

The Life and Work of Ernst Schröder

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Life

Friedrich Wilhelm Karl Ernst Schröder was born on November 25th, 1841 in Mannheim, in the northern part of the German state of Baden (since 1945, part of Baden-Württemberg).¹ He was the oldest son of Heinrich Georg Friedrich Schröder, the director of the Higher Public School (*Höhere Bürgerschule*), later called the 'Realgymnasium', there. Schröder's father was also an amateur natural scientist of some slight local reputation. Schröder himself described his father as very interested in mineralogy, chemistry, and physics and that he anticipated Pasteur's work on the filtration of microbiological agents from air. The elder Schröder was from Munich (although the family was originally from Hannover) and studied there at the *Polytechnische*

¹The information in this essay has four sources. First, there is the Appendix, "A Short Biographical Sketch of Ernst Schröder," in my PhD dissertation, *Development and Crisis in Late Boolean Logic: The Deductive Logics of Peirce, Jevons, and Schröder* (Indiana University, 1978). Second, there is my essay, "Ein Karlsruher Pionier der Logik. Ernst Schröders Beitrag zur Logik und den Grundlagen der Mathematik," in *Fridericiana. Zeitschrift der Universität Karlsruhe* Heft 27 (1981), based upon a paper I gave June 3, 1980 at the *Institut für Philosophie* of the University of Karlsruhe, sponsored by Prof. Dr. Hans Lenk and Dr. Wolfgang Breidert. This paper, which was prepared in German, was later revised with the help of Dr. Breidert, my wife, Monika, my father-in-law, Wilhelm Schmidt of Trier, and the editor, Prof. Dr. Hans-Wolf Thümmel, also contains a photograph of Schröder and facsimiles of a number of documents. Third, I am indebted to Dr. Volker Peckhaus's essay, "Karl Eugen Müller (1865–1932) und seine Rolle in der Entwicklung der Algebra der Logik," *History and Philosophy of Logic* 9 (1988), pp. 43–56, which clarified a number of facts about the history of Schröder's *Nachlass*. Finally, there are the *Nachlässe* of figures with whom Schröder corresponded: Felix Klein, Paul Carus, C.S. Peirce, and Christine Ladd-Franklin that are discussed in more detail elsewhere in this volume.

Zentralinstitut, then at the *Kantonschule* in Soloturn (Switzerland). He was appointed to the Mannheim post in 1840 and retired from teaching in 1873; in 1876 he moved to Karlsruhe to be with his son Ernst (and with a second son then in government service also in Karlsruhe) and died in Karlsruhe May 11th, 1885. Unfortunate and ironic—given his minor importance but the importance his son's lost papers would today have—is the fact that the elder Schröder's papers have been carefully preserved in the library of the *Badische Landesmuseum* in Karlsruhe.

Schröder's mother was Karoline Walther, whose father was a pastor in Haunshheim (a small village in Bavaria, between Stuttgart and Augsburg). Schröder lived two of his early years with his maternal grandfather, where he developed a talent for memorizing words and foreign expressions. At the age of eight, due largely to his grandfather's encouragement, he could read Latin. He later acquired proficiency, to varying degrees, in French, English, Italian, Spanish, and Russian. This linguistic ability eventually allowed him to correspond with Poretskii and other Russian logicians in Russian,² with Peirce, Ladd-Franklin, John Venn and sometimes even his fellow German Paul Carus in English. His ability in Italian allowed him to read the work of, and later correspond with, Peano and Padoa. These linguistic abilities thus placed him in an important position in logic of the late 19th century, which was increasingly becoming an international discipline, with major works in English, German, and Italian (or Peano's *latino sine flexione*). He took an active part in the organization of the 1900 Paris International Philosophical Congress, where he met Russell and encountered Peano again (whom he had met at the latest in Zürich in 1897). He presented the views of Peano (Peano's "pasigraphy") in English.

His grandfather educated him largely at home, where he was taught with much older students. Schröder himself, in later writing about this time, complains that although this period gave him an edge on students of his own age, it took him away from his normal playmates of the same age. He saw this period as the reason for his individuality and a certain tendency toward loneliness („den Grund zum Sondertum und einem Hang zu Einsamkeit“). His biographer and close friend Lüroth strongly confirms Schröder's lack of conviviality and his detachment. Lüroth, 2 years younger than Schröder, attended the same schools in Mannheim as did Schröder, but mentions that

²For more information on the Schröder-Russian connection, consult N. I. Styazhkin, *History of Mathematical Logic from Leibniz to Peano* (Cambridge, Mass.: MIT Press, 1969, orig. Russian 1964), pp. 216–252. Poretskii, roughly Schröder's contemporary (1846–1904), published a great deal in Russian and French, and oversaw the translation of a number of works on the algebra of logic into Russian. See also the reference in Styazhkin (p. 305) to V.V. Bobynin, *Opyty matematicheskago izlozheniya logiki*, part 2: *Sochineniya Ernesta Schrödera* (Attempts towards a mathematical account of logic. Part 2. Works of Ernst Schröder), Moscow 1894.

whenever Lüroth spoke of other students from the same time, Schröder never could recall them (and a weak memory in Schröder's case is very unlikely).

Schröder attended several schools in Mannheim, where he excelled in languages, chemistry, and mathematics. Besides a fascination with the natural sciences, presumably inherited from his father, Schröder also was interested in, as Lüroth puts it, "philosophical speculation." This may have been the consequence of the time spent with his grandfather, although (unlike Boole or Peirce for example) there is no trace whatsoever in his writing of an interest in religion. He began his university study at the University of Heidelberg in 1860. He studied there mathematics with Ludwig Otto Hesse (of 'Hesse normal form' fame), physics with (Gustav) Robert Kirchoff, and chemistry with Robert Bunsen (of 'Bunsen burner' fame). Kirchoff is best known as the discoverer of spectral analysis—work undertaken with Bunsen. After only two years, in 1862, he was graduated with the degree of 'Dr. phil.' with "the best grades possible." With the help of a scholarship, he studied mathematics and physics two further years in Königsberg (with Neumann and Riche-lot), attending both lectures and seminars. He finished in Königsberg in the fall of 1864, and then passed the certification-examination for (*Gymnasium*) teachers of mathematics and the natural sciences in Baden (but only with the somewhat weak grade of "good"). However, instead of then immediately performing a period of student teaching, required for teaching certification, he followed his father's earlier path south and went to Zürich, where he held until 1868 the teaching position of 'Vikar' at the Canton School. (Although this title sounds imposing, it was a special term for a substitute teacher.) At the same time he studied mathematics at the *Eidgenössische Polytechnikum* (Einstein's future *alma mater*), completed his 'second doctorate' (*Habilitation*), for which there is no equivalent in the American system, and also taught there as a lecturer (*Privatdozent*). It is possible that he went to Zürich not purely for academic reasons, since he used his time in Switzerland to perfect his French and undertook a number of expeditions into the Alps. Some of these were major undertakings, which he and a friend did without a guide—rather unusual. He did not rate his chances of finding a desirable position in Switzerland very highly, and because of what Lüroth describes somewhat secretively as "unpleasant events of a personal nature," Schröder returned to Baden. He completed his internship in teaching at the *Pädagogium* in Pforzheim (also in Baden, Germany) and passed his second battery of state tests in October 1869 (this time with the grade of "excellent"). At the outset of the Franco-Prussian war, Schröder volunteered for the army, for patriotic reasons. Although there were difficulties with his eyesight (later photographs show him with thick glasses), he was accepted and served briefly in the 4th Battery of the Baden field artillery, while his youngest brother served in the

