BOOK REVIEW

A Richer Picture of Mathematics

The Göttingen Tradition and Beyond

Reviewed by Jemma Lorenat

A Richer Picture of Mathematics
The Göttingen Tradition and Beyond
By David Rowe

A Richer Picture of Mathematics delivers on the promise of its title.

As a contributor and then editor of the "Years Ago" column for *The Mathematical Intelligencer* since the 1980s, David Rowe wrote scores of articles that illustrate his deep interest in the history of mathematics, particularly focused on nineteenth- and twentieth-century Göttingen and the reverberations of this mathematical explosion, from Hilbert's axiomatic foundations of geometry, to the concept of spacetime, to the now commonplace weekly mathematical research seminars as a formative part of the graduate school experience. A selection of these articles is thoughtfully compiled into six thematic parts. Rowe begins each chapter with an explanatory introduction highlighting unexpected interconnections and updating older material with references to contemporary contributions (there are also updated references in the articles themselves).

David Rowe is a historian of mathematics who is dedicated to subjects of broad interest to the wider mathematical community. Most readers of the *Notices* will know of Felix Klein, David Hilbert, Emmy Noether, Henri Poincaré, and Albert Einstein, but will still be enlightened by the details of, for instance, Poincaré's week-long visit to Göttingen in 1909 as the first guest of the Wolfskehl Foundation, which had been founded to award a proof or counterexample to Fermat's Last Theorem (Chapter 16). Poincaré spoke on a wide range of mathematics, but Rowe focuses particularly on his fifth talk about set theory in which he argued against the axiom of choice much to the assembled audience's chagrin. Later that day, Ernst Zermelo gave a talk to the same audience, from a very different philosophical perspective.

As Rowe demonstrates, these well-known names thrived amidst a supportive community of mathematicians. Any one chapter of this text confirms that mathematics and physics are collective endeavors only made possible through communication, revision, and networking. The wonder of this text is to glimpse this process in action through well-chosen quotes as well as substantial excerpts from archival primary sources. Rowe's choice of subject matter often involves mathematicians who were also exceptional writers. In particular, Rowe describes Weyl "whose masterful control of the German language was probably unmatched by any other mathematician" (p. 185).

One persistent theme running through this text is the personal effort required to gain an audience for mathematical innovations. To take one illustrative example, Rowe's excerpts from Sophus Lie's letters to Klein from Paris during the 1890s reveal his dedication to educating French mathematicians about the advantages of his recent contributions to the study of groups. While Lie found Charles Hermite very amiable, he doubted whether the older mathematician truly understood group transformations.

> Poincaré comprehended me clearly, and I believe Picard as well. On the other hand, I fear that Hermite's recognition was only pleasant phrases. Hermite is a man of the world in conversation, but he appears now to be just a *little* old. (p. 108)

A photograph of Hermite from this time period confirms that he was not young (Figure 1).

Jemma Lorenat is an assistant professor of mathematics at Pitzer College. Her email address is jemma_lorenat@pitzer.edu.

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Figure 1. Charles Hermite

Figure 2. Felix Klein

Though it involved navigating several difficult personalities, Lie's networking points to the value of personal contact in the dissemination of mathematics, particularly in an era when those writing in German might not be read by French mathematicians.

In these collected articles, Rowe presents engaging narratives, sometimes for their own sake and sometimes as evidence for a socially informed vision of the history of mathematics. While Rowe is scrupulous in pointing out false myths and challenging stereotypes, he does so in a compassionate tone and without scolding. Further, the truthful version of events is usually more interesting. As Rowe remarks regarding "Klein, Hurwitz, and the 'Jewish Question' in German Academia,"

> Unfortunately, Meissner's version of the events obscures a far more poignant story, one that deserves to be widely known. In retelling it here, I hope not only to correct the record but also to suggest some larger themes relating to the vulnerability of German Jews who pursued academic careers in mathematics. (p. 171)

Ernst Meissner, Hurwitz's former student, wrote in 1919 that Hurwitz declined an offer of a position in Germany because he wanted to remain at the ETH in Zürich. Yet, as Rowe shows through a careful study of the archival record, Hurwitz was never offered a position outside of Zürich, despite the high opinion of his mathematics expressed by Klein and others. Indeed, the folklore that Rowe aimed to correct in 2007 (when this article first appeared) still remains in the account on Hurwitz in the MacTutor History of Mathematics Archive (which Rowe cited as one version of the false story).

