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"Jewish Mathematics" at Göttingen in the Era of Felix Klein

*By David E. Rowe**

I. KLEIN'S DISPUTED LEGACY

IN 1936 THE *GÖTTINGER TAGEBLATT*, a right-wing newspaper, printed an article with the headline: "Felix Klein was an Aryan. Which no one, in Göttingen at least, doubted." According to the *Tageblatt*, Klein's ancestry was cleared by his family after the *Völkischer Beobachter*, official mouthpiece for the Nazi party, reported that he was of Jewish descent. The source of the error was said to be the *Jewish Encyclopedia*, but the *Tageblatt* added, "It is well known that the Jews love to stamp famous men as Jewish in order to increase the prestige of their people."[1]

Of course, the Nazi party was very diligent when it came to tracing a suspicious family's ethnic background. Still, one might wonder what led them to chase Felix Klein's ghost some ten years after his death in 1925. What apparently prompted the Nazi investigation was a memorandum sent to the Bavarian Ministry of Culture by Hugo Dingler in November 1933, which quickly found its way to the offices of the Prussian Ministry of the Interior. Its subject was the dominance of Jews in the fields of mathematics and physics; and it was accompanied by a cover letter from Phillip Lenard, the father of "Deutsche Physik."[2]

The memorandum presented a twenty-page historical synopsis of how Jews invaded the fields of mathematics and physics after being granted legal equality in 1869. According to Dingler, their ringleader was none other than Felix Klein, who "at least from one side of his family was of Jewish descent." Dingler went on to describe how Klein perverted German mathematics by imposing a self-styled dictatorship over the field. This began when he circulated a proposal among the mathematics professors calling for the organization of research through one central university, namely Göttingen. When this idea failed to win

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[1] Clipping in Göttingen Stadtarchiv, Kat. U3a, no. 290. Unless otherwise stated, all translations from the German are mine.

[2] H. Dingler, "Memorandum betreffend: Die Herrschaft der Juden auf dem Gebiete der Mathematik," Zentrales Staatsarchiv Merseburg (hereafter **ZStA**), Rep. 76 Va Sekt. 1, Tit. VII. no. 14. On Lenard and "Deutsche Physik" see Alan D. Beyerchen, *Scientists Under Hitler: Politics and the Physics Community in the Third Reich* (New Haven: Yale Univ. Press, 1977).

support, he conceived the plan of codifying the subject by publishing the *Encyklopädie der mathematischen Wissenschaften*. Through this instrument, Dingler asserted, Klein was able to control developments in the field, since those who worked outside his empire were never given any recognition. Eventually all the leading journals became dependent on him, and no one could obtain even the lowliest position without his approval. Yet even this could not satisfy Klein's ambition, wrote Dingler, for he also wanted the mathematicians of other countries to submit to his rule. Thus he drew foreign students to Göttingen and gave them work of great interest, while young Germans, unless they happened to be Jewish, were forced into the background. The atmosphere in Göttingen was not only international and pacifist; it was already, in the 1890s, decidedly anti-German. Any expression of nationalist sentiment by a young German automatically jeopardized his career. In fact, Dingler contended, the Göttingen influence was so pervasive it even created a new style among German mathematicians, whose behavior, posture, gestures, and manners of speech were altered in imitation of Jewish prototypes. Only those non-Jews who could adopt this style had any hope of furthering their careers. Klein's dictatorship eventually led to a barely visible but all-powerful organization across the academic landscape, and practically every institution of higher education in Germany had its "Göttingen Jew" on the faculty.[3]

This caricature of Göttingen mathematics is patently ludicrous. Yet despite its exaggerations, Dingler's memorandum is rather suggestive in some respects. The perception that everything new and exciting in German mathematics came out of Göttingen often made colleagues in faraway places like Breslau or Freiburg rather envious. Even Berlin, the traditional center for mathematics in Germany, was relegated to a position of secondary importance beginning around 1900.[4] During the next fifteen years, Klein's colleagues included the illustrious mathematicians David Hilbert, Hermann Minkowski, Carl Runge, and Edmund Landau, as well as the astronomer Karl Schwarzschild and the physicists Ludwig Prandtl, Peter Debye, and Emil Wiechert. This stunning array of talent attracted no less than eighteen *Privatdozenten* in mathematics and mathematical physics to Göttingen between 1890 and the outbreak of World War I. Their names read like a "Who's Who in German Science" during the Weimar era: Hermann Weyl, Arnold Sommerfeld, Constantin Carathéodory, Gustav Herglotz, Erich Hecke, Max Born, Richard Courant, Theodor von Kármán, Otto Blumenthal, Ernst Zermelo, Paul Koebe, Robert Fricke, and Otto Toeplitz.

Göttingen's preeminent position vis-à-vis Berlin and other universities was bound to intensify traditional rivalries, and these were further aggravated by

[3] *Ibid.* Johannes Stark appears to have been under the impression that both Klein and David Hilbert were Jews: "In mathematics there was for a long time the combine of Jewish mathematicians in Göttingen led by Klein and Hilbert"; Stark, *Nationalsozialismus und Wissenschaft* (Munich, 1934), p. 12.

[4] Thus Adolf Kneser (Breslau): "Göttingen has proven again that it is the focal point of the world. But please write. . . . we provincials like to know what is going on in the world at large"; Kneser to Ernst Zermelo, 28 Apr. 1909, Zermelo Nachlass, Universitätsbibliothek Freiburg i.B. Later Zermelo wrote from Freiburg: "There are always more threads running together in Göttingen than anywhere else"; Zermelo to Richard Courant, 4 Feb. 1932, Zermelo Nachlass. In 1914 Georg Frobenius sought to win Hilbert for Berlin after failing in 1902. This time, he thought, the chances were better, as "Berlin had become a little Göttingen"; Kurt-R. Biermann, *Die Mathematik und ihre Dozenten an der Berliner Universität, 1810–1920* (Berlin: Akademie Verlag, 1973), p. 222.

Klein's aggressive academic politics and the influence he enjoyed in extrascientific circles. Klein was a trusted confidant of Friedrich Althoff, the kingpin of the Prussian university system, so that his opinions carried considerable weight in the Ministry of Culture, and it was well known that they could sometimes make or break the career of a young mathematician. Klein also developed contacts with a number of leading industrialists, and by the turn of the century firms like Krupp, Bayer, Siemens & Halske, AEG, and Norddeutscher Lloyd were pumping considerable amounts of money into new research institutes through the newly founded Göttingen Association for the Promotion of Applied Physics and Mathematics.

