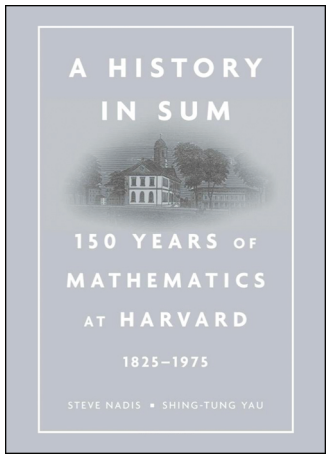
# A History in Sum

*Reviewed by Steve Batterson*




*A History in Sum: 150 Years of Mathematics at Harvard (1825–1975)*
*Steve Nadis and Shing-Tung Yau*
*Harvard University Press, October 2013*
*280 pages, $39.95*
*ISBN-13: 978-06747-250-03*

Mathematicians may be surprised by 1982 Fields Medalist Shing-Tung Yau's collaboration with science writer Steve Nadis on a history of the Harvard mathematics department. Perhaps anticipating some bewilderment, Yau begins his portion of the preface with a justification of why history is important to mathematics. For the purposes of this review, I regard historical value as an axiom.

*A History in Sum* joins Cal Moore's *Mathematics at Berkeley* in the genre of book-length histories of American mathematics departments. Although both volumes are dominated by biographies of university faculty, their underlying methodologies and objectives are very different. Moore wrote what might be classified as a traditional history. He excavated the Berkeley archives and produced a detailed record of the scholarly advancement of the department since the founding of the University of California in 1868. His narrative includes the basic vitae of every faculty member and much more, analyzing changes in the department over the years.

Nadis and Yau focus on the stories of Harvard personnel making pioneering mathematical discoveries. *A History in Sum* features biographies of fourteen Harvard faculty, from the period 1825–1975, "that made the greatest contributions to mathematics." Spoiler alert: If you would like to make your own selections, the names are listed two paragraphs below. In fleshing out these lives, the authors rely on interviews and published material rather than archival sources. As in their first book, *The Shape of Inner Space*, Nadis and Yau set out to make deep mathematics accessible. This time, instead of string theory, the topics range over the various breakthroughs of their stars.

Some readers will have opinions on the merits of a comprehensive departmental history versus singling out its greatest men (at Harvard they are all men). I welcome both approaches as valuable additions to the literature, particularly in view of the distinction of the Harvard and Berkeley departments. In the interest of full disclosure, I need to state that I received honoraria from Harvard University Press for commenting on the manuscript at two stages of its development.

The division of labor between the two authors is not discussed beyond that the initiative arose from Yau. One assumes that Yau selected the names. His bona fides confer special interest on what, in itself, is an intriguing list: Benjamin Peirce, Osgood, Bôcher, G. D. Birkhoff, Morse, Whitney, Mac Lane, Ahlfors, Mackey, Gleason, Zariski, Brauer, Bott, and Tate. Yau acknowledges an element of subjectivity in making difficult decisions about whom to include. While he understandably does not discuss specific omissions, consider some of the Harvard mathematicians who are not featured in the book. Fields Medalists Mumford and Hironaka, whose careers may have been regarded as too late, get some attention as students of Zariski. Joseph Walsh and Marshall Stone receive a mere paragraph apiece, comparable to Moore's coverage of Annie Dale Biddle Andrews, an obscure Berkeley instructor terminated in 1933. Dunham Jackson,

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DOI: http://dx.doi.org/10.1090/noti1133

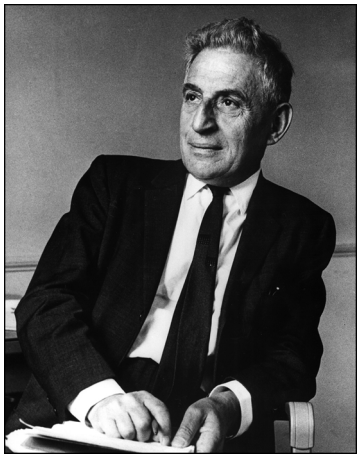

Photo: AMS Archives.

**Oscar Zariski**

who served on the Harvard faculty from 1911 until leaving for Minnesota in 1919, is not mentioned.

The fourteen biographies average about a dozen pages each, touching on both personal and mathematical lives. My prior knowledge of the individual subjects varied substantially. To my surprise, I was most fascinated by the story of Oscar Zariski, about whom I knew little.

Zariski was born at the end of the nineteenth century in a Russian city that is now part of Belarus. For his education he moved to the Ukraine, where World War I and then the Russian Revolution unfolded around him. In 1919 Zariski was wounded by shrapnel when he happened into a skirmish between Bolshevik and Ukrainian forces. Two years later he left embattled Kiev to continue his mathematical education in Italy.

