Review

Reviewed Work(s): The Real and the Complex: A History of Analysis in the Nineteenth Century. (Springer Undergraduate Mathematics Series.) by Jeremy Gray

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But while her claims for the importance of the nudes seem hyperbolic, Gordon's story of their dissemination and circulation in the face of late nineteenth-century antiobscenity crusades is illuminating. Muybridge's commissioners were well aware of the growing pressure brought by repeated prosecution of what was defined as indecent imagery. The Comstock Act, ensuring heavy penalties for those who disseminated lascivious material through the U.S. postal system, had been enacted a little more than a decade earlier. Henry Comstock's cocrusader, the Philadelphian Quaker Josiah Leeds, made a name for himself by lobbying to prohibit images of women in tights on theater posters and naked women on cigarette boxes. Closer to home, in 1886, as Muybridge ended his second year photographing at the university, Edward Coates, a member of his committee, fired the painter Thomas Eakins for disrobing a naked male model in a class of female students. Images of the naked female body, such crusaders believed, elicited prurient thoughts in the minds of men that led to immoral actions and offended women. Photography, with its seeming truth to reality was particularly suspect: photographs slipped too easily between the private and public spheres. Medical photographs, academic nudes, and images of physical culture—bodybuilding photographs—were acceptable if limited to the eyes of doctors, artists, or athletes; once in the public eye, they were liable to prosecution.

Muybridge's nude photographs, with their suggestive poses and ungainly rather than idealized bodies, would have seemed an easy target for the crusaders. Yet the publication of *Animal Locomotion* was greeted with almost universal praise. Gordon claims their gridded backgrounds bestowed a scientific aura to the pictures while their sequential structure directed the viewer to look without lingering. More important, Gordon posits the social and professional status of the Muybridge committee members as the images' safeguard. They could, and did, publish with impunity.

This inner circle of Philadelphians, men who shared interests and relationships, included not only Penn professors on the cutting edge of medicine, engineering, veterinary science, physiology, neurology, and physics, but also members of the arts community centered on the Pennsylvania Academy of the Fine Arts, and the publishers of literary journals and medical periodicals. One of these publishers, Joshua Lippincott, provided financing for *Animal Locomotion* and published the completed work in 1887. Socially exclusive and intellectually superior, they were presumed to have the culture necessary to appreciate the artistic virtues of the nudes. By the very merits of their wealth, the rich, unlike the poor, were assumed to be immune to any deleterious effects the pictures might produce. Selling *Animal Locomotion* by subscription and to a targeted audience of artists and scholars was further protection. The high cost—a dollar a plate and the full set of 781 for $600—also helped.

Indecent Exposures is a study of the social, cultural, and intellectual reception of *Animal Locomotion* that adds valuable context to the subject.

Marta Braun

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Jeremy Gray. *The Real and the Complex: A History of Analysis in the Nineteenth Century.* (Springer Undergraduate Mathematics Series.) xvi + 350 pp., figs., illus., apps., bibl., index. Cham, Switzerland: Springer, 2015. €36 (paper).

The Real and the Complex originated in a course Jeremy Gray gave to upper-level mathematics students and is part of a Springer series on undergraduate mathematics. An important aim of the book is to help the student understand how any given part of mathematics first arises and comes to fruition. The historical subjects covered are familiar ones, but the treatment is informed by the considerable body of work of the past half century on the history of nineteenth-century mathematical analysis.

The book is written in the form of a survey. Gray opens with Joseph Lagrange's work on the theory of functions and proceeds to an account of Augustin Louis Cauchy's foundation for the calculus in the

1820s. He also documents contemporary work of Joseph Fourier on trigonometric series and Adrien Legendre on elliptic integrals. The author then proceeds to an account of Cauchy's pioneering development in the 1820s of a theory of functions of a complex variable. A report on the well-known work of Niels Abel, Carl Jacobi, and Carl Gauss on elliptic functions follows. Gray then resumes his study of Cauchy's work on complex function theory, going up to the 1850s, and goes on to examine how Joseph Liouville and Charles Hermite developed the theory of elliptic integrals and functions using functions of a complex variable. There are two chapters on results in potential theory obtained by Gauss, George Green, and Lejeune Dirichlet. The middle part of the book is devoted to the work of Bernhard Riemann and Karl Weierstrass on functions of a complex variable. In the concluding part Gray examines developments in the foundations of real analysis in the last part of the century. Also included here are chapters on Lebesgue integration and the beginnings of point-set topology.

Exercises for students are given at the end of many chapters. There are also two chapters entitled "Revisions," which contain a discussion of the historical material and suggestions of ways the students can reflect critically and historically on the subject. A novel and possibly controversial aspect of Gray's approach is the use of current software (Maple) to produce graphical images of the functions investigated by the various mathematicians. Clearly, it is engaging to do this sort of thing, and it may be stimulating to students, although the historical relevance is much less clear. Overall, Gray's account is more historically sensitive and certainly better informed than many traditional accounts of the history of modern mathematical analysis. English translations of some of the original sources (one in French and four in German) are given in an appendix.

Although the subject terms "real analysis" and "complex analysis" are standard today, they came into use only since the 1950s. When books with "real analysis" in their title first appeared in the early 1960s they were put in the Library of Congress classification scheme as a subsidiary subject of the theory of functions of a complex variable. Real analysis concerned subject matter that was traditionally subsumed under functions of a real variable, and this field was seen as a sub-branch of theory of functions of a complex variable, the latter being known simply as the theory of functions. From a certain point of view this seemed sensible, since real functions are a subset of complex functions. On the other hand, it made no sense historically or foundationally, where real analysis preceded complex analysis and the two were not always easily distinguished in a straightforward way. If there is one leading theme to this book, it is the rather tangled relationship that existed between real and complex analysis as these subjects developed and acquired their own identities in the nineteenth century.

Several subjects are excluded from Gray's survey of analysis, including the calculus of variations, summability theory, and the theory of differential equations. In fact, Gray plans a book on the history of differential equations in the nineteenth century. It, together with the present book and others on geometry and algebra that the author has already completed or has nearly completed, will form a tetralogy of works on mathematics of the nineteenth century.

It is difficult to imagine that more than a fraction of the contents of the book could be presented in a one- or two-semester course, and even then it would have to be to an exceptional group of students. Thus the intended audience of this book—current or former mathematics majors at colleges and universities—is somewhat idealized. This audience probably overlaps only slightly with the readership of *Isis*, in no small part because the mathematics community and the community of historians of science have to a large degree gone their own ways. Nevertheless, for those readers with some university-level background in mathematics who are interested in the technical contours of nineteenth-century science, Gray's book will repay careful study and is highly recommended.

Craig Fraser

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