Toward a New Biography of Euler:

Historiography

By

Ronald Calinger

The depth and range of his achievement place the Swiss-born genius Leonhard Euler (1707 – 1783) among the greatest mathematical scientists in history, ranking with Archimedes, Isaac Newton, and Carl Gauss. His books and memoirs, of which 873 have so far been listed, comprise approximately a third of the entire corpus of research on mathematics and mechanics, both rational and engineering, published from 1726 to 1800. Euler particularly excelled in organizing the framework for infinitary analysis or differential and integral calculus, adding discoveries and rapidly elaborating the field, and taking the lead in creating its central branches of differential equations, calculus of variations, and differential geometry. Together with Jean d'Alembert, Daniel Bernoulli, Alexis Clairaut, Joseph-Louis Lagrange, and Colin MacLaurin, he painstakingly applied infinitary analysis across mechanics and astronomy, making these fields modern exact sciences. Of the six, Euler was the most brilliant. In pure mathematics, he also contributed significantly to number theory, probability, and topology and in applied

mathematics to acoustics, dioptrics, music, optics, ship theory, turbine design, the foundations of elasticity and hydrodynamics, and the mechanics of rigid bodies, that last in the course of establishing continuum mechanics. Euler formulated mathematical theories that predict the buckling of beams and columns. Employing observations that the improved telescopes of his day provided with necessary accuracy, he refined differential equations to produce two lunar theories that improved navigational charts. By taking full account of air resistance, his equations revolutionized the computation of ballistics tables. Besides this extraordinary research, Euler labored diligently to establish as European institutions the crown academies of sciences in St. Petersburg and Berlin, and to make their journals respected.

Even with his impressive theoretical and technical *oeuvre* transforming the mathematical sciences, no full-scale biography of Euler exists in English.[1] For mathematicians, biographies employing the latest historiographic methods are the exception. The brief lives of Euler in German by Ruediger Thiele, published in 1982, and by Emil Fellmann in 1995 are both solid scholarship, but they lack the length to treat thoroughly his major ideas and his life and place within Enlightenment culture and the emerging republic of science.

For examining the intellectual odyssey of Euler, two principal interpretations of the development of mathematics are available. One holds that, independent of time and setting, mathematics is driven from within by the press and direction of its logic; the other asserts that it owes much to its surrounding culture and society. André Weil

[1]Emil Fellmann likens Euler's impact in the field to the Austrian composer Franz Joseph Haydn's in music. Prolific and a peerless composer in instrumental works Haydn brought the symphony to maturity, and with Wolfgang Amadeus Mozart and Ludwig van Beethoven he moved music away from patronage to professional independence and from the baroque era to the romantic.

espoused the study of the internal development of the field, while Noel Swerdlow views the two approaches as complementary.[2] David Rowe and Joan Richards argue for overcoming the division that has arisen between the two camps, as was done in the history of science.[3] Saunders Mac Lane's *Mathematics: Form and Function* in 1986 and Felix Browder's article "Mathematics and Sciences," in 1988,[4] assert persuasively that the richness and vitality of mathematics arise from its foundations in logic and culture as well as other sources, notably aesthetics.[5]

Growing accessibility to primary sources offered by Euler's *Opera omnia* provides bedrock materials for biographers. As Derek T. Whiteside's perceptive edition from 1967 to 1981 of *The Mathematical Papers of Isaac Newton* enhanced the preparation of Richard Westfall's exemplary *Never at Rest: A Biography of Isaac Newton* in 1980, the completion of the first three series of Euler's *Opera omnia*, seventy-four quarto volumes of three hundred to six hundred pages each, is required for a full-scale biographical study. These series include thirty volumes on pure mathematics, thirty-two on mechanics and astronomy, and twelve on physics and miscellany. A fourth series

---

[2]André Weil, "The History of Mathematics: Why and How," in *Collected Papers* (New York: Springer-Verlag, 1979), vol. 3: 434 – 442 and Noel M. Swerdlow, "Otto E. Neugebauer (26 May 1899 – 19 February 1990)," *Proceedings of the American Philosophical Society*, 137, 1 (1993), 141 – 142.

[3] David Rowe, "New Trends and Old Images in the History of Mathematics," in Ronald Calinger, ed., *Vita Mathematica* (Washington, D. C.: Mathematical Association of America, 1996), pp. 8ff., Joan L. Richards, "The History of Mathematics and *L'esprit humain*: A Critical Reappraisal" in Arnold Thackray, ed., *Constructing Knowledge in the History of Science*, *Osiris*, vol. 10 (Chicago: University of Chicago Press, esp. pp. 123 – 124, and Charles Gillispie, "Scholarship Epitomized," in *Isis* (1991), p. 87.

