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Mathematical Visions: The Pursuit of Geometry in Victorian England (Book Review)

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Abstract

Reviewed Title: Joan L. Richards. *Mathematical Visions: The Pursuit of Geometry in Victorian England.* xiii + 266 pp., illus., figs., bibl., index. Boston/New York: Academic Press, Harcourt Brace Jovanovich, 1988.

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Disciplines

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degree candidates, postdocs, and assistants had worked with Fischer over a period of four decades (see Appendix I). From a historical point of view one is at a loss to know why a republication in 1987 was warranted, except for the prologue, epilogue, and bibliography of the editor, Bernhard Witkop. In several small essays the editor brings Fischer to life, with commentary on topics such as Fischer on the subject of the sensitivity of the nose to odors, his contributions to the Karlsbad Congress of 1902 on exploitation of hydrazine chemistry, the dynamic aspect of carbohydrates, and the importance of methylated purines for genetic engineering. Not cited by Witkop is the rich, invaluable information on Fischer's views about science and many other issues to be found in the Fischer Papers, including correspondence, donated by the only surviving son, biochemist Hermann, and housed since 1970 in the Bancroft Library in Berkeley (see Natasha X. Jacobs, "The Emil Hermann Fischer Papers," *Mendel Newsletter,* March 1983, no. 22).

As Witkop mentions, Fischer's document, which was written "to beguile the tedium of two convalescences," communicates a style that is informal and unbuttoned (pp. v–vi). It dwells, in an extraordinary way, on daily trivia and melancholic events associated with family (the lives, ordeals, physical features, and mental facilities of his four sisters, spouses, children, and cousins), colleagues (with no slinging about of famous names), and numerous friends and acquaintances. It also displays Fischer's deep malaise at having chosen to teach in sober and unbending Berlin (1892–1919).

The chapters on Fischer's preprofessional years convey some insights into a parental environment conducive to one's choosing a career as an empirically oriented, candid experimentalist: game hunting as a serious but fun avocation for the family; a jocose, slow-thinking, Rhenish atheist father who had little education but never ran a bum business deal; a deeply religious Prussian mother who fostered her only son's interest in scientific studies; and a good exposure, for young Emil, to the relevance of chemistry in the Dortmund brewing business.

Fischer was somewhat negative concerning chemical training for women. He admitted Hertha von Siemens as the first woman trainee into his chemical institute in Berlin, but she married one of Fischer's post-Ph.D. assistants (Carl Harries) and gave up chemistry, thus confirming his prejudice. He felt that the achievements of young women were no less noteworthy than those of young men, but that it was not practicable (*zweckmässig,* p. 192) for women to enter chemistry professionally—except to help out during wartime or to contribute to medicine or elementary education.

In light of the recent publicity and polemic about cold fusion, it is timely to mention Fischer's aspirations concerning element transformation. Long before radioactivity phenomena were observed, so Fischer tells us (pp. 162–163), he toyed with the hypothesis that, under the extreme conditions of high temperatures and low pressure that prevail in the sun and stars, element transformation might be realized in the laboratory. He says that he frequently mentioned these views in his lectures but never published anything on the subject because he was unable to support his speculations with any factual evidence. However, in 1898/99, while at Wurzburg, he and Friedrich Kohlrausch carried out numerous experiments in which very pure hydrogen, at 6–8 mm pressure, was subjected to cathode ray beams that were as intense as the vessels could bear. They searched for noble gases spectroscopically, but in vain. Ergo no publications. Chemists 1989 à la Horace: *Nil desperandum.* Physicists also à la Horace: *Nil admirari.*

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Joan L. Richards. *Mathematical Visions: The Pursuit of Geometry in Victorian England.* xiii + 266 pp., illus., figs., bibl., index. Boston/New York: Academic Press, Harcourt Brace Jovanovich, 1988. $34.95.

