Biographie. Felix Hausdorff, Gesammelte Werke. Band IB.

by Egbert Brieskorn and Walter Purkert

BERLIN: SPRINGER, 2018, XXII + 1131 PP., €123.35, ISBN 978-3-662-56380-9

REVIEWED BY GERT SCHUBRING

The almost universal student movement of the 1960s, aiming at removing encrusted social structures, had a specific focus in West Germany: to attack the unmastered past of German universities during the Nazi period. At Bonn University, the movement began as early as 1967, and it was particularly strong among mathematics students. We activists learned, and only then from outside publications, about mathematicians persecuted by the Nazis, among them an eminent Bonn mathematician of Jewish descent, Felix Hausdorff (1868–1942). At the Mathematics Institute, Hausdorff was not part of the shared historical discourse. And we learned from its librarian that Hausdorff's Nachlass, which was supposed to have remained in the library's cabinets, had been removed to Münster by a mathematician who said that he was going to work with it. In fact, he neither published on it nor returned it. It was only in 1980 that a commemorative marble plaque was installed. And in 1992, the Institute organized a colloquium to commemorate the fiftieth anniversary of Hausdorff's death.

Egbert Brieskorn (1936–2013), who had studied in Bonn and earned his habilitation there in 1968 before becoming a mathematics professor in Göttingen, took up the challenge of delivering the biographical address at the Hausdorff memorial colloquium. Studying Hausdorff's life and writing his biography thenceforth became the mission to which Brieskorn devoted the next twenty years of his life. The project developed into the biographical volume of Hausdorff's *Collected Works*, a huge editorial undertaking that followed in the aftermath of the memorial colloquium [1]. The publication of the series was organized by the *Nordrhein-Westfälische Akademie der Wissenschaften und der Künste*, and its board comprised, besides Brieskorn, Friedrich Hirzebruch, the leading Bonn mathematician; Reinhold Remmert, a mathematician from Münster who represented the Academy; Erhard Scholz, a comrade student activist and historian of mathematics; and the mathematics historian Walter Purkert, the one in charge of all the editorial work.

When Brieskorn passed away in 2013, the first 546 pages of the scientific biography were ready. He left behind no notes regarding how he would have continued the chronologically organized work, and it was Purkert who

finished the volume in Brieskorn's spirit. In 2018, the monumental 1131-page work was published as a result of admirably detailed investigations documenting the life and work of a German Jewish mathematician in the context of anti-Semitism and Nazism.

Brieskorn's biography is structured in nine chapters, with numerous subchapters, arranged basically chronologically. The biography has two key foci, which contextualize the life and work of this scientist. I will highlight them first.

Brieskorn, profoundly ashamed for the crimes committed by the Nazis against the Jews as well as against those whom they defined to be Jews, did meticulous research on the integration policies of Jewish communities into German societies, principally in Prussia, since the eighteenth century and about the roots of the Hausdorff family. In so doing, he achieved something of a historical analysis of anti-Semitism in Germany.

The Enlightenment movement in the eighteenth century effected first, yet not consistently, a reduction in anti-Jewish governmental discrimination policies and brought about changes within the Jewish communities themselves. In particular, these communities opened toward the cultural environment from which they previously had been excluded and thus socially and culturally segregated, with the philosopher Moses Mendelssohn serving as an emblematic representative of an enlightened and emancipated eighteenth-century Jew. In 1812, Jews were admitted as citizens in Prussia. Yet in the following decades, there were setbacks. Moreover, the 1812 laws were not applied to all of Prussia. For instance, Breslau, where Hausdorff's ancestors lived, had been part of the Grand Duchy of Warsaw. After its reintegration into Prussia in 1815, the province continued to uphold the more restrictive regulations of the Grand Duchy.

Brieskorn ingeniously identified promising sources and ably traced Felix's ancestors on both his mother's and father's side back to the second half of the eighteenth century. Likewise, he succeeded—thanks to an astonishing degree of preservation of archives of nineteenth-century businesses in Leipzig, whither the family had moved in 1870—in documenting the numerous enterprises run by Felix's father, the merchant Louis Hausdorff (1843–1896), and his relatives. He was also able to analyze the positions that Louis Hausdorff assumed and defended within the local Jewish community, which was facing rising anti-Semitism, based on his publications and on his arguments in community debates in Leipzig. Brieskorn characterizes him as a militant private scholar who was well versed in the tradition of Talmudic discourse and who argued in its spirit (p. 65).

