Review

Reviewed Work(s): Euler at Three Hundred: An Appreciation. (Spectrum Series.) by Robert E. Bradley, Lawrence A. D'Antonio and C. Edward Sandifer

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which the various encyclopedia articles and dictionaries articulated the main lines of thinking (and the fault lines of conflict) within certain sciences. This is especially true of those essays dealing with topics represented in volumes published before the Revolution, such as mathematics, physics, or political economy, but it is also true of the studies concerning architecture and fine arts. In these examples, it is very difficult to locate the broader transitions sketched by Porret. Other essays deal with disciplines that had to take into account the new political and social developments that disrupted established Old Regime categories in the wake of 1789. Fields such as jurisprudence, history, military art, and education all had to be repositioned in response to rapid changes in the very constitution of their objects.

However, the most interesting arguments in this volume emerge in the discussion of those scientific disciplines that were forming or were undergoing radical change just as the relations between knowledge and power were being totally reconstituted in the revolutionary period. Several essays trace these transformative moments as they appear not only within the actual content of the articles, but also in the very organization of the encyclopedic texts. Numerous contributors point out that seeming inconsistencies or even contradictions in the encyclopedia in fact mirror the very tensions generated from diverse and competing intellectual positions, what Isabelle Laboulais-Lesage calls the "fluidity of this field of knowledge" (p. 185). She is speaking here of geography, but we see in other essays that it is true of domains as diverse as theology, anthropology, natural history, and *la police*. Worth noting is the essay on zoology by Pascal Duris, where it is argued that the new organizational demands of the *Encyclopédie méthodique* made visible the move from a systematic zoological model, derived from Buffon's great work on natural history, to a more radical Linnaean categorical methodology. Similarly, Patrice Bret's piece on chemistry charts the well-known intellectual revolution in this domain, led by Lavoisier, while pointing out that the complex plurality of competing discourses present in the text suggests that we should focus on how chemistry asserted its autonomy in relation to other disciplines. We see this same process at work in subjects such as agriculture, whose liberation from botany can be traced in the move from the original *Encyclopédie* to the *Encyclopédie méthodique*.

Overall, these essays do an excellent job of fulfilling the editors' objective—that is, to understand the *Encyclopédie méthodique* as an articulation of an important transformation in the organization and deployment of knowledge, rather than seeing it as some monstrous deformation of the great encyclopedic project of the high Enlightenment. If the individual articles are certainly illuminating in their own right, and the topical organization is always instructive, still, what is most striking is the rich cumulative portrait given of this key transitional epoch.

DAVID BATES

Robert E. Bradley; Lawrence A. D'Antonio; C. Edward Sandifer (Editors). *Euler at Three Hundred: An Appreciation.* (Spectrum Series.) xvi + 298 pp., figs., tables, bibl., index. Washington, D.C.: Mathematical Association of America, 2007. $51.95 (cloth).

Mathematicians are very interested in the work of the great eighteenth-century analyst Leonhard Euler (1707–1783), a fact that is evident in the many conferences and symposia that have been held to commemorate the three hundredth anniversary of his birth. The essays in the present volume originated at various such meetings over the past several years and cover a range of topics corresponding to the many different areas of Euler's research. In keeping with the expository and pedagogical orientation of Euler studies, the essays are well written and clearly presented; many of them are accessible to a motivated reader with basic calculus, although others are set at a more advanced level.

The editors and many of the contributors are active in the Euler Society, an organization formed in 2001 to support and coordinate the study of Euler's mathematics. With the encouragement of the society, Dominic Klyve and Lee Stemkoski launched a project at Dartmouth College to put the writings of Euler online. In a short essay, Klyve and Stemkoski describe the creation and current state of the Euler Archive (www.eulerarchive.org), a resource that has become a valuable tool for Euler studies and an example of how the World Wide Web can be used to make primary sources and translations widely available.