infantry. He took part in the siege of Strassburg and a march to Dijon. He was pulled back from the front, however, by the Ministry of Education in Baden before the major engagement with the French Southern Army, because of an appointment in late 1870 as “Professor” for mathematics and the natural sciences at the *Pro- und Realgymnasium* in the resort town of Baden-Baden. His military service was thus quite brief. The “talented and enthusiastic young teacher” (as his superior there called him) remained in Baden-Baden until 1874. Here too he used the time for hikes into the area—this time, into the Black Forest “in all directions.” (A number of beautiful hiking trails lead from the eastern end of Baden-Baden into the Black Forest, and Brahms had also availed himself of the same opportunities in Baden-Baden several years earlier.) Schröder seemed to target one language for improvement or learning on each way-station of his career path, and in Baden-Baden it was Russian. He obtained in 1874 a university position at the *Technische Hochschule* in Darmstadt as an *Ordinariat* in mathematics.

Just two years later, in 1876, he received a position at the *Großherzogliche Badische Polytechnische Schule* (later: *Technische Hochschule*) in Karlsruhe; he remained in Karlsruhe until his death. His appointment letter, interestingly, was signed by his friend from schooldays in Mannheim, Lüroth, and we might guess that Lüroth’s career had enjoyed a faster start, and that he was chiefly responsible for Schröder’s appointment in Karlsruhe. With the exception of his study and work in Switzerland, East Prussia, and Darmstadt, his entire life was spent in Baden, and more generally, the upper Rhine valley.

Baden was a state in its own right, ruled by a Grand Duke; it joined the North German Confederation in 1867 and became a part of the German Empire under Prussian domination in 1871. Karlsruhe was its capital, and Schröder would have had the feeling of being in a capital-city, although a small one. His voluntary joining of the army in 1870 seemed to show some patriotism to Baden, or to greater Germany. But this experience was, as we saw, short and relatively uneventful and Schröder’s life seems to have been relatively unaffected by this, or any other, political events. He lived in relatively peaceful and stable times.

Schröder taught at Karlsruhe mainly number theory, trigonometry, and higher analysis. He taught also algebra, the theory of functions, and, more rarely, small courses on logic. The impression one might however get that the mighty *Vorlesungen* were lectures in a demanding multi-year course of study on logic is almost surely false. There is no evidence of his having used them in teaching other than occasionally, or that he had other than isolated students who could have followed the material. (Müller however refers to the *Vorlesungen* as intended for students (*Studierende*) and also for laymen!) Because of its size, its still untranslated German text, the relative unpopularity of the alge-

bra of logic in the German-speaking world of the 1890's, and the now-dated nature of its content, I would myself guess that only a very small handful of individuals have ever read carefully the *Vorlesungen* in its entirety. Schröder was on multiple occasions elected to the senate of the *Hochschule*, and for the academic year 1890–91 was the Director (a position later called 'Rektor'). Although German administrative posts tend not to be so all-consuming as American ones, this position still must have imposed some demands and would have surely made the proofreading of the galleys of the *Vorlesungen* very difficult.

While not a Berlin or a Göttingen, Karlsruhe was a modern capital that, in the late 19th century, captured its moments in the limelight. The city and *Land*, under benign and tolerant (Arch)Dukes, especially Friedrich I (1852–1907), became a modern city, with broad streets and modern buildings. Soon after its founding, a tenth of the population of Karlsruhe in 1740 was Jewish and Jews there enjoyed protections and privileges that were slow in coming elsewhere in Germany and central Europe. The first enduring religious building in Karlsruhe (in 1812) was in fact a synagogue, and it was only later that permanent Protestant and Catholic churches were erected. Essentially an 18th-century and therefore youthful German city, Karlsruhe was noted for its open spaces and its large museums (for a relatively small principality, attracting even Voltaire's notice—presumably on a path for him between Switzerland and Berlin). The *Technische Hochschule*, or Technical University, there is the oldest in Germany (from 1825)—although never a major university for the arts and humanities; it has since become a full-fledged 'Universität' in the postwar German system, while retaining its earlier emphasis on engineering and the natural sciences. (It now also has a large computer science department, one of whose specialties is automated theorem-proving, thus preserving, although not consciously, part of Schröder's legacy.) Drainage projects and the channelization of the Rhine improved the Rhine's navigability, and hence the local economy. It also permitted more extensive settlement in the low-lying areas near the Rhine, which since Roman times had been swampy and mosquito-ridden, forcing permanent settlements into the higher areas over the valley, such as the much older towns of Durlach and Ettlingen. During Schröder's tenure, the *Hochschule* itself attracted researchers of the caliber of Heinrich Hertz (1857–1894) and Carl Friedrich Benz (1844 Karlsruhe – 1929). Hertz discovered radio waves in 1885 in his laboratory in Karlsruhe, where he was Professor of Experimental Physics; he moved to the University of Bonn in 1889. Benz studied engineering at what was then called the *Polytechnikum* in Karlsruhe from 1861 to 1864, built his first 2-stroke motor in 1879, and his name was associated with the firms of Benz & Cie (Mannheim, 1883), Daimler-Benz, and, of course, Mercedes-Benz.

Brahms spent some time in Baden-Baden, and after the conductor Hermann Levi was appointed Director of Music for the Court Orchestra in Karlsruhe (in the mid-19th century typically spelled 'Carlsruhe'), visited Karlsruhe as well: the *Liebeslieder* were premiered there (with Levi and Clara Schumann playing the duo-piano parts), as was the First Symphony in C major in 1876, the year of Schröder's arrival in Karlsruhe. We can thus guess that Karlsruhe was an enlightened and civilized place in the late 19th century, and was then not quite the industrial town it has become in the 20th (with a dominant natural gas tank that has been nominated as a protected historical structure, with *Denkmalschutz*).