With comprehensive cited references updated to represent the latest scholarship, Rowe's text might also serve as an introduction to more historically or mathematically technical treatments (including his own work published in other venues). That is not to diminish the serious scholarship demonstrated in this volume. Among historians of mathematics, Rowe is well known (among other things) for his authoritative treatment of the forms and functions of mathematical research schools with an emphasis on Göttingen under Klein (see [2]). Klein (pictured in Figure 2 from the 1870s) remains a focal point in *A Richer Picture of Mathematics*, but other chapters explore how the Göttingen research school evolved under Hilbert and then Courant, eventually inspiring Courant's program at New York University.

One aspect of this research school was the weekly meeting of the Göttingen Mathematical Society, where professors, graduate students, and distinguished visitors would present and discuss their research. Rowe provides an illuminating quote from Max Born that paints a not very welcoming picture.

> Books were piled on the green cloth of the tables; at the beginning of the meeting Klein gave a short account of his impressions of some of these new publications and then circulated them. So everybody soon had a book in his hand and paid very little attention to the speaker, and what attention he gave was mostly in the way of objection and criticism. (p. 145)

Born goes on to explain the many distinguished members of the audience and the emotional strain on the part of the speaker. On the other hand, Rowe also shows how Klein and Hilbert supported talent above all, such as in their fight to secure an academic position for Emmy Noether.

Rowe also welcomes the reader into more personal stories. Most charming is his interview with Dirk Struik (1894–2000) in Chapter 32. Struik studied mathematics in Göttingen during the 1920s and later contributed profoundly to the history of mathematics as a social history. In these two contributions, he bridges Rowe's work as a historian and the subject of mathematics in Göttingen. For another account of their friendship and the delightful circumstances that led to the photograph on page 405, one can turn to Struik himself [1].

The occasional repetition between chapters serves to reinforce significant episodes and key arguments. By Chapter 28, one is already familiar with the facts of the matter surrounding the choice to hire Edmund Landau in Göttingen, despite or because of his difficult personality. In the early twentieth century, when a new academic position opened at a German university, the practice was for faculty to draw up a list of several candidates to submit to the government for the final selection. Strikingly, the candidate list to replace Minkowski, who had died suddenly, consisted of three Jewish number theorists: Otto Blumenthal, Adolf Hurwitz, and Edmund Landau. The true story thus serves to make Richard Courant's peculiar recollection of the events all the more striking. In Courant's version, Landau was selected over Oskar Perron (who was not Jewish and, more importantly, not even an actual candidate). Rowe reconciles the disparities between this and other "counterfactual Courant stories" and more objective versions, in turn drawing more information about the storyteller. In this way many mathematicians feature as alternatively minor characters, contributors of anecdotes, and objects of study as the book progresses.

Instead of reading cover-to-cover, the chapters might be perused in any order. Someone particularly interested in Hilbert's 23 Paris Problems could start with Chapter 15, which might spark interest in Hermann Minkowski's contributions to relativity theory, thus jumping to Chapter 18, or to a later effort in predicting the future of mathematics that is presented in Chapter 37. The book is accompanied by an extensive name index, which could assist in this form of selective reading.

The one difficulty of this text is its tremendous size. The *Mathematical Intelligencer* is a full-page magazine, and (perhaps in order to include the striking full-color illustrations in their full size) this book retains the same format. The effect is textbook-like and thus cumbersome in a way that is not complementary to its accessible and lively contents. This is doubly unfortunate, as this is exactly the kind of text one would want to lend to a colleague or student curious about the developments of so many branches of modern mathematics.

References

[1] Dirk J. Struik, *On my trip to Europe, August 1–9, 1989*, Historia Math. **21** (1994), no. 3, 276–279. MR1295720

[2] David E. Rowe, Mathematical schools, communities, and networks, *The modern physical and mathematical sciences*, Camb. Hist. Sci., vol. 5, Cambridge University Press, Cambridge, 113–132, 2003. MR1990318

Jemma Lorenat

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