The two essays by Rüdiger Thiele are among the most straightforwardly historical, the first being an account of Euler's career in the decade from 1750 to 1760 and the second an examination of the function concept. Euler's theory of infinite series is the subject of essays by C. Edward Sandifer, Mark McKinzie, Dick Jardine, and David J. Pengelley. The pieces by Sandifer and Pengelley, taken together, provide a very nice account of Euler's solution to the

famous Basel problem, the question of determining the sum of the reciprocal squares $1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \ldots$. In a brilliant analysis, Euler showed that the answer to this problem is $\pi^2/6$, obtaining in the process a general and powerful result known as the Euler-Maclaurin formula. Lawrence D'Antonio describes Euler's work on elliptic integrals, a study that he continues in a second essay on elastic curves (an elastic curve is the shape assumed by a loaded elastic column or cantilever; it is described in terms of analytic expressions involving elliptic integrals). Robert E. Bradley discusses Euler's combinatorial study of state lotteries; in a second essay he gives an account of Euler's lunar theory and some exchanges with Jean d'Alembert related to this subject. Stacy G. Langton documents Euler's investigation of rule-and-compass constructions for the quadratures of lunes, then turns in a second essay to the question of how Jakob Bernoulli originally found what are known as "Bernoulli numbers" (the latter appear in several important formulas derived by Euler). Christopher Baltus investigates Euler's proof of the fundamental theorem of algebra as this proof first took shape in his correspondence with Nicolaus Bernoulli during the 1740s. The other essays in the volume are by Janet Heine Barnett (hyperbolic functions), Carolyn Lathrop and Lee Stemkoski (Euler and Thomas Clausen), Roger Godard (the advection equation), George W. Heine III (cartography), and Sandifer (ship design).

These essays provide evidence that one can combine an avid interest in technical science with a substantial engagement with history. Although aimed primarily at a mathematical audience, *Euler at Three Hundred* includes enough articles with historical content to merit consideration by readers of *Isis*. That said, I should note that some of the contributors seem to inhabit an alternate universe from that of the historian of science. The goal of reconstructing the point of view of the historical figure is not always clearly in evidence, in large part because there is little consciousness of the fact that there is any difference between this point of view and our outlook today. For some of the authors, the appeal of history is to allow direct contact with the masters of past mathematics—to enable one "to revel in the original" (p. 174), as one contributor puts it. This attitude is also evident in recent English translations of Euler's writings, which contain not a single critical or bibliographic note to distract the reader from the original text.

A central question in understanding Euler's mathematics concerns the nature of his formalism and its place in the development of eighteenth-century analysis. Euler was a major figure in the movement to separate calculus from geometry, to eliminate the pervasive diagrammatic, visual, and geometric modes of representation employed in the early subject. He carried out this program without adopting the outlook of the modern calculus, the latter being based on ideas of the arithmetic continuum first systematically presented by Augustin Cauchy (1789–1857) in the 1820s. Euler and his successor Joseph Louis Lagrange (1736–1813) therefore occupied a distinct stage in the history of analysis, adhering to a mathematical philosophy embodying definite principles and methodological precepts that departed fundamentally from those of their predecessors but were also very different from modern ones.

CRAIG FRASER

Fabien Chareix. *La philosophie naturelle de Christiaan Huygens*. (Mathesis.) 322 pp., figs., tables, bibl., indexes. Paris: Librairie Philosophique J. Vrin, 2006. €30 (paper).

Christiaan Huygens's natural philosophy confronts the historian with the same problem as his private life: it is not to be found in his papers and letters. In his letters Huygens dutifully described his social interactions, but he was largely silent about his emotional responses. Likewise, he never systematically elaborated his ideas about the constitution of nature and the foundations of natural inquiry, which appear mainly as dispersed afterthoughts. This poses a problem for the historian of science who wants to know about the personality of Huygens or his philosophical ideas. One option is to read the remaining traces meticulously and reconstruct "the man Huygens," as Cees Andriesse has done in his biography *Huygens: The Man behind the Principle* (Cambridge, 2005). Alternatively, one can try to reconstruct Huygens's natural philosophy, as Fabien Chareix does in *La philosophie naturelle de Christiaan Huygens*. Reconstructing a philosophy that has not been elaborated may seem a futile undertaking, but Chareix is confident that the effort will contribute to our understanding and appraisal of Huygens.

Unfortunately, Chareix does not manage to steer clear of some historiographical pitfalls. He is aware of the problems with the edition of Huygens's manuscripts presented in the *Oeuvres Complètes*, but he nevertheless has not studied the original manuscripts. He knows not to impose an *a priori* method on Huygens's researches or to devise a rational reconstruction of his science, as is done so often in the history of science. Chareix wants to recover the conceptual framework of