As concerns Schröder's personality, Schröder was apparently an extremely even-tempered and gentle man. All his biographers attest to this fact, and these qualities are shown conspicuously in his correspondence with Peirce, and his generosity toward Christine Ladd-Franklin and her young daughter, Margaret. The *Vorlesungen* is, rather unusual for the times, careful to note the work of others and never takes vague credit for what was in fact others' work. While Peirce overall praised Schröder, he nevertheless sometimes ferociously attacked him, in print and in private correspondence. Schröder venerated Peirce, however, and had in abundance what Peirce acknowledged he lacked: self-control.

The impression has occasionally been created in the sparse mentions of Schröder's name in recent English-speaking literature that Schröder was harsh or even cruel in his evaluation of Frege's *Begriffsschrift* (in, for example, T. W. Bynum's *Conceptual Notation*, which includes a translation of Frege's *Begriffsschrift*, as well as a translation of Schröder's review). Reading this review carefully, however, confirms the view that Schröder was not unkind. Although the review is critical, and Schröder was obviously irritated with Frege's unwillingness at that time fully to explain why he virtually ignored the Boolean approach, the review is even-tempered—although certainly not overly generous. In the context of a common tone of such reviews when critical, and general traditions of academic posturing in late 19th century Germany, the review seems quite balanced and fair. We must keep in mind that Frege's idiosyncratic notational system was to irritate and frustrate almost everyone who encountered it, such as Peano (who refused to decipher it at all and demanded translations into his own notation). Schröder at least clearly mastered it, since he found a small mistake. German logic and philosophy of the time was rife with unusual personalities—sometimes outright cranks—and theories (such as Wilhelm Schlötel's), and the merit of a proposal was not so easy to assess as it is for us in hindsight and with the prior testimonials of Russell, Wittgenstein, and Carnap. While Schröder's attitude toward Frege suggests slight irritation and frustration, it should be kept in

mind that Frege's own views, certainly as early as the 1884 *Grundlagen*, suggest real bitterness and outrage toward a variety of figures (such as J.S. Mill and the Booleans, although not toward Schröder by name) whose positions he did not understand well or had not carefully studied. Schröder himself lists with an asterisk the *Begriffsschrift* in the bibliography of Vol. I of the *Vorlesungen*, p. 704, as one of the most important books in the history of logic, despite the lack of influence it then had (he also appends a paragraph criticizing Frege on a number of points).

Of Schröder's professional situation at Karlsruhe, we know comparatively little. We know that he was elevated to the position of 'Hofrat' on December 24, 1899—literally 'Court Advisor', but in fact a largely honorary position. Its privileges must have been minor, since less than one year later (November 25, 1900), Schröder wrote a letter to the Senate of the *Hochschule* begging for a key to the outside door of the main building, so that he could retrieve his bicycle, boots, gloves, and student papers after late classes and lectures, or could have access to his papers and books in his office at times when the outer doors were normally closed. He mentions that for answering correspondence and his own work "only Sundays, as well as hours in the evening and night, are available." There is reason to believe that Schröder did a great deal of his work not just in the evenings, but in the night (work habits a great deal like Peirce's, in fact). We can guess from earlier letters to Ladd-Franklin that he was greatly overworked. In a letter of September 17, 1893, he refers to his being "overtasked" with official duties, and writes, "the examination fatigues next to come are quite frightful." On August 15, 1894, he wrote that the amount of work required to fill up 800 pages of the *Vorlesungen* is "indescribable," and that since 1889 he has had no vacation.

And immediately when the so-called vacations come to an end, is incumbent on me to examine 73 candidates, 35 of whom *singly*, during a quarter of an hour each orally, afterwards jotting down the questions and themes with censures [i.e., corrections and comments] of the answers at large, again correcting and censuring what the 73 have calculated together by writ during 80 days (compressed into 3) under my own supervision—all of which I have to correct during several nights, mostly. And the problems and questions to be proposed must be prepared during the "vacation" without any regard to the exigencies of my book and its printer.

He then asks the Franklins not to visit him, because he would have at most a few hours to spend with them.

The story of the *Vorlesungen* itself is also not an altogether happy one. Its writing and correction, on top of his normally extensive teaching duties,

must have cost Schröder a great deal of time. In the letter to Ladd-Franklin of September 17, 1893, he mentions that the *Vorlesungen*, because of the section on relatives, had swollen into a third volume. This, he says, will cause him a “very pinching pecuniary sacrifice (of over 1000 Mark certainly).” In a postcard from November 1898 to Ladd-Franklin, he again mentions the difficulty of keeping up with his correspondence and adds, “besides I am actually yet worried with distributing my 400 copies.” We may guess that, in compensation for his personal financial support, he received a number of copies of the *Vorlesungen* that he could sell—a common practice in the 19th century. In the last sentences of his biographical essay (and perhaps echoing a eulogy), his good friend Lüroth mentions the “irritations” (*Reibungen*) that were part of his position, and that these were ever more burdensome in Schröder’s last years and that consequently his research on logic was left incomplete. (Lüroth’s precise wording is intriguing and suggests indecisiveness on Schröder’s part: he writes that the irritations bound up with his life and position weighed ever more heavily on him, and apparently so limited his ability to do research, that he “could not resolve” to complete the great work of his life, the *Vorlesungen* on logic.)

Among Schröder’s hobbies were hiking, swimming, ice-skating, horseback riding, and gardening—and perhaps these are what Lüroth is also suggesting distracted Schröder from his research. He was specifically interested in breeding flowers, and thus preserved an earlier interest in botanical classification and observation. He also had grown plants in his room as a student. Schröder was enamored of bicycle riding in a time where this was relatively rare for professionals in his position. He designed and built his own saddle, and became known to the locals as the ‘Bicycle-professor’ (*Fahrradprofessor*). Even when he was 60 he regularly bicycled around Karlsruhe. He must have engaged in these activities with a considerable passion and partly for reasons of health, because in a letter to Christine Ladd-Franklin of September 17, 1893, apparently responding to an earlier letter from the Franklins complaining of their ill-health, he rather presumptuously and sharply advises them: “please mind to take more physical exertion; so far as I know you have even on your journey [apparently an earlier trip to Europe] behaved too sedentary.”

After moving from apartment to apartment in Karlsruhe, he settled sometimes after 1886 into a newly-built apartment building at 9 Gottesauerstrasse, where he lived until his death. The location must have then been an excellent one: an attractive area, close to the imposing major building of the *Hochschule* on the Kaiserstrasse. The building even has a plot of land in front, approximately 4 by 4 meters, that Schröder might have tended—certainly small for an American garden, but rare in the densely-settled section of Karlsruhe where Schröder lived. Although the major *Hochschule* building

on the Kaiserstrasse, perhaps a 5 minute walk from Schröder's apartment, has recently been restored to its handsome red sandstone exterior, with large gold letters spelling 'Technische Hochschule', this section of the Kaiserstrasse is now one of the most unsavory, and both Schröder's nearby former apartment building and his garden are poorly tended, having turned into student housing.

