descartes, Beeckman, Gassendi, Hobbes, the Royal Society apologists, Newton, Boyle and so on. Yet at least half of this large book is dedicated to the preceding period, which prepared the ground for the great scientists of the seventeenth century. Gaukroger's manner of investigation is based on the Kuhnian model of the "paradigm shift", which the author cites explicitly and with approval (p. 19). To my knowledge, this book also represents the largest attempt, and one of the most serious, at exploring the emergence of modern science in earlier periods. It nicely bridges the aforementioned gap between Aquinas and Descartes. The years given in the subtitle roughly define this period, although Gaukroger's intention in choosing them might be slightly different: 1210 is the year of the first Paris condemnation of Aristotle, while 1685 "is not marked by an event and is a little rubbery", yet roughly marks "a natural divide" between "some formative developments whose origins predate 1685" and "seminal works by Newton, Varignon, Locke, Leibniz, Ray, Fontenelle and others" (p. v-vi).

If we accept the Gadamerian hermeneutical principle whereby understanding a book means understanding the question to which it is an answer, then – if we were to single out *one* question – this book would be an answer to the following:

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[3] Ibid p. vii.

[4] P. O. Kristeller, *Eight Philosophers of the Italian Renaissance* (Stanford, California: Stanford University Press, 1964) p. 126 (my italics).

> The question is, then, not why the Scientific Revolution didn't occur in any of the other cases of rich, innovative scientific cultures, but why it occurred in the West. The core issue here is this: how was scientific practice in the West so transformed in the course of the modern era that it was able to establish cognitive priority for itself, so that it was able to shape other cognitive values around its own? (p. 18–19)

What Gaukroger has in mind here is this: the identity and self-understanding of Western civilization, its relation to its past and future, its religion and its understanding of the world have all been profoundly – and irrevocably – altered as modern scientific values have become the dominant cognitive values. With a touch of paradox, the author asks how something which is meant to be value-free and appeal to objectivity, like the ideals of Western science, can "realize human ideals and aspirations". (Gaukroger's premise is that the modern and contemporary world is a sort of epistemocratic one; I am not sure I would agree with this without much more argumentation than he offers.) The answer, Gaukroger argues, "is that it cannot, and what in fact happens instead is that scientific, technological, and economic goals replace – rather than realize – more traditional political, social and cultural ones" (p. 2). Fortunately, Gaukroger does not dwell too much on how good or bad this change of values is, but instead offers a discussion of the different forces and processes that contributed to the "exceptional and anomalous" emergence of modern science. A symbolic answer to this crucial question is sketched out by these words from the Conclusion:

> [T]he exigencies of the Italian patronage system, the classificatory problems posed by New World flora and fauna, local forms of anti-Aristotelianism, the attempt to forestall acceptance of a Tychonic system in astronomy, the stress on practical understanding in Tudor and Stuart England, attempts to provide foundations for knowledge that trump traditional notions of natural philosophical authority, to change natural philosophy from a speculative to a practical discipline, to incorporate practical mathematics into natural philosophy, to establish the autonomy of medicine with respect to natural philosophy, and so on. (p. 509)

What takes place between the question Gaukroger poses on pp. 18–19 and this summary on p. 509 is a meticulous and very clear analysis of all these elements by this leading Descartes scholar.

The book is structured as follows: The Introduction and Part I present a general overview, in which the author develops his thesis on the assimilation of all cognitive values into scientific ones and how this came about, i.e. the question of how it happened that the fundamental values of the sciences came to be viewed as providing a new basis for morality, politics, religion, and philosophy. One important starting point is the problem of