The other main focus of the biography is an attempt to understand Felix Hausdorff's "dual life" (p. 243) as the philosopher "Paul Mongré," his pen name, on the one hand, and as the scientist-mathematician Felix Hausdorff on the other. Due to the absence of more concrete evidence for this double life, Brieskorn highlights the strongly literary culture at the Nicolai-Gymnasium of Leipzig, where Felix was educated from 1878 to 1887 and where he learned to write poetry. Brieskorn calls the dominance of

classical education, with Greek and Latin as key disciplines, “neohumanist,” but he here uses the term erroneously, failing to give sufficient consideration to the differing educational structures and values in different German states. While the Prussian reform movement of 1810 had instituted the notion of the neohumanist gymnasium, that is, one no longer dominated by classical values, Saxony continued to practice classical humanist education [2]. Even so, Hausdorff did not become a one-sided “humanist,” achieving rather an equilibrium between the arts and sciences; he was the only one among his cohort to have obtained a top “1” as the overall score in all his school subjects (p. 70).

As another probable source of information concerning Hausdorff’s intellectual development, Brieskorn analyzes the lectures that he attended besides those in mathematics and the sciences. Indeed, the traditional ideal of academic education in Germany (before the EU-imposed Bologna process!) included attending lectures outside one’s own specialty in the Philosophical Faculty. Indeed, Hausdorff—during his first four terms spent at the Universities of Leipzig, Freiburg, and Berlin—attended a considerable number of extracurricular lectures, ranging from music to theories of socialism and especially philosophical matters, while he concentrated more on mathematics during his last five terms, all spent at Leipzig. Brieskorn’s analysis of young Hausdorff’s forays into philosophy in particular reveal that issues around the relationship between thought and language (*Sprachkritik*) as well as that between space and time (pp. 85ff. and 180ff.) assumed the greatest importance for his development. Best documented, thanks to his lecture notes from his term in Berlin, is the influence of Friedrich Paulsen (1846–1908), who organized discussion sessions around Kant’s *Critique of Pure Reason*. Paulsen was not only a historian of German education but also a specialist in Kant’s philosophy; his conceptions of transcendental philosophy and the evolution of our ideas and concepts regarding space and time agreed well with Hausdorff’s (p. 187).

Brieskorn characterizes the opposite poles of Hausdorff’s “double life” as philosopher and mathematician as two spheres: “the one, perhaps as the ecstatic personal experience of time, of feeling, the other as critical conceptual thinking, the scientific man” (p. 275). In 1897, Hausdorff began to publish papers and books as a philosopher, writer, and time-critical essayist, adopting Paul Mongré as his pen name, which can be explained as a derivation from *à mon gré*, “according to my taste” (p. 260). Hausdorff’s philosophical conceptions, as expressed by Mongré, were shaped by the confluence of three movements marking strongly the German cultural landscape, particularly in the last third of the nineteenth century: the music of Richard Wagner and the philosophies of Arthur Schopenhauer and Friedrich Nietzsche. His notes on lectures on projective geometry, for instance, are peppered with references and drawings related to Wagner’s *Lohengrin*, *Rheingold*, *Parsifal*, etc. (pp. 107ff.). Hausdorff himself characterized his way of developing his philosophical thinking as moving “from Wagner to

Schopenhauer, from there back to Kant and ahead to Nietzsche” (p. 111).