Schröder was unmarried.³ Given the lack of personal papers, and a lack of people today alive who could have known Schröder, we have little information about his personal life. His professional publications give little insight into his personality, and his style of writing there is deliberately somewhat dry and unrevealing. His autobiographical remarks (quoted by Lüroth, many of which are paraphrased above), as well as Lüroth's own remarks about Schröder, are more interesting, revealing, and suggest a livelier and more sensitive command of language (as one would expect, given his linguistic talents): they point to his individuality and loneliness, lack of conviviality, his obsession with sports and hobbies that could be pursued individually, his nocturnal habits, and so on. Still more revealing, if it is true, is a report of remarks by Hugo Dingler about a conversation he had with a nephew of Schröder's (presumably his nephew and namesake, Ernst).⁴ The nephew had taken charge of the portion of the *Nachlass* containing private papers, and had later burned Schröder's correspondence being in his possession, because it contained "love-letters" (*Liebesbriefe* from Schröder's youth that should not be publicized („gehörten nicht in fremde Hände“). Again, this saga sadly echoes the story of Schröder's contemporary C.S. Peirce, whose full correspondence is reputed to have contained letters that would have damaged his, or Harvard's, reputation and were destroyed.⁵

Schröder died in Karlsruhe on June 16th, 1902, at 5:30 a.m. after an illness of several days that was diagnosed simply as "brain fever" (*Gehirnentzündung*). Several days before, he had taken an extended bicycle trip, gotten a cold, and a number of people (Lüroth reports) attributed his demise ultimately to his passion for sports. In the winter of 1901–2, when he was 60, he took up skiing and Lüroth describes his last conversation with Schröder in March of 1902 as

³In my dissertation I incorrectly stated he was married, but Dr. Peckhaus and Prof. C. Thiel have brought to my attention a great deal of evidence that he was never married. For example, the personnel folder of the *Hochschule* lists him as unmarried (*unverheiratet*). Furthermore, his lack of a spouse or children explains the somewhat shoddy treatment of his private *Nachlass* immediately after his death.

⁴This information is paraphrased from a letter to C. Thiel from A. Menne of April 7th 1975, reporting a conversation with Dingler. I am grateful to Dr. Peckhaus and Prof. Thiel for sharing the information with me.

⁵This information comes from a conversation in 1972 with A.W. Burks reporting comments by C.I. Lewis in the 1950's.

primarily devoted to Schröder's tales of bicycling and skiing; Lüroth said he looked exceptionally fit, and one would have expected him to live many years longer. He was buried the day after his death in the main cemetery (*Zentralfriedhof*), not far removed, actually, from his apartment, and a memorial service (*Leichenbegängnis*) took place in the cemetery chapel at 11:30 a.m., just before the burial. My own recent effort (in May 1990) to locate Schröder's grave was without success. The record of his burial was found in the records of the cemetery, but his grave had been "turned over" (*umgelegt*): this is a German practice of reusing scarce plots in graveyards after a specified time (often 30 years) if no further family burial has taken place and if someone does not then come forward to pay an additional fee. Neither Schröder's title of *Hofrat*, nor his distinction of being one of Germany's major logicians of the 19th century, saved him this indignity, although it is interesting to note that the graves of the *Hofbäcker* (Court Baker) and *Hofbuchhändler* (Court Book Dealer) of the same period were still well maintained.

Schröder's Work

Certain limitations force this section to be shorter than it ideally should be. Both the topic of the development of Schröder's views over the approximately 35 years of his professional career (from 1867 until his death in 1902), and the topic of his later influence on the history of logic, are formidable issues that have not, to my mind, been dealt with adequately by any researcher.

In what follows, I shall refer to the items in the bibliography of works of Schröder by Lüroth in the complete, posthumous edition of Vol. II of the *Vorlesungen* by the prefix 'L', followed by the item number in Lüroth's list, followed by the date. Thus 'L-13-1877' refers to *Der Operationskreis des Logikkalküls*. Where useful, I will translate the titles into English.

We can distinguish in Schröder's *oeuvre* basically four kinds of works: (a) pedagogical works, (b) mathematical works, (c) logical works, and (d) philosophical (or otherwise broadly speculative) works. Naturally, the distinction between these domains is not always so sharp. For example, for Schröder the reflections on the notion of a sign that we see in the Introduction to the *Vorlesungen* (L-27-1890) and simultaneously in the *Festrede* "On the Sign" (L-31-1890, subsequently translated into English for *The Open Court*, for which see Volker Peckhaus's essay in this volume) are partly a logical issue in category (c), but also a more speculative question in (d): we might thus be inclined to delineate 'logical' works according to whether they take a formal, symbolic form, from broader philosophical, or broadly speculative, issues in category (d). But then, unfortunately, a distinction that provides somewhat

arbitrary clarity in distinguishing (c) from (d), produces difficulties in distinguishing (c), logic, from (b), mathematics: the symbolic algebra of logic is also an abstract algebra. But a more accurate and precise demarcation would clutter my account here, and I will intentionally proceed with a somewhat simplistic account for the purpose of giving an compact overview.

Among Schröder's major works, I would list the following: *Lehrbuch der Arithmetik und Algebra für Schüler an Gymnasien und Realschulen* (L-8-1873), *Der Operationskreis des Logikkalkuls* (L-13-1877), „Anzeige von Gottlob Freges *Begriffsschrift*“ (L-18-1879),⁶ the three volumes of the *Vorlesungen*: Vol. I, L-27-1890; Vol. II (first part only), L-32-1891; and Vol. III, L-34-1895, “On Two Definitions of Finitude and G. Cantor's Theorems” (L-36-1896), “On Pasigraphy . . .” (L-39-1898) and “On an Extension of the Idea of Order” (“Sur une extension de l'idée d'ordre,” L-41-1900).