A nationalist and anti-Semite like Hugo Dingler could hardly fail to notice that soon after the war Göttingen was filled with foreign and Jewish mathematicians. The paranoia that echoes throughout Dingler's memorandum is particularly striking in those passages where he describes the differences between Jewish and Aryan modes of mathematical thinking. Although he claims that Jews made no fundamental contribution to mathematical knowledge prior to 1870 (an incredible assertion, given C. G. J. Jacobi's importance for German mathematics), he insists that they still pose a very real danger to the Germans: "Because of their cleverness, speed, and sure memory power, Jewish mathematicians are everywhere in the foreground." Naturally these are only apparent strengths, reflecting the lack of depth in Jewish thought; Dingler quickly points out that "the non-Jewish mentality therefore only appears slower, as more secondary associations are taken up." All this fits the classical pattern of racist hysteria at the time: German *Geist,* that frail but sacred essence, was being threatened by the dirty world of Jewish moneylenders, with their sharp, keen, reckoning minds. Special stereotypes developed in the world of mathematics, where it was commonly believed that Jews were innately inclined toward algorithmic, analytic, or abstract thinking, whereas Germans tended to think intuitively and synthetically, often drawing their inspiration from natural phenomena. The distinction between these two modes of thinking in mathematics, one *internal* and purist, the other *external* and applied, is commonplace even today (although without these racial overtones). What is ironical about the Dingler memorandum, however, is that Felix Klein himself was largely responsible for giving this distinction widespread currency. Moreover, he did so as a champion of the externalist tradition rather than the purist approach so often associated with "Jewish mathematics."[5]

That this was the case did not remain a secret to the Nazi regime for long; only a few months after the Dingler memorandum appeared, Ludwig Bieberbach delivered a well-publicized lecture, entitled "Personality Structure and Mathematical Creativity," in which he invoked the example of Felix Klein as a model for Aryan as opposed to Jewish mathematics.[6] One of Klein's last doctoral students, Bieberbach was appointed as *Dekan* of the Berlin philosophical faculty shortly after the Nazi takeover and became an official member of the party in 1937. His

[5] See, e.g., Felix Klein, "Über die Arithmetisierung der Mathematik," *Gesammelte Mathematische Abhandlungen* (Berlin: Springer, 1921–1923), Vol. II, pp. 232–251. Michael Atiyah, following in the tradition of Hermann Weyl, may be regarded as a contemporary exponent of the external approach, while the group known as Bourbaki is the leading modern representative of the internal one. See Robert Minio, "An Interview with Michael Atiyah," *Mathematical Intelligencer,* 1984, *6*:9–19.

[6] Ludwig Bieberbach, "Persönlichkeitsstruktur und mathematisches Schaffen," *Unterrichtsblätter für Mathematik und Naturwissenschaften,* 1934, *40*:236–243.

staunch supporter was Theodor Vahlen, who had been an outspoken racist since the early 1920s and was head of the Division of Higher Education in the Ministry of Culture after 1934. Vahlen and Bieberbach were publisher and editor, respectively, of the journal *Deutsche Mathematik*, an enterprise undertaken in the same spirit as the "Deutsche Physik" promulgated by Lenard and Johannes Stark. In pursuing this course, Bieberbach believed he was following the lead of his revered teacher, a claim he supported by citing this since-infamous passage from Klein's Evanston Colloquium lectures:

> It must be said that the degree of exactness of the intuition of space may be different in different individuals, perhaps even in different races. It would seem as if a strong naive space-intuition were an attribute pre-eminently of the Teutonic race, while the critical, purely logical sense is more fully developed in the Latin and Hebrew races. A full investigation of this subject, somewhat on the lines suggested by Francis Galton in his researches on heredity, might be interesting.[7]

Thus Bieberbach not only called attention to Klein's "healthy" German mathematical style; he also emphasized that Klein himself had known that stylistic distinctions were grounded in racial types. On the other hand, he never troubled to consider how it was possible for such an influential figure as Klein to have become surrounded by so many Jews and "white Jews," non-Jews who were considered to have been corrupted in spirit, inclination, and character by Jewish culture. Once the mystery surrounding Klein's racial background had been settled, it was safe for Bieberbach to use Klein's immense prestige as a vehicle for launching his own career as a Nazi mathematician. He helped advertise Klein's family history to the German mathematical community and continued to set forth his theory concerning the interplay between race and mathematical style, despite the outrage it provoked among foreign mathematicians.[8] Moreover, by drawing on Klein's numerous pronouncements regarding mathematical style while divorcing this issue from the familiar stereotype of Göttingen mathematics in the Weimar era as a manifestation of the Jewish conspiracy to undermine German culture, Bieberbach conducted an apparently successful campaign to "rehabilitate" Klein's legacy as a proto-Nazi thinker.

The central task of this essay will be to reassess this disputed legacy in the light of unpublished documentary evidence. I begin with some brief remarks on the plight of Jewish mathematicians in the German universities, together with a sketch of Klein's early contacts with some of them. The emphasis here falls on Klein's pivotal role in building a power base and network of contacts outside the mainstream tradition of Berlin. In the next section, Klein's seminar on the psychology of mathematics and his famous lectures on the history of nineteenth-

[7] Felix Klein, *The Evanston Colloquium: Lectures on Mathematics* (New York: American Mathematical Society, 1911), p. 46. On "Deutsche Mathematik," see Helmut Lindner, " 'Deutsche' und 'gegentypische' Mathematik," in *Naturwissenschaft, Technik und NS-Ideologie*, ed. Herbert Mehrtens and Steffen Richter (Frankfurt: Suhrkamp, 1980), pp. 88–115; see also Herbert Mehrtens, "Ludwig Bieberbach and 'Deutsche Mathematik,' " in *MAA Studies: Studies in the History of Mathematics*, ed. Esther Phillips, forthcoming.

[8] The documentation of Klein's Aryan ancestry was presented in E. Manger, "Felix Klein im Semi-Kürschner!" *Jahresbericht der Deutschen Mathematiker-Vereingung*, 1934, *44*:4–11. On the reaction to Bieberbach's speech, see Herbert Mehrtens, "Die 'Gleichschaltung' der mathematischen Gesellschaften im nationalsozialistischen Deutschland," *Jahrbuch Überblicke Mathematik*, 1985, *18*:83–103.

century mathematics serve as the primary vehicles for a reassessment of his views on "Jewish mathematics." These are compared with the opinions of other contemporary figures and contrasted with the racial theories forwarded by Bieberbach and the Nazi psychologist Erich Jaensch. The essay then concludes with some remarks directed toward the interpretation of Göttingen mathematics as a phenomenon of Weimar culture. Here the Jewish question forms part of a larger complex of social and political issues that led to a divisive and ultimately untenable situation within the Göttingen philosophical faculty. Alienated from their colleagues in the humanities, Göttingen mathematicians and scientists carried on a persistent battle with members of that group to ensure equal and just treatment for Jews, foreigners, women, pacifists, and other left-wing political dissidents. Led by David Hilbert, the most prestigious mathematician of the period, their efforts steadily polarized opinion within the philosophical faculty until a crisis in 1918 led to its permanent dismemberment. These events and circumstances illustrate the inadequacy of Fritz Ringer's "mandarin thesis" regarding the reactionary character of the German professoriate when it is uncritically extended from the humanists to the community of mathematicians and natural scientists.[9]

II. KLEIN'S RISE TO POWER

The German universities, which for centuries enjoyed a semiautonomous corporate status, have sometimes been likened to the medieval craft guilds.[10] And as many of the former institutions were founded during the late Middle Ages, the resemblance is not entirely fortuitous. Moreover, the neohumanist value system that dominated the scholarship of the early nineteenth century tended in many respects to reinforce patterns of training reminiscent of the apprenticeship required by the craft traditions. Neohumanism rested on the twin pillars of *Lehr- und Lernfreiheit*, the freedom to teach and to learn. These emphasized the autonomy and self-sufficiency of the academic disciplines, ideals that made the inner sanctum of the universities rather similar to the insulated and closed societies that developed around the guilds. After obtaining his Ph.D., the "apprentice-student" was promoted and became the "journeyman-doctor," who often studied at a number of universities before commencing his *Habilitation*. To reach this rung of the academic ladder, it was necessary to present the faculty with a finished "masterwork," the *Habilitationsschrift*. If this was found to be satisfactory, the candidate was granted the *Venia legendi*, which gave him the right to lecture as a *Privatdozent*. This meant that he collected the usual course fees from students (which were minimal) while the university paid him nothing. It was next to impossible to maintain oneself as a *Privatdozent* without substantial private means, and as the nineteenth century wore on a bottleneck developed in the system that left many in this state of limbo for ten years or more. Not that it had ever been all that easy to break in: Immanuel Kant taught for nine years as a *Hauslehrer* and fifteen as a *Privatdozent* before he finally obtained a professorship.[11]

[9] Fritz Ringer, *The Decline of the German Mandarins: The German Academic Community* (Cambridge, Mass.: Harvard Univ. Press, 1969).