The publication of Hausdorff’s doctoral thesis of 1891/93 and habilitation dissertation of 1895 were followed by two mathematical papers under his own name, but between 1897 and 1903 he mainly published as his alter ego, particularly his two key books in 1897 and 1898. Between 1905 and 1908, however, Mongré published nothing, returning to the scene in 1909 and 1910 and making his final appearance in 1912. Mongré’s first book, *Sant’ Ilario. Gedanken aus der Landschaft Zarathustras*, was written in Nietzsche’s preferred landscape of northern Italy. It was not a systematic presentation of anything but consisted of 411 aphorisms and sonnets on a variety of topics discussed by Schopenhauer and Nietzsche, in particular their doctrine of eternal recurrence of the same. This book can be understood simultaneously as an expression of either close affiliation or cautious reticence in his attitude towards Nietzsche (p. 264). The book enjoyed an overall positive reception, quite different from the second one, *Chaos in kosmischer Auslese*, which connected mathematics and philosophy. The title refers to an uncountable set of cosmic worlds, the existence of which the author proposes and among which a selected one always appears to its inhabitants as a unique and exclusively real world (p. 309). The book is an attempt at epistemology in its discussion and adaptation of Kant’s transcendental idealism of space and time to the state of modern science. The philosophical refinement discussed aims to relate the concepts of essence and existence to “time content” and “time sequence” (pp. 326ff.). The analysis of the notion of space was connected to contemporary developments of non-Euclidean geometry and its philosophical implications. In fact, Hausdorff’s inaugural lecture in Leipzig in 1903, on the space problem, was an emblematic contribution to the epistemology of geometric space.

The mathematics curriculum at the Nicolai-Gymnasium had been quite elementary and traditional, following the Saxonian practice of humanism. In 1887, however, Hausdorff began his studies at the University of Leipzig. Felix Klein had moved to Göttingen the year before, and his successor was Sophus Lie, an eminent mathematician whose psychiatric problems had begun to affect his relationship with the mathematical community precisely in those years. Hausdorff attended his lectures, and a project of cooperation was envisaged, but Lie’s worsening health impeded its realization. Thus, Hausdorff worked with other mathematicians at Leipzig: Adolph Mayer (1839–1908), a specialist in variational calculus and partial differential equations; and Heinrich Bruns (1848–1919), an astronomer and the director of the Leipzig Observatory. Apparently uninterested in becoming a gymnasium teacher of mathematics, Hausdorff pursued doctoral studies—without a prior teacher’s examination—supervised by the astronomer Bruns; one wonders why he did not specialize in pure mathematics. He defended a thesis on astronomical refraction in 1891 and worked for some time thereafter as a calculator at the observatory. For his habilitation as a university lecturer in 1895, he continued work in this area, studying the absorption of light in the atmosphere.

The first course that he gave as a privatdozent at the University of Leipzig was on celestial mechanics, the next one on cartographic projections. Both had so few students that Hausdorff chose analytic geometry for his third term in 1896, acquiring a larger audience. During that term, he also lectured on actuarial mathematics, a topic incorporated into the curriculum thanks to governmental initiatives. At the private commercial college (*Handelshochschule*) established in Leipzig in 1898, Hausdorff regularly lectured on actuarial mathematics, mathematical statistics, probability theory, and political arithmetic (p. 249), until his move to Bonn in 1909/10. He also served as library assistant at the mathematics seminar of the university.

Although Hausdorff had published only two mathematical papers since his doctorate and habilitation, the Göttingen faculty ranked him second, in 1897, for an extraordinary professorship in theoretical astronomy and higher geodesics (pp. 284ff.). In 1901, after having published just two additional papers—one on non-Euclidean geometry and the other on systems of complex numbers—the faculty of his university requested that the ministry appoint him as a “supernumerary extraordinary professor,” which was a rather standard manner in Saxony of promoting a privatdozent, after some years of activity, to a regular, albeit unsalaried, position. Even though a minority of the faculty voted against this promotion (22 in favor, 7 against) because of his “Mosaic faith” (p. 508), the ministry appointed Hausdorff. His inaugural lecture, on the space problem, was delivered only in 1903. It was published shortly afterward and proved to be a highly substantial, epistemologically well-argued analysis of recent developments in the conception of space in mathematics. Mongré’s philosophizing was thus transferred to mathematics. Hausdorff even used the notion of “model” in the epistemological sense well before Hermann Weyl took it up for mathematics in 1918 [3].