As pedagogical works I would classify: L-7-1871, L-8-1873 (the *Lehrbuch*), L-9-1874, and L-10-1874. As one can see from the dates of these works, they corresponded with Schröder's time as a *Gymnasium* teacher. We might guess, then, that other than immediate occupational pressures of the early 1870's, Schröder had little intrinsic interest in issues of mathematical education. Confirming this suspicion, we can note that in his later logical work there is virtually no discussion concerning how logic should be taught, or how—or even whether—to make people more logical, as one would expect if Schröder had an abiding interest in pedagogy. In the second category of “mathematical” works (b), we encounter the difficulties alluded to above. Items L-1-(before 1867), L-3-1869, L-4-1869, L-5-1869, L-11-1875, and L-12-1876 address (what we would today tend to regard as) such elementary aspects of the theory of functions and algebra that one might be tempted to see them as essentially pedagogical works. They were, however, presented to audiences of professional mathematicians and do not have obviously “educational” titles or subtitles. Other mathematical works include: L-2-1867, L-6-1870, L-16-1879, L-17-1879, L-19-1879, L-20-1880, L-21-1881, L-23-1885, L-24-1886, L-25-1887, L-26-1887, and the later L-29-1890 and L-30-1890. Some of these “mathematical” works are, however, also viewable as works about abstract algebra, or about algebraic techniques, that are useful in the algebra of logic, such as L-21, 23 (“On the Elimination Problem in the Calculus of Identity”), 25, and 26. They are thus not strictly “mathematical.” From the dates of these mathematical works, we see them appearing mostly in his students days or in the earlier days of Schröder's career as a Professor at the *Hochschule*.

⁶Translated in *Conceptual Notation and Related Articles* trans. and edited by T. Bynum (Oxford: Clarendon Press, 1972) and also by V.H. Dudman in *The Southern Journal of Philosophy* 7 (1969), pp. 139–50.

We know that Schröder's interest in logic was first aroused by his work on the *Lehrbuch*, probably thus no earlier than 1872–3, and specifically by reading Robert Graßmann's *Formenlehre* (published in 1872). He must have very soon thereafter learned something about Boole's work (by 1874), and Lüroth mentions a sustained program of study in logic that continued into his time in Karlsruhe (after 1876) and included reading works of Boole, De Morgan, Peirce, "and other especially English and American authors on mathematical logic" and also writings by Sigwart, Trendelenburg, Lotze, Ueberweg, Wundt and others.

Schröder's "logical" work is first seen clearly in the *Operationskreis* (L-13-1877), although there is some discussion of "logical" algebraic techniques in the *Lehrbuch* (L-8-1873), as well as in *The Abriß of Arithmetic and Algebra for Pupils at High Schools: First Part—The Seven Algebraic Operations* (L-9-1874)⁷ and L-10-1874. Later logical works include: L-14-1877, the review of Frege (L-18-1879), the short English report L-22-1883, the three volumes of the *Vorlesungen*, as well as L-33-1894, L-35-1895, L-36-1896 (providing one counts "set theory" as logic), L-37-1896 (same problem), and L-38-1896. Particularly interesting are his mature reflections on set theory in L-36, 37, 38, and 41 (of which there are also traces in sections of the *Vorlesungen*). As one can see from their dates, these logical works occupy the middle, and later portion of Schröder's professional career, and represent his major professional contributions—both in terms of quantity and, I think, in terms of quality. Schröder's more or less philosophical works are: the introduction to Vol. I of the *Vorlesungen* (L-27-1890), L-31-1890, L-39-1898, and L-40-1898. They represent the very last chapter in Schröder's output and intellectual development. In this categorization, there is no obvious place for the several pages he wrote as part of a survey of the life and work of Hermann Graßmann, L-15-1878.

Very broadly characterized, one sees Schröder's development from a pedagogue and *Gymnasium*-teacher, to a professional mathematician (which merged imperceptibly into a career as a logician of the "algebra of logic" school), and finally to a philosopher, or at least to a mathematician concerned with the foundations of mathematical communication and of mathematics itself. More detail on Schröder's contributions to mathematics and logic is to be found Lüroth's essay, although Lüroth is no expert on the algebra of logic.

⁷No other part ever appeared, and his call first to the *Technische Hochschule* at Darmstadt in 1874, then to Karlsruhe in 1876, apparently interrupted his career as a writer of textbooks and his plans for later parts. Lüroth mentions that 4 parts were planned.

The Reception of Schröder's Work and Its Later Influence

To my knowledge, Schröder's contribution to the history of mathematics, is minute: he is not mentioned in any standard histories of mathematics (except for his contributions to the algebra of logic), and his works have not been cited by major late-nineteenth century works in, say, abstract algebra. In particular, he does not seem to have had a clearly articulated view of abstract algebraic processes that was distinct from, or as sophisticated as, views of mathematicians such as Sylvester, Cayley, and Klein. His influence on what we would today call the philosophy of language or semiotics is also very small. However, as is discussed elsewhere in this volume, his views on these topics are not without interest. Finally, on questions about the foundations of mathematics, and the relationship of logic to mathematics (e.g., his stance toward 'logicism'), a reader of Schröder's published works is likely to be disappointed. He did not seem especially interested in these questions (except in carefully characterizing the exact relationship between logic and algebra), and although he must have understood Frege's views on these topics, for example, they seem not to have engaged him. There is in some very late writings (in correspondence and his writings on set theory), the suggestion that Schröder was in fact after 1897, and presumably especially after the 1900 Paris Congresses, wrestling with questions in the foundations of mathematics. Unfortunately, however, since Frege's views had failed to interest him in the most active period of his professional life (presumably because of their logical formulation, not because of the foundational views themselves), and because he was to die in 1902, before major discussions were to occur as a result of Russell's work and the influence of Hilbert, Schröder has had no influence on this topic, which so fascinated early 20th-century logicians and philosophers.

In his lifetime, there was almost no one in the German-speaking world who was capable of, and would have been interested in, evaluating his symbolic logical work.⁸ Frege himself would have been capable of doing so, but devel-

⁸Later in German publications, or by German-speaking logicians, we see works such as: H. Behmann, „Das Auflösungsproblem in der Klassenlogik,“ *Archiv für mathematische Logik und Grundlagenforschung* 1 (1950–2), no. 1/2 (September 1951), 33–51, i.e. *Archiv für Philosophie* 4 (1952), 193–211, Behmann, „Zu den Parallelreihentransformationen in Schröders ‚Algebra und Logik der Relative‘,“ *ibid.*, 52–62, i.e. *Archiv für Philosophie* 4 (1952), 212–222; G. Behrens, *Die Prinzipien der mathematischen Logik bei Schröder, Russell und König* (Diss. Kiel: Hamburg, 1918); Paul Bernays, review of the *Vorlesungen*, Vol. I, *Journal of Symbolic Logic* 40 (1975), pp. 609–14; F. Klein-Barmen, „Boole-Schrödersche Verbände,“ *Deutsche Mathematik* 1 (1936), 528–537; Klein-Barmen, „Weitere Untersuchungen über Boole-Schrödersche Verbände,“ *ibid.*, 618–632; and J. von Kempster, „Ernst Schröder: der Algebraiker der Logik,“ *Geistige Arbeit. Zeitung aus der wissenschaftlichen*