[10] This comparison is made in, e.g., C. E. McClelland, *State, Society, and University in Germany, 1700–1914* (Cambridge Univ. Press, 1980), pp. 180–181.

[11] For precise statistics, see Peter Lundgreen, *Sozialgeschichte der deutschen Schule im Über-*

After about 1860 it was no longer customary to apply for a university position when a vacancy arose—to obtain an appointment above the rank of *Privatdozent* one needed to receive an unsolicited *Ruf,* or call to the position. The two basic types of appointment were as *ordentlicher Professor* or *ausserordentlicher Professor,* but until the end of the century only the *Ordinarien* enjoyed full faculty privileges, and there was a gross disparity between their incomes and that of the other *Dozenten.* To be appointed to an *Ordinariat*—to become a master in the guild, as it were—was the coveted goal of every aspiring academic. Yet, as Max Weber once remarked, the dominant characteristic of German academic life was that many were called (figuratively speaking) but few chosen. Even David Hilbert spent many years as a *Privatdozent* before moving up the ladder amid the extensive reshuffling of positions that took place in 1892.

Felix Klein, on the other hand, was the great exception that proves the rule. He took his doctorate in 1869, shortly after the death of his teacher, Julius Plücker. He then went on to study with Alfred Clebsch in Göttingen, made brief sojourns to Berlin and Paris, where he met Sophus Lie, and finally returned to Göttingen in 1871 to begin his short stint as a *Privatdozent.* The Göttingen faculty waived the normal requirement that he submit a *Habilitationsschrift,* and less than two years later he was appointed *ordentlicher Professor* in Erlangen at the practically unheard-of age of twenty-three. It was on this occasion that he presented the faculty with his famous *Erlanger Programm*—an impressive achievement, considering that throughout his student days Klein was intent on pursuing a career in physics.[12]

During the era of Friedrich Althoff (1882–1907) the Prussian universities expanded at an unprecedented rate, a development largely due to the long-term trend toward specialized research, especially scientific and medical research undertaken in special seminars and institutes. This growth was accompanied by a modest improvement in the placement and promotion of non-Protestant minorities. Bernhard vom Brocke has described the earlier situation in these terms: "In Prussia before Althoff's time it was impossible for Social Democrats, nearly impossible for unbaptized Jews, and seldom possible for Catholics to become *Ordinarien.*" Even during Althoff's first fifteen years in office the situation of the Jews improved only slightly; as the figures in Table 1 indicate, the jump from *Privatdozent* to *Ordinarius* remained exceedingly difficult.[13] One must exercise extreme caution in drawing conclusions from these and other statistics, above all because they are based on confession alone and therefore fail to take into account the considerable number of nonreligious Jews. Nevertheless, all sources seem to indicate that despite the rapid expansion of the German universities that

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blick, Vol. I: *1770–1918* (Göttingen: Vandenhoeck & Ruprecht, 1980), p. 106. The standard account of Kant's life is K. Vorländer, *Immanuel Kant, der Mann und das Werk,* 2 vols. (Leipzig, 1921).

[12] For an overview of the literature on Klein's career, see David E. Rowe, essay review of Renate Tobies, *Felix Klein;* Karl-Heinz Manegold, *Universität, Technische Hochschule und Industrie;* and Lewis Pyenson, *Neohumanism and the Persistence of Pure Mathematics in Wilhelmian Germany,* in *Historia Mathematica,* 1985, *12*:278–291.

[13] See Bernhard vom Brocke, "Hochschul-und Wissenschaftspolitik in Preußen und im Deutschen Kaiserreich, 1882–1907: Das 'System Althoff,'" in *Bildungspolitik in Preußen zur Zeit des Kaiserreichs,* ed. Peter Baumgart (Stuttgart: Klett-Cotta, 1980), pp. 84–85. In fact, neither the increase in the percentage of Jewish *Ordinarien* ($z = 0.833$) nor the decrease in the percentage of Jewish *Privatdozenten* ($z = 0.790$) is statistically significant.

Table 1. Jews in Academic Positions in Prussia

	Position	Jews	Total
1880	*Ordinarien*	11 (2.77%)	397
	Privatdozenten	41 (16.66%)	246
1897	*Ordinarien*	17 (3.63%)	469
	Privatdozenten	61 (14.66%)	416

accompanied the onset of the economic boom in 1895, the position of Jewish scholars, baptized or not, grew worse rather than better. A breakdown of the number of Jews gainfully employed in academic and freelance professions in 1907 reveals that only about 1.5 percent were *Dozenten*, the vast majority preferring careers as doctors (35.7 percent), teachers (24.5 percent), lawyers (14.2 percent), and artists (13.4 percent). Whereas the number of Jewish *Ordinarien* at all German universities during the period 1882–1909 remained relatively stable, fluctuating between twenty and twenty-five, by 1917 there were only thirteen, or approximately 1 percent of the total. Eleven universities, including Berlin, had none at all. Moreover, in a number of fields it was virtually impossible to find entry: no Jew ever held a chair in German literature, classical languages, or antique cultures before the Weimar era. Of the roughly two hundred Jewish *Dozenten* in all institutions of higher education in Germany in 1910, more than half were in medicine, and most of the remainder were members of a philosophical faculty (which normally included mathematics and the natural sciences). Very few held positions on a law faculty, which was one of the preferred means of entry into the civil service and other distinguished careers.[14]

One of the academic fields that was particularly attractive to Jewish scholars, no doubt partly because of its relatively value-free status, was mathematics. In fact, the first unbaptized Jew to be elevated to an *Ordinariat* at a German university was the Göttingen mathematician Moritz Abraham Stern. Born in 1807 in Frankfurt am Main, which for many years had the largest Jewish population of any German city, he was educated at home by his father and grandfather. Hoping that he would become a rabbi, they also hired a tutor who gave him lessons in Latin, Greek, Chaldaic, and Syriac (as an old man he learned Danish and Russian). When he matriculated at Heidelberg in 1826, however, his major subject was mathematics. One year later he began his studies at Göttingen, where his teachers were Bernhard Friedrich Thibaut, Tobias Mayer the younger, and Carl Friedrich Gauss. Stern remained in Göttingen for the next sixty years, retiring in 1885, when he was succeeded by none other than Felix Klein. Stern was an active member of the Göttingen Jewish community all his life, and during his student days he wrote home in Hebrew. He befriended Klein during the latter's brief tenure in Göttingen as a *Privatdozent*, and their correspondence from the 1880s suggests that he hoped to win Klein's services for the university sometime in the future.[15]

[14] See Arthur Prinz, *Juden im deutschen Wirtschaftsleben, 1850-1914* (Schriftenreihe wissenschaftlicher Abhandlungen des Leo Baeck Instituts) (Tübingen, 1984), p. 185; E. Hamburger, *Juden im öffentlichen Leben Deutschlands* (Schriftenreihe wissenschaftlicher Abhandlungen des Leo Baeck Instituts) (Tübingen, 1968), pp. 56–58; and D. L. Preston, "Science, Society, and the German Jews, 1870–1933" (Ph.D. diss., Univ. Illinois, 1971).

