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John Bennett Shank. *Before Voltaire: The French Origins of "Newtonian" Mechanics, 1680-1715.* Chicago: University of Chicago Press, 2018. 464 pp. $55.00, cloth, ISBN 978-0-226-50932-7.

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The first surprise about this book it its title: "Before Voltaire." Not until several pages into the introduction does one find its origin: that "the Enlightenment narratives that Voltaire and other eighteenth-century Newtonians spun around their hero must be discarded" (p. 6). Further on we get a whiff of literary deconstruction when we read that "rather than try to understand how technical mathematical science was made into the sugary metanarratives of Enlightenment, this book aspires to wipe away the sticky pink fluff that these later, celebratory accounts have spun around Newton's *Principia* in order to return directly and precisely to its initial European reception" (p. 5). The author continues: "It further strives to build from this pre-Enlightenment vantage point—a perspective before Voltaire, in other words—a new and sugar-free account of the outcomes that ensued when other mere mortals (or in this case, Frenchmen) began to study Newton's *Principia* without any awareness of the epochal significance that later interpreters would attribute to this treatise or their reading of it" (p. 5). These claims, however, do not have any basis on historical facts. The handful of mathematicians (no more than five or six) who were able to understand the *Principia* promptly realized the enormous importance of Newton's magisterial book that ignited the seventeenth-century Scientific Revolution, and they endeavored to translate its geometric propositions into the language of Gottfried Wilhelm Leibniz's differential calculus.

The main subject of this lengthy book is a description of the activities of members of the French Academy of Sciences during the period following the publication of Isaac Newton's ***Principia,*** and before the appearance of Voltaire's book, ***The Elements of Sir Isaac Newton's Philosophy*** (English translation, 1738), which he wrote with the very able assistance of the mathematical prodigy Émilie du Châtelet. The work of the French academicians consisted primarily in applying Leibniz's differential calculus to solve problems in mechanics that had been treated by geometric methods developed previously by Christiaan Huygens and Isaac Newton.

A very important contribution for the dissemination of this calculus was the publication of Guillaume François Antoine, Marquis de l'Hôpital's textbook ***Analyse des infiniment petits***. According to the spokesman for the French Academy, Bernard le Bouvier de Fontenelle, l'Hôpital's acclaim as a mathematician "made him the equal of Huygens, Newton, Leibniz, and Bernoulli" (p. 142). Actually, l'Hôpital's book was entirely based on lectures he received from his tutor, John Bernoulli, which is well documented; Bernoulli's

original lectures have subsequently been published.

The central figure among the French academicians who are the focus of the polemics in this book is Pierre Varignon. There is endless repetition to his so-called "new science of motion" without any explanation of what this new science was supposed to be. According to ***Before Voltaire***, "a pervasive historiographical tradition in fact makes Newton the primary author of Varignon's new science of motion" (p. 115). In this understanding, Newton's ***Principia*** brings all the essential elements needed for his science into the world in 1687, and the French origination of analytical mechanics is reduced to Varignon's transcription and then translation of Newton's science as found in the ***Principia*** into idioms more familiar to his Continental mathematical colleagues. "This book offers a very different account of this history," Shank writes. "Varignon's analytical mechanics is misunderstood, I argue, if it is conceived as the rationally determined overshoot of Newton's prior work in the ***Principia***" (p. 115). Shank claims further that "analytical mechanics is especially misrepresented when it is described as a mere dissemination of the oracular scientific light said to have begun radiating out of Newton's ***Principia*** after 1687" (p. 115). And furthermore, "nowhere in the archive of French mathematics in the years around 1700 does one find any anxiety about this influence, or any sense that Varignon's work was ever conceived as anything other than an original scientific achievement" (p. 255). On the contrary, as Niccolò Guicciardini pointed out in his book, "the ***Principia*** was clearly his starting point."[1]

In the 1700 issue of the ***Memoires de L'Academie Royale*** Varignon published a paper entitled (in translation), "General Manner to Determine the Forces, the Velocities, the Location and the Times ... for Rectilinear Motion." It gives for the first time the now familiar equations of motion for classical dynamics in the language of Leibniz's differential calculus. Varignon deserves the credit for this achievement, which is generally accorded to Leonard Euler. But it is incorrect to call Varignon's mathematical transcription "a new science of motion" as claimed in ***Before Voltaire***. One of Varignon's main applications of his result was to express Newton's proof of Proposition 39 into the language of the calculus.

Actually, in numerous instances the discussion in ***Before Voltaire*** reveals that its author does not understand the relevant mathematics. For example, he states that Newton "insistently deployed his more complicated, cumbersome, and abstruse synthetic method of first and last ratios in the ***Principia*** to secure the epistemological foundations of his work. This even though he possessed a more transparent and economical analytical approach that he could have used instead" (p. 130). But Newton could not have used his analytic approach (Fluxions), because at the time of the first publication of the ***Principia,*** in 1687, it was unknown. Besides, in correspondence with Edmond Halley he argued that his geometrical method was superior. Newton supported this method in the ***Principia***, in Lemmas 1-10, with added Corollaries, and two related Scholia that do not contain anything "complicated, cumbersome, or abstruse" except for a mathematically illiterate reader. Newton remarked to William Derham, who later advised a friend, that "to avoid being baited by little smatterers in Mathematicks ... [he] designedly made his ***Principia*** abstruse; but yet as to be understood by able Mathematicians."[2]

Another mathematical nonsensical claim in ***Before Voltaire*** is that Cavalieri found "an aggregate of parallel lines of a given figure to be equal to the area of that figure," and that the "problem of quadrature, is the problem of producing a rectilinear figure equal to a curvilinear one" (p. 150). Quadrature was the name given at the time to the ***area*** enclosed by a bounded curve, and it is calculated by the integral calculus.

The only revelation I found in ***Before Voltaire*** is that Fontenelle anticipated Francesco Algarotti's

"Neutonianismo per le dame." For readers familiar with Algarotti's book it is worth quoting the relevant passage: "Like the Mercure galant that the author knew so well, Fontenelle situated his presentation of Cartesian science squarely within the mondain social world of elite society. The result was 'disguised philosophy,' as the Mercure itself described it: 'Physics is made accessible to all ladies without exception even if they have never even heard about it.' The setting for the work is a garden to which two members of the elite retreat after an evening supper. The literary form is a breezy dialogue, the salon genre par excellence. An aura of eroticism also permeates the book as the savant increasingly 'seduces' the marquise to his position" (p. 227).

Notes

[1]. Niccolò Guicciardini, *Reading the* Principia*: The Debate on Newton's Mathematical Methods for Natural Philosophy from 1687 to 1736* (Cambridge: Cambridge University Press, 1999), 292.

[2]. Quoted in Rob Iliffe, "'Is he like other men?' The Meaning of the *Principia Mathematica*, and the Author as Idol," in *Culture and Society in the Stuart Restoration Literature, Drama, History*, ed. Gerald MacLean (Cambridge: Cambridge University Press, 1995), 175.