oped very early in a his life a fierce hostility to the mathematization of logic in the fashion of Boole. The early German set theorists, such as Dedekind and Cantor and their immediate followers, showed no interest in mixing set theory and logical formulations in, for example, axiomatizing set theory, or using quantifiers in a rigorous way. Although his appreciation of the mathematical techniques was probably small, an exception to this generalization is however E. Husserl's lengthy review of the first Volume of the *Vorlesungen* in the *Göttingische Gelehrte Anzeigen* 7 (1891), pp. 243–278, where Schröder's logic is recognized as the first extensional logic on German soil; Husserl also discussed related issues in another paper of the same year „Der Folgerungscalcul und die Inhaltslogik“ (“The Calculus of [Logical] Consequences and Intensional Logic”) in the *Vierteljahrsschrift für wissenschaftliche Philosophie* 15 (1891), pp. 168–189 and 351–356. The still more significant third volume of the *Vorlesungen*, with its discussion of the logic of relatives and the attendant importance of this issue for deep philosophical issues and for the adequacy of various systems of logic, seems to have been even less appreciated, especially among German philosophers. (Lüroth blames Schröder for having failed to give simple examples of the importance of relations.) In the English-speaking world, Schröder's work, starting with the *Operationskreis* of 1877,⁹ was widely circulated and widely reviewed (especially the volumes of the *Vorlesungen*). Reviews of the volumes of the *Vorlesungen* and scattered remarks by Peirce and Christine Ladd-Franklin show especially that they had read Schröder's work very carefully. However, although they noted Schröder's views, this appreciation of Schröder's work has far more the air of self-congratulation than of being substantially influenced by any of Schröder's views. Namely, Peirce especially took the almost wholesale adoption of his approach by Schröder in the *Vorlesungen* (quantifiers, the subsumption operator, and most importantly, the theory of relatives) as confirmation of the merits of his own theories. Other than an occasional proof or comprehensive presentation of an issue already well-known to the Peirce school, there is no single instance that I know of where we find Peirce (or Ladd-Franklin) following Schröder's lead: Schröder was almost viewed as the agent of the ‘Peirce school’ to the German-speaking world and to professional mathematicians and was thus lauded—but primarily for his obeisance. There are, however, cases where Peirce criticized Schröder for deviations from the Peircean line,

Welt (Berlin) 9 (1942), pp. 1–2. (This article may be all that eventually came of von Kempf's plan for an issue of *Frege-Studien* on Schröder.) In Spanish or Spanish-language journals, we encounter: V. Reyes y Prósper, “Ernesto Schröder,” *El progreso matemático* 2 (1892), pp. 33–6 and R.C. Pereira, “On Schröder's Algebra of Logic,” *Revista matemática hispano-americana* 11 (1951).

⁹R. Adamson, review of the *Operationskreis*, *Mind* (1878), pp. 252–5; W. J. Stringham, review of the *Operationskreis*, *Johns Hopkins University Circulars* 1 (1879), p. 49.

such as the interpretation of propositional logic (Schröder's *Aussagenkalkul* in Vol. II) in terms of domains of time.

But there are other, complicating factors here. Peirce and Schröder never met, and their correspondence (judging from the extant sections) was thin, often interrupted, and wary. (The contrast in tone between the Peirce-Schröder correspondence and the Ladd-Franklin-Schröder correspondence is quite noticeable, and presumably due to the fact that the latter had met; then too, Schröder's extensive borrowings from Peirce might have also created a certain cautiousness on Schröder's part.) By the time Schröder published the *Vorlesungen*, Peirce himself was doing very little in symbolic logic (except for work on the existential graphs and work on the continuum and set theory). Consequently, Schröder was then publishing work in an area that Peirce had virtually abandoned almost a decade before, and probably regarded as "finished" with his work of 1885-6. Peirce had a rather harsh opinion of German academics of the 19th century, and might even have envied Schröder's secure, if not exactly prestigious, academic post. He also found the plodding, methodical, and even exhaustive style of Schröder to be irritating and excessive: at one point he refers to the "thousands" of theorems Schröder proved, and their lack of overall purpose or direction.¹⁰ Finally, in comparison with his own sophisticated, subtle, and possibly excessively complicated reflections on language and signs (his semiotics), Peirce must have found Schröder's efforts to be rather shallow and naive. Perhaps significantly, Peirce never extensively commented upon them, although this issue of signs and logical/mathematical communication was Peirce's most intense interest, particularly in the 1890's. Possibly it would have been unseemly, and contrary to his own best interests, to castigate as simple-minded the views of his own most respectable disciple! Certainly, Schröder's reflections are not part of a grand philosophical system of the relationship of mind and world that Peirce offered. And in this sense, Peirce is the more traditionally "German" and systematic philosopher.

Interestingly, however, although few of Schröder's positions were adopted, or his logical views debated, his notation for what we know as the first-order

¹⁰Ladd-Franklin was more humorous concerning this distinctive characteristic of Schröder's work: "Mr. Charles S. Peirce, to whom Symbolic Logic owes its present state of development, wrote papers with the brevity and abstractness that befit a scientific journal. Dr. Schröder's book will be objected to on the ground that it is unnecessarily diffuse; but it should be remembered that the subject has had hard work to get itself recognised, and that it is a principle of psychology that a certain degree of voluminousness in a sensation is essential to the producing of a lasting impression. It must be admitted that the book is discursive to the last degree." C. Ladd-Franklin, review of the *Vorlesungen*, Vol. I, *Mind* 1 (1892), pp. 126-32. Even Schröder's best friend, Lüroth says of the *Vorlesungen*: "Only one can perhaps say that [Schröder] has presented the reader with too much" and his editor Müller refers to the peculiarities of his writing style (*Diktion*), and especially "his broad and often digressive manner of presentation."

predicate logic (much of which he had in turn adapted from Peirce's work of the 1880's), using for example the Greek Pi and Sigma with subscripts for quantifiers, was widely used in German logical works into the 1920's (and by Skolem into the 1940's). Some of the major papers by authors such as Löwenheim and Skolem, and their now well-known results, were proven in articles using Schröder's notation, and citing the *Vorlesungen* reverently. It is not just Schröder's notation, however, that had a later influence. The *Vorlesungen* abounds in proofs using what we would now recognize as semantic techniques, i.e., models and countermodels. In particular, Schröder shows independence results, and that certain results do not follow, by constructing countermodels of formal systems.¹¹ Peirce had occasionally done so as well, but was usually not so careful and explicit about what he was doing as was Schröder. (There is, I believe, no hint of such techniques in Boole, Jevons, De Morgan, or Frege—and Frege in fact would have, and did, dogmatically oppose arbitrary “interpretations” of sentences.) It is just possible that these semantic techniques, gleaned from Schröder's *Vorlesungen*, were decisive in influencing Löwenheim, Skolem, and thus the whole German “semantic” tradition through Gödel. This claim must be described as speculative, pending a more careful study of early 20th century figures in logic, and of the precise influence Schröder's work had on them, about which we now know very little.¹² There are however two possible weaknesses in this argument. First, Schröder's notion of a “formal system” is excessively loose—he never made any systematic effort to develop an axiomatic presentation of the algebra of logic, for example. (This was Müller's interest, however, and was also promoted by the Americans E.V. Huntington, H.M. Sheffer, and R.A. Bernstein.) Consequently, what counts as a “model” of a theory was necessarily merely suggestive. Secondly, the notions of formal theories, interpretations, and models, seem to have originated first in geometry well before the *Vorlesungen*, with work by Beltrami and Klein, and finally in a crystal-clear form in Hilbert's *Grundlagen der Geometrie* of 1899. However, one may still maintain that Schröder's was the first use of models in proofs of logical theorems. Lüroth discusses Schröder's semantic techniques in his biographical essay, p. IX, and also Schröder's penchant for exhaustive combinatorial arguments