[4] Felix Browder, "Mathematics and Sciences," in William Aspray and Philip Kitcher, eds., *History and Philosophy of Modern Mathematics* (Minneapolis: University of Minnesota Press, 1988), pp. 278 – 292 and Saunders Mac Lane, *Mathematics: Form and Function* (New York: Springer-Verlag, 1986).

[5]See Subrahmanyan Chandrasekhar, *Truth and Beauty: Aesthetics and Motivations in Science* (Chicago: University of Chicago Press, 1987), G. H. Hardy, *A Mathematician's Apology* (Cambridge: Cambridge University Press, 1993, 1st ed., 1940), and Jerry King, *The Art of Mathematics* (New York: Plenum Press, 1992).

projects eight volumes in section A to include more than 2,840 of the estimated 5,000 letters in Euler's correspondence in French, German, Latin, Russian, and English that will supersede their piecemeal, incomplete publication. In section B his notebooks and adversaria -- questions addressed with assistants during his second stay in St. Petersburg -- should fill about seven volumes. The *Opera omnia* make it possible to clarify and reappraise Euler's thought as well as to remove false notions about his lack of recourse to empirical studies and to dispel myths about his health. They will also supply texts, many of them noncanonical, that help situate his work within the German current of the European Enlightenment, the political culture of reform absolutism, the royal science academies in the capital cities of St. Petersburg, Berlin, and Paris, the clear popularization of the sciences for the general reading public, and the improvement of science education at Prussian universities.

The *Opera omnia* lend support to Lorraine Daston's 1999 portrayal, in *The Sciences in Enlightened Europe,* of advances in the eighteenth-century mathematical sciences as reverberations within "a great echo chamber."[6] Not the parrying of Scholastic disputes or the elegant dialogue of humanists but a spirit of criticism guided Enlightenment sociability in the sciences. From books, treatises, memoirs in journals, reviews and responses, correspondence, and -- for scientific instruments -- advertisements, ideas and techniques were articulated, disputed, and advanced or discarded within a complex and rhythmic resonance. Encounters were not mainly from person to person but across time and territorial states. In their meetings, commission reports, prize competitions, and research, the royal academies or science societies did the

[6] Lorraine Daston, "The Ethos of Enlightenment," in William Clark, Jan Golinski, and Simon Schaffer, eds., *The Sciences in Enlightened Europe* (Chicago: The University of Chicago Press, 1999), p. 498.

most to promote the evolution of the mathematical sciences during the Enlightenment. Crucial to toning the echo chamber were more nearly exact measures and observations provided by improved instruments, especially the telescope, clocks, and surveying equipment.

A single scholar cannot master all fields of Euler's extensive and profound research. But his biographers have sound secondary writings with skilled analyses of his scientific work by Charles Blanc, William Dunham,[7] Giovanni Ferraro, Craig Fraser, Walter Habicht, Hans-Christoph Im Hof , René Taton, Clifford Truesdell, A. P. Youshkevitch, and others. Euler's original and synthetic contributions to the mathematical sciences appear in his books, memoirs, and many of his letters, which have the nature of modern research articles. Close textual analysis can elucidate guiding methods in his labors, persistent problems, such as the brachistochrone or curve of quickest descent, the nature and patterns of his breakthroughs, his adept arrangement of fields, his errors and failures, his standardizing of notation, and essential elements in the transmission of his thought. From his texts come suggestions of the exhilaration his discoveries brought him. The death of Clifford Truesdell in January of 2000 deprived us of a most perceptive investigator of his scientific accomplishments.

For the historian, the genre of biography poses many challenges. An author must not only formulate rationales for inclusion, exclusion, and historiographic style, but also select among differing readerships. Spanning the distance between requirements set by academic peers and the coverage sought by general readers adds to the difficulty.

---

[7] For a solid survey of Euler's contributions to mathematics bringing out the excitement of his discoveries, see William Dunham, *Euler: The Master of Us All* (Washington, D. C.: The Mathematical Association of America, 1999).