[15] The discussion of Stern's life is based on Martha Küssner, "Carl Wolfgang Benjamin Gold-

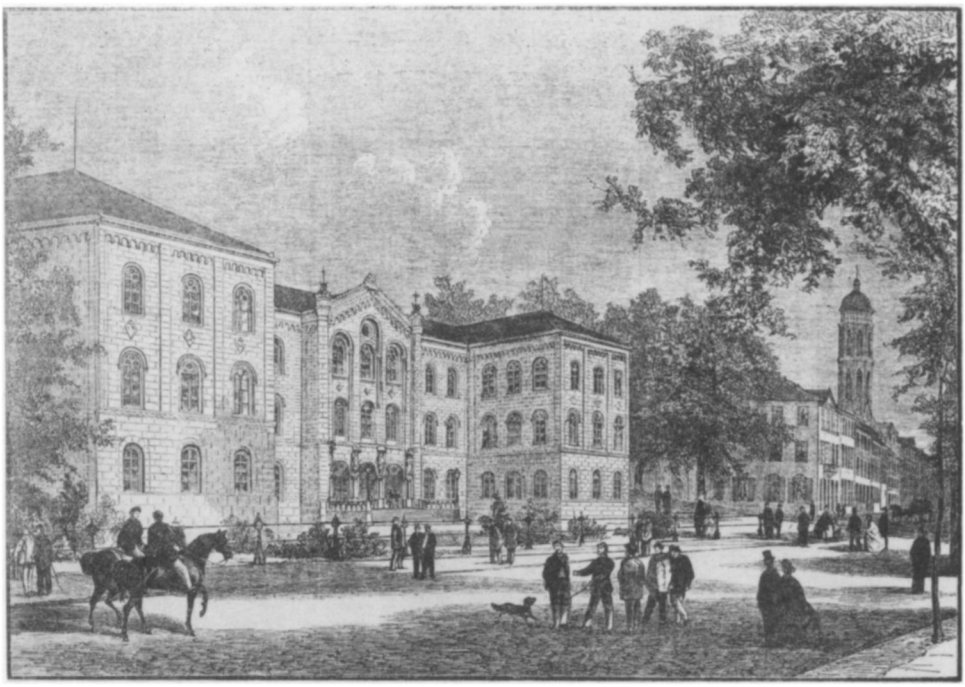

Figure 1. *The* Auditorienhaus, *built in 1865, was the home of Göttingen mathematics during the Klein era.*

Although he was a Göttingen fixture for so many years, Stern's career was filled with hardships. In 1829 he was awarded the doctoral degree with distinction, Gauss having been one of his examiners, and in 1830 he was made *Privatdozent*. To supplement his meager income he translated Siméon Denis Poisson's textbook on mechanics and published two popular works on astronomy. Eight years later the Hanoverian Ministry agreed to pay him a yearly salary of 150 taler, with the explanation that "as a Jew, Stern cannot become a professor." In 1840 he was recommended by his colleagues for the position of *ausserordentlicher Professor;* five years later the Ministry sent its reply: "As a Jew it is completely out of the question." The winds of 1848 apparently changed the climate of opinion enough so that he was finally appointed *ausserordentlicher Professor,* and throughout the 1850s he received small salary increases. Still, he had to wait until 1859, nearly thirty years after he had begun his career as a Göttingen *Dozent,* before he was finally made an *Ordinarius*.[16]

Stern's career clearly reflects the nearly insurmountable obstacles faced by Jewish scholars intent on pursuing academic careers prior to the founding of the Second Reich. It was only after the North German Confederation passed laws in 1867 and 1869 (which were incorporated into the Constitution of the Reich in

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schmidt und Moritz Abraham Stern, zwei Gaußschüler jüdischer Herkunft," *Mitteilungen der Gauss-Gesellschaft,* 1982, *19*:37–62. Stern's letters to Klein can be found in Klein Nachlass XI, 1160–1160C, Niedersächsische Staats-und Universitätsbibliothek, Göttingen (hereafter NSUB).

[16] Küssner, "C. W. B. Goldschmidt und M. A. Stern," p. 53.

1872) that eliminated politically sanctioned discrimination against Jews in the public service sector and freelance professions that the fifty-year process that led to the legal emancipation of Prussian Jewry came to an end. After this, baptism was no longer imperative for Jewish academics, although it was certainly a more prudent course than remaining of the Jewish faith. By the end of the 1860s two more mathematicians, Lazarus Fuchs and Leo Königsberger, had managed to overcome the stigma of being unbaptized Jews and were appointed to positions as *Ordinarien*. A third, Leopold Kronecker, declined Bernhard Riemann's chair in Göttingen, preferring to remain in Berlin, where he taught at the university by virtue of his membership in the Berlin Academy.[17] Yet the gains made by German Jewry in the ensuing period were purchased dearly: the wild speculation occasioned by the founding of the Reich led to the financial collapse of 1873 and an economic depression that lasted well into the 1890s. One of the side effects of these events was modern anti-Semitism. The evils of capitalism and Jewish banking interests soon became one in the minds of many Germans, particularly those whose livelihood and station in life were most immediately threatened by rapid modernization. At the universities this situation was aggravated by the swift emergence of the formerly repressed Jewish element that was being drawn to the academic professions in large numbers, at a time when the costs of higher education had become increasingly onerous.[18]

In the meantime Felix Klein had begun laying the groundwork for a new school of German mathematics. To a large extent he inherited this role as the leading student of Alfred Clebsch, who died just after Klein was called to Erlangen in 1872. A number of Clebsch's students at Göttingen followed Klein to Erlangen shortly thereafter, and at the same time he took on the major responsibility for editing the journal Clebsch had founded, *Mathematische Annalen*. Through the *Annalen* Klein maintained close working relationships with most of the leading members of the Clebsch school: Paul Gordan, Max Noether, Alexander Brill, Jacob Lüroth, and Aurel Voss. It was largely through the influence and support of these men that Klein was able to build the network of contacts among German mathematicians that he later expanded into a small empire.

Among these early supporters the most important were Gordan and Noether, both of whom were Jewish. Gordan was a rather cantankerous character twelve years Klein's senior. After working with Clebsch in algebraic geometry, he turned to the more formal aspects of the subject, where he made his fame as the "King of Invariants," a title that lost most of its distinction after Hilbert proved the finite basis theorem in 1892. Gordan joined Klein on the Erlangen faculty in 1874 and remained there all his life, producing exactly one Ph.D. student (who happened to be his colleague's daughter)—the great Emmy Noether. Ludwig Bieberbach later considered Gordan's algorithmic style a perfect model for "Jewish mathematics," in direct opposition to Klein's "Germanic" approach. But he

[17] On Fuchs and Königsberger see, A. A. Fraenkel, *Lebenskreise: Aus den Erinnerungen eines jüdischen Mathematikers* (Stuttgart: Deutsche Verlags-Anstalt, 1967), p. 76; on Kronecker, see Kurt-R. Biermann, "Leopold Kronecker," in *Dictionary of Scientific Biography*, 16 vols. (New York: Scribners, 1970–1980), Vol. VII, pp. 505–509, on p. 506.