¹¹I have in mind especially the independence of the 2nd distribution law, discussed in Ladd-Franklin's review and in my dissertation.

¹²Done with the care we see, for example, in G. Moore's *Zermelo's Axiom of Choice* (New York, Heidelberg, Berlin: Springer Verlag, 1982). Although Schröder's work is discussed at a number of points in this book, Moore is generally more concerned to show the novelty of Zermelo's work than to show its connections to earlier work, and does not investigate the question of Schröder's actual influence upon Zermelo and others, either in terms of techniques, or in terms of notational borrowings. There are hints—such as in Carnap's remark quoted above—that the *Vorlesungen* was a standard text on symbolic logic in Germany well into the 20th century that must have had an enormous influence.

and analyses—e.g., of 7342 possible equations of a certain type.

By contrast, there is in some major strands of early 20th-century German logical and set-theoretical work no discernible influence of Frege (an exception is Hilbert's work of 1917–1920 and later) or, for that matter, of Russell and Whitehead's *Principia*. The German logical/mathematical tradition of this period was thus, in some sense, autonomous and originated with work by Dedekind, Cantor, and, notationally at least, Schröder. Furthermore, as I have elsewhere argued¹³ there is reason to believe that Peano's notation and techniques were derived almost entirely from the influence of Peirce and Schröder (with Graßmann's views in the background),¹⁴ and that it is Peano's system that was the primary influence on the notation and development of functions and relations in the *Principia*, rather than Frege's. Consequently, if we see modern mathematical logic as developing, somewhat independently, through Peano, Russell, and Whitehead on the one hand, and from a strictly German school of set theorists, together with Löwenheim, and Skolem on the other, in both cases we arrive at the work of Ernst Schröder. Only slightly further back in this genealogy, we find C.S. Peirce—who could most properly be said to have invented the notation for quantifiers as we now use them. Frege's influence was primarily on the philosophical relationship of mathematics and logic, and it was indeed great, but his own logic, and his conception of logic, have had, until recently, very little influence: modern logic has been primarily extensional, for example, as it was for Schröder.

Sources and Schröder's Nachlass

There are two non-derivative published sources of information about Schröder's life. These are, first, Jacob Lüroth's biography published in the complete version of Volume II of the *Vorlesungen* in 1905, after Schröder's death; a relatively complete bibliography of Schröder's works is also to be found there. Lüroth's essay is a revised version of the obituary published in the *Jahresbericht der Deutschen Mathematiker-Vereinigung* Vol. XII (1903), pp. 249–265. For items about Schröder's life and personality, Richard Baldus' essay „Ernst Schröder“ in *Badische Biographien* VI (1935) pp. 377–379 is also useful. Portions of the personnel files on Schröder are in the *Badisches Generallandesarchiv* in Karlsruhe, item number 76/10053 (records of the Education Ministry of Baden) and 448/2330 (records of the *Technische Hochschule*).

Schröder left what we know to have been a large *Nachlass*, that included

¹³In a paper on Peirce's influence on the history of mathematical logic.

¹⁴See for example H. Kennedy, *Peano. Life and Works of Giuseppe Peano* (Dordrecht/Boston/London: D. Reidel, 1980).

letters, manuscripts, and notes. Eugen Müller, a student of Schröder's work, termed the *Nachlass* "extensive" (*umfangreich*) in the forward to the *Abriß* of the *Vorlesungen* that he prepared in 1909 (and is published with the reprinting of the complete *Vorlesungen* in the Chelsea reprinting of 1966). A large portion of material in the personnel files on Schröder is concerned with the disposition of this *Nachlass* after his death.

Schröder's papers were given to the Archives of the *Technische Hochschule* at Schröder's death in 1902, and lay largely undisturbed into the early 1930's. There is in fact some evidence that the papers were kept, until their removal to Münster, in a separate locked cabinet that was virtually inaccessible. Schröder had given the authority over his papers to the *Deutsche Mathematiker-Vereinigung*, and had intended that they be edited by his long-time friend (and the Director of the *Hochschule* when he was hired) Jacob Lüroth (later professor of mathematics at Freiburg, also in Baden), and Friedrich Schur and Robert Haußner, both of Karlsruhe. This group commissioned Eugen Müller to edit material connected with the *Vorlesungen*. Although not formally a student of Schröder's, Müller (who taught mathematics at a *Gymnasium* in nearby Bruchsal), had apparently become familiar with Schröder's work in the years before Schröder's death; his own interest was in the axiomatization of the algebra of logic, and this would have predisposed him for the organizational work for his *Abriß*—in contrast to the sprawling *Vorlesungen*. The results of Müller's work were the second part of the second Volume, and the *Abriß*, a sketch of which Müller said he found in Schröder's *Nachlass*. (Sections of the *Nachlass* that Müller borrowed were however never returned.) Lüroth died in 1910, and this original committee became inactive. Shortly thereafter, Schröder's brother, then a high government official (*Oberregierungsrat*) in Düsseldorf, agitated for renewed activity on the edition, but although the committee was reconstituted, nothing was done. In December of 1932, Schröder's nephew, also named Ernst Schröder and the director of a Stuttgart bank, suggested that some attempt be made to sort and edit the papers of his uncle. This suggestion was made to the librarian of the *Hochschule*, who replied that something should be done with them because they were taking up too much space and no one was looking at them. In response to this suggestion, and with the encouragement of several letters from the *Hochschule* librarian who complained about their volume, the administration of the *Hochschule* urged the *Deutsche Mathematiker-Vereinigung* to reconstitute a committee, the "Schröder Kommission," to undertake the task of an edition project. This committee was headed by Schur, now in Breslau, and after his death, Ludwig Bieberbach of the University at Berlin. Bieberbach proceeded fairly actively in his attempts to find an editor. He contacted Rudolph Carnap, then in Prague, whose response of January 17th, 1933 is:

Ich selbst möchte mich nicht aktiv in der Bearbeitung des Nachlasses beteiligen. Wenn trotzdem meine Teilnahme an der Kommission als Berater gewünscht wird, bin ich gerne dazu bereit. Zur Sache einige Bemerkungen ... Ein Werk wie das Schrödersche, das zu seiner Zeit ein Standardwerk der formalen Logik gewesen ist, müsste, auch wenn es nicht mehr aktuell ist und keinen grossen Absatz mehr findet, in seinen geringen Restbeständen unbedingt erhalten werden.