From the time of Plato down to our own century, Western culture has exhibited a deep-seated commitment to the ideal that absolutely certain truth about the structure of created reality can be attained through human reason. Mathematics has always been the model science in this quest, demonstrating in its methods and results that such a goal can be successfully realized. Hope was thus kept alive that similar knowledge might one day be achieved in the physical and social sciences and even in moral theory and religion.

A number of nineteenth- and twentieth-century trends in science undermined this outlook and cast doubt upon the accomplishments of the enterprise. Technical developments in mathematics itself, especially the appearance of non-Euclidean geometry, made people skeptical about the program and helped reshape epistemological expectations in mathematics and elsewhere.

In *Mathematical Visions* Joan Richards documents the response of nineteenth-century English mathematicians and educators to new discoveries in geometry. Placing their reactions within the broader cultural and intellectual climate of Victorian society, the author relates perspectives on the foundations of geometry to events of the time and so is able to make sense out of certain technical developments that seem inexplicable from the more narrow viewpoint of a purely internal history of mathematics.

The genesis of non-Euclidean geometry in mid century posed serious problems for traditional views of mathematical truth. One could no longer hold that geometrical knowledge provided necessary truths about the world. Various Continental mathematicians, convinced that non-Euclidean geometry was logically consistent, concluded that geometry must be an empirical science. A few English mathematicians and scientists followed suit. As Richards notes, they were mainly those disposed toward scientific naturalism in the debate over evolution.

The majority of Victorian mathematicians, however, had too much at stake culturally to draw this conclusion. The transcendent truths of Euclidean geometry formed the basis for the privileged position of mathematics in liberal education at Cambridge, and they provided crucial support for theology's claim that absolute truths existed and could be known. Since the truths of geometry could not be defended as necessary in the sense that their opposites were self-contradictory, mathematicians shifted their understanding of "necessary" from the realm of logic to that of epistemology or psychology. Euclidean geometry was necessarily true because its alternatives lacked conceptual clarity and spatial content. Richards overlooks the point, but the discovery of Euclidean models for non-Euclidean geometry enabled mathematicians to maintain the primacy of Euclidean geometry as the only system that does justice to the nature of the straight line and the plane.

The debate in the 1860s over non-Euclidean geometry and the nature of geometrical truth was largely defused in the 1870s when it was shown that Euclidean and non-Euclidean geometries could be considered types of projective geometry equipped with different metrics. This gave rise to new problems, but it allowed English mathematicians to incorporate the new geometries into mathematics without granting them ontological status as theories of space.

The last two chapters are devoted to a discussion of educational trends in school geometry at the end of the century and to an examination of Bertrand Russell's early work in foundations of geometry. An epilogue then briefly discusses certain twentieth-century developments, when mathematicians had largely adopted a more formal viewpoint. This part of the book is the least satisfying and the most incomplete, and really requires, as the author remarks, another book. No final answer is provided to the question of what effect non-Euclidean geometry actually had on the emerging abstract, formal outlook in mathematics, but it is clear from the English reaction that the historical connection is more complex than standard accounts suggest.

Mathematical Visions grew out of the author's 1980 dissertation and goes beyond the articles she has already published on the topic. It is attractively printed and well documented and contains almost no misprints; the bibliography is exhaustive and up-to-date. The book provides a scholarly survey of a subject that has been largely unexplored until now, and it does so without making excessive demands on the reader who lacks a technical background in projective and non-Euclidean geometry. It is an excellent addition to Victorian intellectual history and to the history of geometry and provides a model for how history of mathematics can be pursued holistically.

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Charles Darwin. *The Correspondence of Charles Darwin.* Volume IV: *1847–1850.* Edited by **Frederick Burkhardt** and **Sydney Smith.** xxxiii + 711 pp., illus., apps., bibl., indexes. Cambridge/New York: Cambridge University Press, 1988. $37.50.

The many virtues and manifest achievements of the whole remarkable Darwin