[18] For a provocative study of modern anti-Semitism and its larger political implications, see Hannah Arendt, *The Origins of Totalitarianism*, 3rd ed. (New York: Harcourt, Brace & World, 1973). On Jews in the universities during this period, see Prinz, *Juden im deutschen Wirtschaftsleben* (cit. n. 14), pp. 138–140.

failed to point out that these styles, while admittedly poles apart, apparently complemented one another rather well. A great deal of Klein's work in Galois theory was undertaken with Gordan, with whom he often met during semester breaks after he accepted a call to the Munich Institute of Technology in 1875. Their joint efforts culminated in Klein's famous *Lectures on the Icosahedron,* about which the author had this to say in the preface:

> If now a far-reaching theory has grown . . . I attribute this result primarily to Professor Gordan. I am not here referring to his trenchant and profound labours, which shall be fully reported upon hereafter. In this place I must report what cannot be expressed in quotations or references, namely, that Professor Gordan has spurred me on when I flagged in my labours, and that he has helped me . . . over many difficulties which I should never have overcome alone.[19]

Max Noether and Klein began their lifelong friendship as fellow students of Clebsch in Göttingen. When Gordan was called to Erlangen in 1874, Klein's second choice for the position was Noether, which leaves little doubt that it was Klein's recommendation that brought him to Erlangen one year later. This appointment was as *ausserordentlicher Professor,* but Klein hoped that through his influence Noether would soon become an *Ordinarius.* These hopes were unfounded; eight years after Noether's appointment in Erlangen, Klein wrote to say that despite his best efforts he was unable to win support for Noether's candidacy in Freiburg and that the situation in Tübingen was even worse, as the faculty there was opposed on principle to accepting a Jewish colleague. Max Noether never received a call to another university, and he had to wait thirteen years before Erlangen finally made him an *Ordinarius.*[20]

During the five years Klein taught alongside Alexander Brill in Munich, he expanded his base of potential resources considerably. There he befriended the engineer and entrepreneur Carl von Linde, who was later instrumental in helping him establish new institutes for technological research in Göttingen. His most important contacts, however, were with two young students, Walter von Dyck and Adolf Hurwitz. Dyck was a talented teacher and organizer who served as the workhorse for many of Klein's larger projects, such as the *Encyklopädie der mathematischen Wissenschaften.* He later inherited Klein's chair in Munich and for many years was managing editor of *Mathematische Annalen.* Hurwitz, on the other hand, was strictly a mathematical talent; he also happens to have been Jewish. After studying with Klein in Munich, he went on to Berlin before returning to his mentor in Leipzig, where Klein was called to a special chair for geometry in 1880. Shortly before graduation Klein wrote a letter to Hurwitz's father, expressing his views on the young man's future:

[19] Felix Klein, *Lectures on the Icosahedron and the Solution of Equations of the Fifth Degree,* trans. G. G. Morrice, 2nd ed. (London: Kegan Paul, 1913), pp. viii–ix. On the impact of Hilbert's work on the finite basis theorem, see C. S. Fisher, "The Death of a Mathematical Theory," *Archive for History of Exact Sciences,* 1966, *3*:137–159. On Gordan's career, see Max Noether, "Paul Gordan," *Mathematische Annalen,* 1914, *75*:1–41. Bieberbach's contrast of Gordan's and Klein's mathematical styles appears in Ludwig Bieberbach, "Die völkische Verwurzelung der Wissenschaft," *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse,* 1940, *5*:1–31, on p. 22.

[20] See Felix Klein to M. A. Stern, 26 July 1874; Klein to Max Noether, 29 May 1883; in Klein Nachlass XII, NSUB. On Noether's career, see Alexander Brill, "Max Noether," *Jahresber. Deut. Math. Ver.,* 1922, *32*:211–233.

> Above all I want to stress that among the totality of young people with whom I have up until now worked there was not one who in specifically mathematical talent could measure up to your son. From now on your son will enjoy a brilliant scientific career, which is all the more certain because his gifts are combined with endearing personality traits. The only dangerous point is his health. Your son probably already long ago weakened himself through overwork in his studies. . . . Let me close with the assurance that no one will be happier than I when your son's health . . . fully returns. I need his thoroughgoing collaboration for my latest mathematical investigations.[21]

As this letter illustrates, Klein had an uncanny eye for spotting mathematical talent, which was certainly one of the keys to his later success in Göttingen. Hurwitz went on to make fundamental contributions in function theory, and as an *ausserordentlicher Professor* in Königsberg he became good friends with two students named Hilbert and Minkowski.

Klein had a long-standing interest in building a mathematical center in Göttingen that would rival Berlin, but it was only in the mid 1890s that he began to develop the resources necessary to do so. As a student of Plücker and Clebsch, Klein had inherited their strong antipathy for the purism of the Berlin tradition. Still, he seems to have been on fairly good terms with the leading Berlin mathematicians throughout the early stages of his career. The first sign of serious tension developed in 1885 when Klein, who until then had been teaching outside of Prussia, accepted a call to Göttingen. Against strong opposition he managed to secure the chair in geometry at Leipzig for his Norwegian friend Sophus Lie, a relatively unknown figure who was in fact the greatest geometer of the day.[22] As it turned out, Hermann Amandus Schwarz, Klein's future colleague in Göttingen and a leading representative of the Berlin school, coveted this position and even expected to be offered it. He and his teacher, Karl Weierstrass, were incensed to learn that a foreign mathematician had been favored above everyone in Germany. Weierstrass wrote Schwarz: "A pretty beginning to the new era that shall begin under Klein's presidency. Paul Dubois-Reymond sometimes really does hit the nail on the head; already years ago he called the triumvirate Klein-Lie-[Adolf] Mayer the société thuriféraire [mutual admiration society]."[23] Weierstrass and his allies had no difficulty in reading Klein's intentions; they were well aware that by bringing Lie to Leipzig Klein hoped to broaden his front against the Berlin school. What still remained unclear was his long-range plan: to rehabilitate the Göttingen tradition of Gauss and Riemann, with its strong emphasis on the interplay between mathematics and physical reality.

This strategy, however, could hardly have been realized without the strong support of Friedrich Althoff, head of the Prussian system of higher education. Although nominally accountable to the Prussian Minister of Culture, Althoff managed to carve out a vast sphere of influence all his own, which he ran with all the sovereign authority of a powerful prince. When a change in the Ministry led to his dismissal in 1907, it was necessary to appoint four new functionaries to

[21] Klein to Adolf Hurwitz's father, 10 May 1880, Mathematisches Archiv, NSUB.

[22] On Klein's early relations with the Berlin mathematicians, see Renate Tobies, *Felix Klein* (Leipzig: Teubner, 1981), p. 22; for his relations with Lie, see David E. Rowe, "On the Mathematical and Personal Relationship of Felix Klein and Sophus Lie with a Transcription of Klein's Unpublished Manuscript 'Über Lie's und meine ältere geometrische Arbeiten,'" forthcoming.