I myself would not like to take an active part in the work on the *Nachlass*. If in spite of this, my participation as an advisor is desired, I would be happy to do this. On the matter several remarks ... A work such as Schröder's, which in its day was a standard work of formal logic, must absolutely be kept in its present condition, even if it is old-fashioned and doesn't have much of a market anymore.

Bieberbach also contacted Abraham Fraenkel, who too declined. In March 1933, the Rector of the *Hochschule*, Holl, wrote Schröder's nephew to inform him that no one appeared interested in editing his uncle's papers. The nephew replied April 25, 1933 that perhaps the committee should attempt to find younger, less famous men to work on the edition, perhaps even outside of Germany. No action was taken on this suggestion. In the summer of 1936, Heinrich Scholz, perhaps the singlemost important figure in the renewed interest in formal logic in Germany, sent his assistant, Friedrich Bachmann, to see Schröder's papers. His report was glowing:

[daß Schröders Nachlaß] für jemand, der ein spezielles Interesse an Schröder besitzt oder allgemeiner die Geschichte der Mathematischen Logik in der zweiten Hälfte des 19. Jahrhunderts studieren will, von einzigartig hohem Wert ist.

[that Schröder's *Nachlass*] is of singular value for anyone who has a special interest in Schröder or, generally, in the history of mathematical logic of the second half of the 19th century.

The *Nachlass* was eventually transported to Münster: the details of how and why are sketchy. We know that in 1939 the *Nachlass* was still in Karlsruhe, while by 1942 it was in Münster. At the University of Münster, Heinrich Scholz was accumulating a repository of important 19th century German logical works that also included the papers of Frege. Once the war began, these papers were kept in the basement of a building of the University of Münster near the center of the town of Münster. Münster was the site of the first, massive daylight bombing mission by the Allies on October 10, 1943, as well as many very damaging later day- and night-bombings, and in a raid on March 25th, 1945 (Palm Sunday) the building where the *Nachlässe* of Frege

and Schröder were stored was completely destroyed. British troops occupied Münster less than 3 weeks later, by April 14, 1945.

A portion of Frege's papers had been transcribed by the time the archive was destroyed, and one of the carbon copies of these has survived. As nearly as I could determine in my stay in Münster in 1983–4, no work had begun on Schröder's papers, and there was no recollection of, or list of the contents of, these papers, beside a list made by Bachmann in 1936. The circumstantial evidence that Schröder's *Nachlass* was destroyed (with the exception of papers Müller had earlier borrowed) is thus great—although, unlike the case with Frege's *Nachlass*, we lack direct testimonials to this effect. We might guess, given Schröder's meticulous nature and the testimony of Bachmann, that there were drafts of his own works, and, what today would be especially valuable, letters from Peirce, Russell, Peano, Carus, and possibly other 19th century logicians and mathematicians. In other German *Nachlässe*, there are letters or cards from Schröder to A. Krazer, Felix Klein, and A. Maurer.

By the 1930's, as the lack of interest in his *Nachlass* indicates, there remained little interest in Schröder, or in mathematical logic, in Karlsruhe.¹⁵ However, in October 1943, at the suggestion of Jürgen von Kempfski, an Ernst-Schröder-Prize was organized by the Karlsruhe *Technische Hochschule* to commemorate the 100th anniversary of Schröder's birth. The rather large sum, for war-time, of 500 Marks, was gathered in Karlsruhe. The rector (R. G. Weigl) insisted, however, that the *Hochschule* be well represented on the awards committee—in spite of the fact that there was no one familiar with mathematical logic in Karlsruhe anymore. Von Kempfski graciously accepted this condition, but remarked that he would perhaps be in the better position to suggest names of those in Germany who were able to judge work in this field. Von Kempfski, then in Berlin, indicated that a planned issue of the *Frege-Studien* to be dedicated to Schröder's work, was now not certain (and to my knowledge, never appeared, presumably because of wartime conditions).

The awards committee consisted of Wilhelm Ackermann (then in Burgsteinfurt), the Rector of the *Hochschule* Weigl, A. Bühl and E. Ungerer of Karlsruhe, Scholz, and von Kempfski. The acceptance letter of Scholz (of January 16, 1942—already well after the 100th anniversary of Schröder's birth) for

¹⁵When I first visited Karlsruhe as a graduate student in 1976 to do research on Schröder, memory of Schröder had so faded that I could find no one at the university or area libraries and archives who knew that Schröder had been there, although his name, strictly as a 19th century logician, was known by the philosophers and mathematicians. One librarian who was otherwise well-informed about figures associated with Karlsruhe thought I was asking about Schrödinger—although this was also possibly a problem with my accent. He had, in any case, never before heard of, or had an inquiry about, Schröder.

membership on this committee is itself not without interest for what it conveys about the atmosphere of German logical research in the midst of World War II. He stresses the importance of recognizing Schröder's work for what it demonstrates about the strength of German logical research, and the symbolic meaning of the prize itself for German logic. He adds, in a way that suggests wartime paranoia and distortions: "German work on the foundations of mathematics still has to fight (*kämpfen*) against all odds for its existence and recognition, in spite of Ernst Schröder, Gottlob Frege and Hilbert." Ironically, the award eventually went to an American, J.C.C. McKinsey. And although of the trio of Frege, Schröder and Hilbert, it is true that Schröder remains the least known, German 19th and early 20th century logical research has since been widely, and in fact internationally, recognized—and has had to struggle, if anywhere, most for recognition in German philosophy departments.¹⁶

¹⁶I am grateful to the *Deutscher Akademischer Austauschdienst* (DAAD) for a grant to support research on Schröder and the history of German logic in April-May 1990. I am also very grateful to the editor of this issue, Dr. Volker Peckhaus, who made a number of suggestions and corrections of an earlier version. Finally, I thank the *Institut für Philosophie* at the *Universität Karlsruhe* for their hospitality and help on my many visits to Karlsruhe, and Wolfgang, Marlene, Janka, and Tilo Breidert for having so graciously hosted me and my family on now numerous occasions.