In Rome, Zariski came under the influence of the pioneering algebraic geometers Guido Castelnuovo, Federigo Enriques, and Francesco Severi. As was characteristic of his life, Zariski made the most of the opportunities in an environment with monumental barriers. Despite being a Communist Jew in a time and place where Mussolini was advancing his fascist agenda, Zariski absorbed the classical techniques of his Italian teachers. He completed his Ph.D. in 1924 under Castelnuovo.

Zariski was fortunate in that, of the Italian geometers, Castelnuovo recognized the limitations of the Italian school. He encouraged Zariski to study the topological techniques being introduced by Solomon Lefschetz. Lefschetz, himself a Russian Jew, had just moved from the University of Kansas to Princeton. Lefschetz used his influence to assist Zariski in obtaining a research fellowship for 1927–1928 at nearby Johns Hopkins.

At Hopkins, Zariski came into his own as an independent scholar, earning a position on the faculty. In preparing his comprehensive text *Algebraic Surfaces*, Zariski gradually realized that the entire subject of algebraic geometry rested on a wobbly geometric foundation. As he began to craft a more rigorous algebraic replacement, a fortuitous opportunity arose. When the Institute for Advanced Study opened in 1933, his Johns Hopkins colleague Egbert van Kampen was part of an experiment in which several promising mathematicians spent a year in residence. The trial was so successful that the president of Hopkins agreed to provide full support for Zariski to visit the institute for 1934–1935. In that same year Emmy Noether commuted to Princeton from Bryn Mawr, delivering lectures on some of the algebraic structures that Zariski needed.

In 1945 Zariski made the most of a posting as an exchange professor in São Paulo. There he engaged in stimulating discussions with another visitor, André Weil. Two years after his return from Brazil, Zariski became the first tenured Jewish mathematician on the Harvard faculty. By attracting strong students and bringing in distinguished visitors, he soon made Harvard into an international center for algebraic geometry. In the late 1950s the Zariski milieu included his students Heisuke Hironaka, Michael Artin, and David Mumford, as well as the groundbreaking Europeans Jean-Pierre Serre and Alexander Grothendieck.

The biographies in *A History in Sum* illustrate contrasting approaches to doing mathematics. Whereas Zariski thrived on interaction with other great scholars, Hassler Whitney preferred "solitude". According to Nadis and Yau, Saunders Mac Lane's most important contributions came out of his long-term collaboration with Samuel Eilenberg. Andrew Gleason never wrote a paper with his Harvard colleague George Mackey, but found inspiration from their frequent discussions.

Interspersed throughout the twenty-one-page section on Zariski is a variety of mathematical excursions, beginning with the basic idea of algebraic geometry. The authors discuss the motivation behind Zariski's development of algebraic tools as well as provide an introduction to problems over finite fields. I liked the explanation of resolution of singularities, taken largely from an interview of Hironaka in the October 2005 *Notices*.

Nadis and Yau draw heavily from Carol Parikh's biography *The Unreal Life of Oscar Zariski*. Their narrative is enhanced by fresh recollections of mathematicians from Zariski's circle. Over sixty interviews were conducted for the book, including Tate, the only featured subject who survives. The remembrances about Raoul Bott give the reader a genuine feeling of Bott's jovial charm. On the other hand, the section on Marston Morse only hints at the magnitude of his ego.

The authors turned up a variety of biographical sources on their subjects. A minor criticism is that, in some cases, they could have used more discretion in filtering biased perspectives. For example, Garrett Birkhoff should not shape the impression of his father. The dogmatic Norbert Wiener is a less-than-objective source on Harvard faculty. Memorial tributes have a tendency to airbrush personal qualities.

Nevertheless, the featured subjects stand on the merits of their theorems. Tying them together

is their link to Harvard. The strength of the Harvard mathematics department, going back to Ahlfors and Birkhoff, is well known. The careers of Benjamin Peirce, W. F. Osgood, and Maxime Bôcher demonstrate that, with the exception of the ten years from Peirce's death (1880) to the appointment of Osgood (1890), the university faculty has included leading mathematicians since 1831. Indeed, Harvard merits consideration with Johns Hopkins and the University of Chicago as the first academic home for mathematical scholarship in the United States.

Although the authors focus on mathematics at Harvard, a connection to the university is not necessary for enjoyment of the book nor is any special knowledge of the areas explored. *A History in Sum* should find an audience among mathematicians from two broad classes: those who enjoy biography and those who would like to gain a nontechnical flavor of major developments in their science.