[23] Karl Weierstrass to H. A. Schwartz, 12 Dec. 1885, quoted in Biermann, *Die Mathematik und ihre Dozenten* (cit. n. 4), p. 130.

fulfill his former duties. It was an unofficial yet central feature of Althoff's educational politics that certain universities were given preferential treatment as outstanding research centers in selected fields. This was a marked departure from the earlier situation in which Berlin, as the capital and wealthiest university city, was invariably regarded as the final destination of a brilliant academic career. Under Althoff Berlin continued to dominate in classics, history, and the arts, but in the natural sciences, and particularly in mathematics, Göttingen became the new standard-bearer.[24]

A critical turning point for these developments occurred in 1892, when Kronecker's death and Weierstrass's retirement brought the "golden age" of Berlin mathematics to an end. It is interesting to follow some of the behind-the-scenes maneuvering during this period of transition. On 22 January a committee of Berlin faculty members met to propose candidates to fill the vacancies, and on one point there was unanimity of opinion. As excerpts from the committee's protocol indicate, under no circumstances would any of them countenance the candidacy of Felix Klein:

> Helmholtz: Kronecker spoke very disparagingly of Klein. He regarded him as a charlatan.
>
> Weierstrass: Klein dabbles more. A bluffer.
>
> Fuchs: I have nothing against his person, only his pernicious manner when it comes to scientific questions.[25]

The committee nominated Georg Frobenius to fill Kronecker's chair and Göttingen's H. A. Schwarz to succeed Weierstrass. These recommendations were approved by the Prussian Ministry, and one month later Klein wrote Adolf Hurwitz:

> Althoff was here for three days and has decided on the calls to Berlin. . . . [Concerning Schwarz's replacement] you will probably have guessed that I want to recommend you and Hilbert as the only two who, together with me, are in a position to assure Göttingen a place of scientific distinction. . . . Naturally I will name you first and Hilbert behind you. There are, however, a series of difficulties associated with your being called. . . . First, there is the problem of your health. . . . Secondly, there is the much subtler difficulty that you are, not only personally but also in your mathematical style, much closer to me than is Hilbert. Your coming here could therefore perhaps give our Göttingen mathematics a too one-sided character. There is thirdly—I must touch on it, as repugnant as the matter is to me, and knowing full well your justified sensitivity to this—the Jewish question. Not that your call as such would present difficulties; these I would be able to overcome. The problem is that we already have [Arthur] Schönflies, for whom I would like to create a firm position as salaried *Extraordinarius*. And having you and Schönflies together is something I will not get past either the faculty or the Minister.[26]

Two weeks later Klein wrote again, this time informing Hurwitz that he was now the only serious contender for Schwarz's position; it had been impossible

[24] Vom Brocke, "Das 'System Althoff'" (cit. n. 13), p. 22; on Althoff's role in Göttingen, see pp. 52–59.

[25] Biermann, *Die Mathematik und ihre Dozenten* (cit. n. 4), pp. 205–206.

[26] Klein to Hurwitz, 28 Feb. 1892, Mathematisches Archiv, NSUB.

even to get Hilbert's name on the list as he was still a *Privatdozent*. This assessment, however, did not accurately reflect the real state of affairs. After a long and intense debate between Klein and his colleagues Schwarz and Ernst Schering, the Göttingen faculty had compromised on the following list of candidates, in descending order: Heinrich Weber, Hurwitz, and Friedrich Schottky. Thus Klein was counting on Althoff to support him by passing over Weber and choosing Hurwitz instead. He even made it clear to Althoff that, in view of the anti-Semitism within the philosophical faculty, he would be willing to "sacrifice" Schönflies in order to get Hurwitz. This plan might well have been realized had not an unexpected circumstance diverted Klein from his original objective: Frobenius, who had not yet accepted the call to Berlin, began to consider openly whether he might not prefer the position in Göttingen instead. Klein was delighted by this turn of events, and assured Althoff that not only would Frobenius be welcomed by the faculty, but, as a leading representative of the Berlin school, he would also be a perfect complement for Göttingen. He even wrote Hurwitz that had he known there was any possibility of winning Frobenius he would have placed his name first on his list of nominees. Klein invited Frobenius to visit him in Göttingen, and following this meeting there was great suspense as everyone awaited the candidate's decision. Not surprisingly, he accepted the chair in Berlin, and immediately afterward Althoff offered the vacant post in Göttingen to Heinrich Weber.[27]

Klein was furious when he learned that Althoff had chosen to honor the faculty's wishes rather than his own, although it is not implausible that his own opportunistic fence-jumping may have ruined Hurwitz's chances. Another possibility is that Hurwitz was the victim of an "anti-Semitic backlash" within the Prussian Ministry, a suspicion Klein himself raised. For this reason, he wrote to Hurwitz, he considered the latter's "chances of succeeding Weber in Marburg or obtaining a call anywhere else in Prussia as unfavorable." This prophecy turned out to be true, although Hurwitz did receive an offer shortly thereafter from the Zurich Polytechnic, where he taught for the remainder of his career.[28] Whether or not Klein really believed that anti-Semitism had quashed Hurwitz's candidacy, there is no question that he was disappointed not to have won him for Göttingen. But Paul Gordan, who was thirty-eight years old before he became an *Ordinarius* and therefore presumably knew something about anti-Semitism in the German universities from firsthand experience, had a different perspective. As he wrote Klein:

> I am sorry to hear that you were not called to Berlin, as your all-embracing spirit would have brought order to the mathematical relationships in Germany. . . . It was

[27] Klein to Hurwitz, 17 Mar. 1892, Mathematisches Archiv, NSUB. A more accurate account of the faculty's considerations can be found in Klein Nachlass XXII L and Personalakten Heinrich Weber, 4Vb, Nr. 239, Universitätsarchiv Göttingen (hereafter **UAG**). Regarding Schönflies, see Klein to Friedrich Althoff, 7 March 1892, Rep. 92 Althoff AI No. 84, Bl. 21–22, ZStA. On Frobenius, see Klein to Althoff, 21 March 1892, Rep. 92 Althoff AI No. 84, Bl. 27–28, ZstA; and Klein to Hurwitz, 23 March 1892, Mathematisches Archiv, NSUB.

[28] Klein to Hurwitz, 7 Apr., 11 Apr. 1892, Mathematisches Archiv, NSUB. Ernst Meissner's story that Hurwitz was offered a chair at Göttingen, but had to turn it down because he had already accepted Frobenius's former position in Zurich, is simply false; Ernst Meissner, "Gedächtnisrede auf Adolf Hurwitz," in Adolph Hurwitz, *Mathematische Werke*, Vol. I (Basel: Birkhäuser, 1932), pp. xxi–xxiv.

Figure 2. *Adolf Hurwitz (1859–1919), who was not appointed at Göttingen. He accepted a chair at Zurich Polytechnic University in 1892 instead. Courtesy Springer Verlag.*

Figure 3. *Friedrich Althoff (1839–1908) masterminded the Prussian universities from 1882 to 1907. Through his support and efforts Göttingen assumed its place as the leading mathematical center in Germany.*

> just that you recommended Hurwitz for Göttingen; Hurwitz deserves this distinction. That your recommendation did not go through, however, is a fortune for which you cannot thank God enough. What would you have had with Hurwitz in Göttingen? You would have taken on the complete responsibility for this Jew; every real or apparent mistake by Hurwitz would have fallen on your head, and all his utterances in the faculty and senate would have been regarded as influenced by you. Hurwitz would have been considered nothing more than an appendage of Klein.[29]

Although disappointed, Klein was not one to take such a defeat calmly. He fired off an angry letter to Althoff complaining about the loss of face he had suffered in the Göttingen faculty; he had fought tenaciously for Hurwitz's cause, only to have Weber, the candidate proposed by his opponents Schwarz and Schering, called instead. This situation, he asserted,

> can only be somewhat remedied by having Schönflies named *Extraordinarius*. On the one hand, it is known that I have been working on his appointment for years, on the other, that my efforts have only met with resistance, so that I only dispensed from doing so as Hurwitz's call stood in question. Should Schönflies now be passed over, this impression [i.e., of Klein's impotence] will become a virtual certainty. I would then be forced to advise young mathematicians not to turn to me, if they hope to make further advancements in Prussia.[30]

[29] Paul Gordan to Klein, 16 April 1892, Klein Nachlass IX, NSUB.
[30] Klein to Althoff, 10 Apr. 1892, Rep. 92 Althoff AI No. 84, Bl. 32–34, ZStA.