Academic historians have not often satisfied both publics. But after historians associated primarily with two journals, the French *Annales: économies, sociétés, civilisations* and the English *Past and Present*, joined Marc Bloc and Lucien Febvre in revitalizing history fifty years ago by moving it to the study of entire societies, biography flowered. Renaissance and Reformation scholars in particular employed the investigation of individual lives to open up an examination of larger problems in social and cultural history. For that period, Anthony Grafton's *Joseph Scaliger: A Study in the History of Classical Scholarship* in 1983 is a prominent example. Late in the twentieth century, theories from structuralism, semiotics, linguistics, post-modernism, and the role of memory, often proposed in disciplines outside history, altered our understanding of the nature of history and biography. This has led historians of science to reject positivism and in science biography the models of the great man or the isolated scientific hero.[8]

The biography of Euler envisaged here will examine the development of his scientific thought, both internally and in its interplay with the institutions, political structures, and social matrices of his time, together with the century's cultural and intellectual discourses. The biography will investigate Euler's long-term motivation, a relentless, near inexhaustible drive to solve problems, which appears to be in large part an urge for self perfection.[9] A critical analysis of Euler's contributions to the mathematical sciences would thus be the core of the biography. That requires illuminating the original sense of his writings shorn of retrospective meanings. A balanced biography must relate

---

[8] Michael Shortland and Richard Yeo, eds. *Telling Lives in Science: Essays in Scientific Biogtraphy* (Cambridge: Cambridge University Press, 1996).

[9] Michel Foucault, *Care of the Self,* R. Hurley, trans. (Hammondsworth: Penguin, 1986) and Peter Gay, "History, Biography, and Psychoanalysis," in *Three Cultures: Fifteen Lectures on the Confrontation of Academic Cultures*, ed. Evelyn Foz Keller (The Hague: Universitaire Pers Rotterdam, 1989), pp. 89 – 101.

him not only to changes occurring in the Enlightenment setting but also to the fund of belief and theory of knowledge, tacit as well as consciously held, on which he and his contemporaries drew; the uses they made of language; and the state of material and print culture.[10] The contextual approach, such as Quentin Skinner achieves**,** should provide a textured narrative giving the reader a feeling for the living reality of the subject shaping events and its influence upon him.[11] Recognizing the power of paradigms and social and cultural settings, Thomas Soederqvist insists that a contextualized science biography is incomplete without some recognition that a scientist can break with these through the exercise of free choices.[12]

The aspiring biographer of a mathematical scientist will find instructive the achievements in this genre during the last decade. These show that the two major traditions of such biography have open and protean boundaries. Among books fitting more into an older tradition of scientific biography are Bruno Belhoste's, *Augustin-Louis Cauchy: A Biography,* published in 1991, and M. A. Akivis and B. A. Rosenfeld's *Elie Cartan (1869 – 1951),* which came out two years later in translation by V. V. Goldberg. Significant contextual biographies include *Galileo, Courtier*: *The Practice of Science in the Culture of Absolutism* by Mario Biagioli, appearing in 1993, and *Descartes: An Intellectual Biography*, which Stephen Gaukroger published in 1995. Current models for

---

[10] For comments on contextual tasks, see Gert Schubring, "Pure and Applied Mathematics in Divergent Institutional Settings in Germany: The Role and Impact of Felix Klein," David Rowe, *The History of Modern Mathematics* (San Diego: Academic Press, 1989), p. 173.

[11] See Robert Darnton, "Looking the Devil in the Face," *The New York Review of Books*, XLVII, 2, February 10, 2000, esp. p. 14, Clifford Geertz, *Available Light* (Princeton, NJ: Princeton University Press, 2000), and Quentin Skinner, *Reason and Rhetoric in the Philosophy of Hobbes* (Cambridge: Cambridge University Press, 1996).

[12] "Existential Projects and Existential Choice in Science: Science Biography as an Edifying Genre," in Michael Shortland and Richard Yeo, eds., *Telling Lives in Science,* [fn. 6], pp. 45 – 85.

the field combine mathematical depth with substantial historical sensitivity and perspectives. Among them are Jesper Luetzen's 1990 book *Joseph Liouville 1909 – 1882: Master of Pure and Applied Mathematics* and Joseph Dauben's *Abraham Robinson: The Creation of Nonstandard Analysis*, published in 1995. Others are Detlef Laugwitz's *Bernhard Riemann, 1826 – 1866*, which appeared in 1999, and in the next year Arild Stubhaug's *Niels Henrik Abel and His Times*.

Calinger@cua.edu
The Catholic University of America
Washington, D.C. 20064
Autumn 2001