According to German social norms, a man could marry only after having achieved a certain “position.” Even so, Hausdorff married Charlotte Goldschmidt in 1899, a bit before his promotion of 1901. Charlotte, born in 1873, was the daughter of the Jewish physician Sigismund Goldschmidt and his Lutheran wife Coelestine (née Bendix), whose father was a Jewish merchant and whose mother descended from noble Protestant families. The young couple had one daughter, Lenore, born in 1900 and baptized as a Protestant. In 1925, Lenore married Arthur König, a Protestant astronomer working with the Zeiss company. Lenore, who passed away in 1991, was very helpful in assisting Brieskorn in writing her father’s biography. Brieskorn provides a sort of psychographics of the couple Felix and Charlotte Hausdorff (pp. 463ff.).

Hausdorff’s first attempt at mathematical research failed, the conception proposed by his supervisor Bruns proving unsustainable (p. 606). After various other trials, set theory (*Mengenlehre*) turned out to be the area of his most famous mathematical contributions. Having learned about Cantor’s new concepts from Hurwitz’s talk at the first International Congress of Mathematicians (Zurich, 1897), he undertook research in set theory and gave lectures on it in 1901. At the Heidelberg Congress in 1904, the third ICM, Hausdorff’s

contributions presented evidence of significant progress regarding the vehemently debated questions surrounding the continuum problem and the well-ordering of the continuum (pp. 625ff.). The ensuing research in order types of ordered sets led him to intense research in the entire domain of set theory (thus, besides ordinal and cardinal numbers and order types, also the theory of point sets and measure theory), which he succeeded in presenting in a comprehensive form in his textbook *Grundzüge der Mengenlehre* (1914), which became a standard reference for set theory. In the generation of mathematicians after Cantor, Hausdorff was the researcher who considerably extended the mathematical substance of set theory. The biography provides a careful situating of the textbooks on set theory available before Hausdorff’s publication of 1914 and presents an excellent and extensive analysis of his contributions.

Thanks to his by then numerous mathematical publications, Hausdorff was proposed as a regular (i.e., paid) extraordinary professor at the University of Bonn in 1904, but the ministry chose to nominate another mathematician. This sequence of events repeated itself at Greifswald (in Prussia) also in 1904. In both cases, the ministry may have been deliberately avoiding a Jewish scholar. It was only in 1910 that a call to a regular extraordinary position became a reality at Bonn, instigated by Eduard Study (1862–1930), whom Hausdorff knew from his time in Leipzig and with whom he shared many mathematical interests. The decisive promotion to an *Ordinarius* position followed in 1913 at Greifswald, Hausdorff’s set-theoretic research having been a major argument for the call (p. 735). The other *Ordinarius* at Greifswald, Theodor Vahlen, would become one of the most active Nazi mathematicians; indeed, together with Ludwig Bieberbach, he founded the infamous journal *Deutsche Mathematik*. In 1921, Hausdorff received a call back to Bonn; his work on set theory was highlighted, together with recent analytic research. This allowed him to leave the small University of Greifswald, with its reduced sphere of social relations and uncomfortable relation with his only colleague in mathematics.

In Bonn, Hausdorff began a period of excellent cooperation with three colleagues, first with Study and then, after his retirement in 1927, with his successor, Otto Toeplitz (1881–1940), as well as with the young historian Erich Bessel-Hagen (1898–1946). Hausdorff made contributions to several branches of mathematics: probability theory, which he first taught in 1923, presenting probability as an axiomatically structured discipline well before the better-known work by Andrey Kolmogorov, as well as combinatorial topology, set theory, Fourier series, the momentum problem, topological spaces, metric spaces, and hypercomplex numbers. Bonn provided not only an excellent network of relations at the local level but also international contacts, some of which developed into fruitful friendships, in particular with Paul Alexandroff.

The decisive turning point was the Nazi takeover in January 1933. The first immediate measures of summarily dismissing professors in March 1933 did not yet affect Hausdorff, since civil servants who had been *Beamten* (the upper category of civil servants in Germany) since at least