Shortly after this letter was written Arthur Schönflies was appointed *ausserordentlicher Professor* in Göttingen, where for the next seven years he attracted droves of students to his classes in descriptive geometry.

Three years later Heinrich Weber accepted a call to Strassburg, thus paving the way for Hilbert, who had since become an *Ordinarius* in Königsberg, to come to Göttingen. Klein had had his eye on Hilbert for several years—already in 1890 he described him to Althoff as "the rising man"—and this time he was taking no chances. He wrote up the faculty's list of recommendations himself, and it consisted of just two names: Hilbert and Minkowski.[31] Hilbert was delighted to accept the call, and as it turned out the hard part was not so much winning Hilbert as keeping him once the rest of the world realized that Göttingen had another Riemann in its midst. No mathematician before Hilbert had ever declined a formal offer from Berlin, which was still the most prestigious mathematical center in Germany. Hilbert not only turned down offers from Leipzig and Bern; he twice refused a chair in Berlin. The first of these calls, which was a true test of strength for Göttingen mathematics, came in 1902. Klein, who was of course willing to do almost anything to keep Hilbert, urgently appealed to Althoff, who obliged by creating a new *Ordinariat* at Göttingen out of thin air, as it were, and calling Hilbert's long-time friend, Hermann Minkowski, to fill it.[32]

This unprecedented action was all the more daring in that Minkowski's appointment also overturned the unofficial policy in Göttingen that restricted the proliferation of Jewish *Dozenten* within a given discipline. Schönflies was by this time gone, but in the meantime Karl Schwarzschild, with strong backing from Klein, had been appointed professor of astronomy in 1901, inheriting the chair once held by Gauss. Thereafter the former residence of the "Prince of Mathematicians" in the west wing of the *Sternwarte* became a lively meeting place for the Göttingen mathematical community. Schwarzschild later accepted a call to the Potsdam Observatory and then volunteered to serve in the army during World War I, a decision that cost him his life. He is remembered today as one of the founders of astrophysics. Schwarzschild's sensitivity to the Jewish question was poignantly revealed by his son Martin, also a renowned astronomer. In his will, written before he entered the army, Schwarzschild advised his wife not to let their children know he was Jewish until they were older (she followed this advice after his death). Schwarzschild's decision to join the army in the first place, certainly an unusual step for a professor in his forties, was prompted by his conviction that German Jews could not expect to overcome anti-Semitism if they were unwilling to go above and beyond the call of duty in their support of the Reich.[33] A number of prominent "assimilated" Jews—the industrialist Albert Ballin, the public servant Walter Rathenau, and the chemist Fritz Haber, to name but a few—shared this conviction.

In 1909 Minkowski died suddenly after suffering an attack of acute appendi-

[31] Klein to Althoff, 23 Oct. 1890, Rep. 92 Althoff B No. 92, Bl. 76–77, ZStA. Klein's list of 13 Dec. 1894 is in the Personalakten Hilbert, UAG.

[32] On Hilbert's offers, see Biermann, *Die Mathematik und ihre Dozenten* (cit. n. 4), pp. 131, 209, 221–224; on the Hilbert-Minkowski relationship, see Constance Reid, *Hilbert* (New York: Springer, 1970) and *Hermann Minkowski, Briefe an David Hilbert*, ed. L. Rüdenberg and Hans Zassenhaus (Berlin: Springer, 1973).

[33] Interview of Martin Schwarzschild by Spencer Weart, Archive for History of Quantum Physics, American Institute of Physics, New York.

Figure 4. *David Hilbert (1862–1943), appointed to a chair at Göttingen in 1895. Courtesy Springer Verlag.*

Figure 5. *Hermann Minkowski (1864–1909), appointed to a chair at Göttingen in 1902. Courtesy Springer Verlag.*

citis. A number of apocryphal stories have since circulated describing how Klein and Hilbert chose his successor, but none of these squares with the facts, which indicate that the Göttingen faculty was not at all clear whom it wanted to nominate. The faculty ended up naming Hurwitz, Otto Blumenthal, and Edmund Landau—in no particular order, as all three were considered to be of equal merit. All three also happened to be Jewish. Blumenthal, an *Ordinarius* at Aachen, was a former student of Hilbert's and had succeeded Dyck as managing editor of *Mathematische Annalen*. During the Nazi era he was stripped of this office, and he eventually died in a concentration camp. Blumenthal and Hurwitz both had strong connections with Göttingen, but the call went instead to the *Privatdozent* Landau, a gifted number theorist and an outstanding representative of the Berlin school. His appointment illustrates, once again, a characteristic feature of Klein's mathematical outlook that had a profound impact on Göttingen mathematics, namely, his constant pursuit of breadth and balance. Klein was no mere ideologue pushing a particular approach to mathematics; more than anything else he respected talent and accomplishment, regardless of the packaging.[34]

[34] The faculty's list of recommendations can be found in Rep. 76 Va Sekt. 6, Tit. IV, 1 Vol. XXII, Bl. 24–27, ZStA. Klein's emphasis on ability is stressed by W. H. Young: "Klein's two principles in recommending the call of a new professor were, first, *individual pre-eminence*, and second, collective *representativeness*"; "Christian Felix Klein, 1849–1925," *Proceedings of the London Royal Society*, Series A, 1928, *121*:1–19, on p. 12. The omission of this emphasis is one of the weaknesses of Lewis Pyenson's *Neohumanism and the Persistence of Pure Mathematics in Wilhelmian Germany* (Philadelphia: American Philosophical Society, 1983).

The "Landau style" later became one of Bieberbach's principal targets in his attack on "Jewish mathematics," and shortly after the Nazi takeover its leading proponent was forced to resign his position in Göttingen. Another important Jewish mathematician in Göttingen was Felix Bernstein, who became *ausserordentlicher Professor* for statistics and actuarial mathematics in 1911. For a time he was vice-president of the local organization of the German Democratic Party, but he gave up politics when it became clear that his outspoken support for the Weimar Republic was so unpopular that it interfered with his standing in the academic community. A number of leading Jewish mathematicians came to Göttingen from abroad: the Swiss Paul Bernays, the Ukrainian Alexander Ostrowski, the Hungarians Theodor von Kármán and John von Neumann, and the Yugoslav Willy Feller. Four others—Richard Courant, Ernst Hellinger, Max Born, and Otto Toeplitz—all came from Breslau. Courant took his degree under Hilbert, was decorated during World War I, and later returned to Göttingen as heir to Klein's position as *wissenschaftlicher Führer*. The height of this Jewish influx came during the Weimar era, but, as with so many other aspects of Weimar culture, the pattern was well in place a decade before the outbreak of the war. And, as with so much else, its demise came quickly on the heels of the Nazi takeover. When the first series of dismissals reached the German universities in April 1933, Göttingen lost six faculty members, and four of the six—Courant, Bernstein, Born, and Emmy Noether—were Jewish mathematicians or physicists. James Franck did not wait to be fired; he resigned a few weeks earlier in protest against the impending action.[35]

III. KLEIN'S VIEWS ON "JEWISH MATHEMATICS"

During the war years Felix Klein busied himself with a series of lectures on the history of nineteenth-century mathematics. Originally intended for the series *Kultur der Gegenwart*, they remained unpublished for some ten years until Otto Neugebauer and Stephen Cohn-Vossen prepared a revised edition shortly after Klein's death in 1925.[36] Since then this two-volume work has become an acknowledged classic that crystallizes a lifetime of rich experience spent in the service of mathematical ideas and culture. And yet, like so many of Klein's accomplishments, these lectures were very much a communal effort that grew out of his intense interaction with the Göttingen milieu. He prepared for them by holding a colloquium on the mathematical literature of the period during the summer of 1914; among those who attended were Courant, Carathéodory, and Debye. After the war broke out, however, it became clear that most of the younger mathematicians, whom he had been counting on to help him with the lectures, would be called into the army. Thus it happened that during the first two semesters they were written up by Klein's daughter Elisabeth, who had studied mathematics and physics at Bryn Mawr and Göttingen, rather than by one of his assistants, as was the custom.