the relationship between religion and science. Gaukroger rejects the traditional picture of secularization, according to which scientific progress became possible when, and only when, the grip of the religious authorities and their regressive paradigms were loosened. Instead, he shows that it was often religious ferment and motives that advanced the new scientific culture. He argues that seventeenth-century science did not emerge in opposition to religion, but rather was in many ways driven by it. Part II deals with "natural philosophy", namely, how its status changed "from a marginal enterprise to one that forms the principal point of entry into our understanding of the world" (p. 47). Gaukroger argues here that this is not a consequence of the Scientific Revolution of the seventeenth century (like Steven Shapin or, more recently, Peter Harrison, he uses this term with caution, as it is rather unclear what the Scientific Revolution stands for, even if it was not a single event, but a complex process). Rather, it is a process set in motion at the height of scholasticism. Part III deals with the replacement, at the methodological level, of the traditional Aristotelian understanding of natural philosophy, namely, how the image of the natural philosopher was altered with regard to objectivity, intellectual honesty, and its general implications for understanding the aims of natural-philosophical enquiry. In this part of the book, Gaukroger offers a very interesting discussion about the different roles assumed by scientists, showing how such thinkers as Bacon, Galileo, and Descartes constructed a new persona for themselves: the professional natural philosopher, working outside both Church and university. Part IV deals with three seventeenth-century forms of natural-philosophical practice (a tripartite division which is fairly standard in Renaissance literature): mechanist systems (the corpuscularianism of Beeckman, Gassendi, Hobbes and Descartes), the development of experimental natural philosophy based on natural history (Gaukroger explores this via the critical conflicts between Gilbert and Bacon, Boyle and Hobbes, and Newton and Descartes), and the quantification of natural phenomena and forces (Galileo, Descartes, Huygens and Newton). Part V deals with the unity of natural philosophy, considered in the context of both the traditional Aristotelian notion of the unity of science and the Christian idea of God's creation of the universe, as well as new notions from the previous part of the book (mechanism, experimental philosophy, and "physico-mathematics").

After reading Gaukroger's book, my impression is that many of the questions he raises have been successfully and convincingly answered, but that the central one – namely, why the changes he describes should have occurred in seventeenth-century Europe – remains largely unanswered. To avoid possible misunderstandings, I must say that I do not believe there is any one elegant sentence or paragraph that would answer this question (which, after all, might even be too intractable to solve). Still

less do I think that Gaukroger has overlooked something important in this book. I only wish that he had dug a bit deeper into the internal intricacies of the sixteenth-century critique of Aristotle's concept of demonstration and *episteme*. In my opinion, this relatively under-investigated area of philosophical inquiry represents a goldmine for understanding (or at least coming closer to understanding) how the conceptual change that led to the emergence of modern science occurred. True, Gaukroger dedicates a few pages to this problem (under the heading "Reconstructing Natural Philosophy" in the section entitled "The Problem of Discovery", pp. 160–169); but he does not, in my opinion, do justice to the depth and significance of the purely theoretical anti-Aristotelian criticism of the sixteenth century. In this context, the complete absence in this book of the sixteenth-century Cicerionian philosopher Mario Nizolio is significant, for his *De veris principiis et de vera ratione philosophandi* (Parma, 1553) contains a radical anti-Aristotelian discussion. As has been argued elsewhere, Nizolio's critique of the Aristotelian concepts of demonstration and *episteme* most likely influenced Frane Petrić (Franciscus Patritius), and contributed much to the change of paradigm of *scientia* in the second half of the sixteenth century. The significance of Nizolio's book is further illustrated by the fact that, more than a century later, the young Leibniz deemed it appropriate to issue a reprint (in 1670, under the title *Antibarbarus philosophicus*), and this at a time when reprinting was not common. In an extensive and very interesting foreword, Leibniz, despite some serious criticisms of Nizolio's ideas, finds the Italian philosopher's dismantling of Aristotle's concept of *episteme* akin to his own understanding of *scientia*. Taking into account the consequences of purely metaphysical anti-Aristotelian considerations for the change in understanding of *scientia* might shed some extra light on Gaukroger's project.

Although this book may not be suitable for complete beginners (mostly due to its omissions, such as the lack of a discussion of magic and alchemy, whose contribution to modern science is unquestionable – which, I presume, the author takes for granted), it is recommended to any scholar interested in the question of the emergence of modern science. Gaukroger succeeds in offering a clear exposition of the majority of current problems in this area, presenting the dominant views of those problems and solutions to them, and providing us with the most comprehensive overview of the *status quaestionis* thus far.

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