August 1, 1914, were exempted. Anti-Semitic student riots forced Hausdorff to cancel a lecture for the first time on November 29, 1934. Next, the regime made sixty-five the compulsory age of retirement, but Hausdorff, who was already sixty-seven and emeritus, did not suffer discrimination due to this change. A preserved document, in which a group of Nazi-activist students evaluated the mathematics professors of Bonn, classified Hausdorff as “in no way harmful to the student body” (p. 945). Things changed drastically shortly thereafter, with the racial Nuremberg laws decreed in September 1935. Even earlier, as many as 637 decrees and laws discriminating and persecuting people regarded as Jews had been enacted. By 1935, Hausdorff was forced to sell a small publishing company inherited from his father. Between 1935 and 1939, 582 additional laws, decrees, and orders were issued that made life for families deemed Jewish unbearable. A decree of December 1935 changed Hausdorff’s status from an emeritus professor to a retired person, thereby halving his pension. This, however, was revoked a few days after its enactment. Hausdorff, who reportedly thought that the Nazis “would not harm us old people” (p. 953), remained calm, withdrew into his mathematical research—mainly set theory and topology—and made no effort to emigrate in the time period when it would still have been possible.

Toeplitz, who was forced to retire with a poor pension in 1936, tried to organize the survival of the small Jewish community in Bonn. Two *Ordinarius* positions were thus vacant, but replacement proved complicated, since the faculty refused several poorly qualified candidates. The ministry ultimately imposed two members of the National Socialist German Workers’ Party (NSDAP), Ernst Peschl and Wolfgang Krull, both of whom were competent mathematicians.

Even before the *Reichs-Kristallnacht* of November 9, 1938, the situation of the Jews in Germany had decisively worsened during that year: their passports were declared invalid; they had to apply for an identity card marking them as Jews; and they had to adopt a typically Jewish first name. Almost at the last moment in 1938, Toeplitz decided to emigrate and successfully arrived in Palestine, where he died shortly afterward, in 1940. Hausdorff, who had always thought he would not be personally persecuted, became more realistic following the increasingly inhuman discriminations and expropriations after *Kristallnacht*. On January 31, 1939, he wrote to Richard Courant, asking for his help in finding a fellowship in the United States. Courant and Hermann Weyl actively offered assistance, but it was too late. There were already too many applicants.

After the invasion of the Soviet Union in June 1941 and the Wannsee Conference of January 1942, the Nazi government reinforced its insistence on eradicating all non-Aryan blood. Thus, the last remaining Bonn inhabitants regarded as Jews would also be eliminated. Around January 18, 1942, Felix and Charlotte Hausdorff, together with Edith Pappenheim, one of Charlotte’s sisters, who had long been living with the family, received the order to present themselves at a collection point in Endenich, a Bonn suburb, on the twenty-ninth, an order understood to imply that they

were to be transported to a concentration camp. Having foreseen such a destiny, they had decided (and prepared) to avoid it by taking their own lives. This they did on the twenty-fifth, by an overdose of veronal. Those detained in Endenich—in a confiscated monastery—were transported in July 1942 to various concentration camps.

Hausdorff’s voluminous Nachlass was saved by a family friend, the Egyptologist Hans Bonnet, who had the space to store it. It was only in a new epoch that Bonnet thought it appropriate to hand Hausdorff’s papers over to the Bonn Mathematics Institute. And it was then that Günther Bergmann, one of Hausdorff’s last students and now a mathematician in Münster, began to work with the Nachlass. As a late effect of the 1960s student movement in Bonn, the great professional enterprise of Hausdorff’s *Collected Works* was inaugurated in 1992, and it was crowned by the volume presented here, an excellent and exemplary realization of a scientific biography, uniting a deeply contextualized historical analysis with profound analyses of Hausdorff’s mathematical achievements.

FUNDING

Open Access funding enabled and organized by Projekt DEAL.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Gert Schubring
Institut für Didaktik der Mathematik/Fakultät für Mathematik
Universität Bielefeld
Bielefeld
Germany
e-mail: gert.schubring@uni-bielefeld.de

REFERENCES

- [1] Gert-Martin Greuel and Walter Purkert. Leben und Werk von Egbert Brieskorn (1936–2013). *Jahresbericht der Deutschen Mathematiker-Vereinigung* 118 (2016), 143–178.
- [2] Gert Schubring. Antagonisms between German states regarding the status of mathematics teaching during the 19th century:

processes of reconciling them. *ZDM – The International Journal on Mathematics Education* 44:4 (2012), 525–535.

- [3] Gert Schubring. Searches for the origins of the epistemological concept of model in mathematics. *Archive for History of Exact Sciences* 71:3 (2017), 245–278.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.