[35] For a detailed account of the impact of the Nazi takeover on Göttingen mathematics see Norbert Schappacher, "Das Mathematische Institut, 1929–1950," in *Die Universität Göttingen unter dem Nationalsozialismus*, forthcoming. On Courant, see Constance Reid, *Courant in Göttingen and New York: The Story of an Improbable Mathematician* (New York: Springer, 1976).

[36] The original lecture notes can be found in Klein Nachlass XXI J–M, NSUB. The published version is Felix Klein, *Vorlesungen über die Entwicklung der Mathematik im 19. Jahrhundert*, 2 vols. in one (New York: Chelsea, 1967; rpt. of Berlin: Springer, 1926–1927).

Figure 6. *The* Aula *was the official meeting place for the University and the Göttingen Academy of Sciences.*

During the second semester these lectures attracted twenty-eight listeners, including the professors Runge, Carathéodory, Bernstein, and Edward Riecke and six women. Among the latter was Emmy Noether, who came to Göttingen in April 1915 and played a large role in assisting Klein from the moment she arrived. His lecture notes are full of references to meetings with Fräulein Noether, which became even more frequent after he began to concentrate on the mathematical foundations of relativity theory. Klein's interest in this field dated back to the days when Minkowski was laying the mathematical groundwork for special relativity. His interest in the general theory was ignited after Einstein gave six lectures on the subject in Göttingen during the summer of 1915. Shortly thereafter Einstein wrote: "To my great joy, I succeeded in convincing Hilbert and Klein completely." This satisfaction wore off rather quickly, however, as by November both Einstein and Hilbert had serious misgivings about the Einstein-Grossmann theory and were engaged in an intense correspondence that eventually led to the discovery of the ten gravitational field equations for general relativity theory.[37] In the wake of this exciting activity Klein began a new lecture series on invariant theory and its applications to classical electromagnetic theory and special relativity. He also began related investigations into the mathematical foundations of general relativity theory, which resulted in three papers published in 1918. In all this work he, like Hilbert, relied heavily on Emmy Noether's expertise in differential invariant theory. She went on to generalize their work by demonstrating the underlying connection between variational principles and con-

[37] Abraham Pais, *"Subtle is the Lord . . .": The Science and Life of Albert Einstein* (Oxford: Clarendon, 1982), pp. 257–261; quoting Albert Einstein to W. J. de Haas, undated, probably Aug. 1915, on p. 259. See also John Earman and Clark Glymour, "Einstein and Hilbert: Two Months in the History of General Relativity," *Arch. Hist. Exact Sci.*, 1978, *19*:291–308.

servation laws in physics. The capstone to this elegant theory is today known as "Noether's Theorem" in the calculus of variations.[38]

Having suggested some of the circumstances surrounding Klein's lectures, it remains to consider their content insofar as this relates to his views on "Jewish" versus "German" mathematics. The editor of the recent English translation of the first volume of Klein's lectures, Robert Hermann, offers this disturbing assessment of their character: "Klein certainly spoils his case for us by his blatant nationalism and racism. Judging from his statements here, he hated most, in descending order a) Frenchmen, b) Jews, and c) Axiomatists. It is a good thing there were no Franco-Judaic-Axiomatists! It would be almost funny if there had been no Hitler to pander to this disease of the German intellectual mind."[39] Exaggerated as this verdict may be, it is certainly worth examining what Klein actually said in the lectures that could have prompted such harsh words.

The Jewish question surfaces most often in Klein's remarks about individual mathematicians, such as J. J. Sylvester: "As a personality Sylvester was outwardly lively, witty, and sparkling. He was a splendid speaker, who often distinguished himself with his striking and clever versifying. In the brilliance and versatility of his spirit he was a true representative of his race—he was descended from a purely Jewish family." Klein's portrait of Jacobi was not nearly so flattering:

> Less deep and original than Abel yet much more versatile, Jacobi possessed not only the impulse to acquire pure scientific knowledge, but also the desire to impart it. This drive to activate others manifested itself, on the one hand, in a brilliant pedagogical talent, and on the other, in a strong determination to assert his personality, even to the point of inconsiderateness. The keenness and versatility of his brilliant mind, together with an infamous and often feared sarcastic wit, supplied him with most effective weapons for his incessant battles, although he was often seduced into using them imprudently.

Klein went on to point out that Jacobi encountered difficulties in gaining acceptance as a member of the Königsberg faculty, as it was reported that he had said something unpleasant to everyone on it. In closing his account of Jacobi's career, he had this to say:

> As is well known, the year 1812 brought with it the emancipation of the Jews in Prussia. Jacobi was the first Jewish mathematician to take a leading place in Germany, and in so doing he was again at the forefront of a great, and for our science significant, development. This measure opened up a large reservoir of new mathematical talent for our country, whose powers, along with those of the French immigrants, very soon bore fruit. It appears to me that our science has won a strong stimulant through this type of blood replenishment. Along with the already mentioned law regarding shifts of productivity from country to country, I would like to designate this phenomenon as the effect of national infiltration.[40]

[38] On this work, see E. J. McShane, "The Calculus of Variations," in *Emmy Noether: A Tribute to Her Life and Work*, ed. James W. Brewer and Martha K. Smith (New York/Basel: Dekker, 1981), pp. 125–130.

[39] Felix Klein, *Development of Mathematics in the 19th Century*, Vol. I, trans. M. Ackerman. (Lie Groups: History, Frontiers and Applications, 9) (Brookline, Mass.: Math-Science Press, 1979), p. 365.

[40] Klein, *Entwicklung der Mathematik* (cit. n. 36), pp. 163, 108, 114–115.

This unfortunate choice of terminology was later exploited by the Nazi psychologist Erich Jaensch, who argued that Klein was a forerunner of his own pseudoscientific racial theory. Jaensch first introduced the jargon of S-types and J-types that Bieberbach borrowed to characterize the thinking of Jewish and Aryan mathematicians, respectively. Later Jaensch got into the act himself, and in his 1939 study *Mathematisches Denken und Seelenform,* dedicated to Felix Klein as "German educator and early champion of German-oriented science," he even proclaimed that it was Klein who prompted him to investigate the connection between race and mathematics.[41] This prompting allegedly took place during the winter semester of 1909–1910, when Klein held a seminar on the psychology of mathematics. From the passages cited above, it seems clear that Klein accepted uncritically the racial views that colored the thinking of his time. The Jewish question, as Klein perceived it, centered on an ethnic type rather than the members of a religious faith (Jacobi, after all, had been baptized). Still, the biological metaphor—German mathematics regenerated by new blood (*Bluterneuerung*)—makes it clear that for Klein, unlike Jaensch and Bieberbach, this intermixture of Teutonic and Semitic peoples was a sign of health, not disease, in German society.

According to Jaensch, Klein was intrigued by the "conflict between the German spirit and the preponderance of a completely different type of thinking in mathematics" and continually returned to this theme in his seminar "despite the fact that it was intentionally repressed by several of the participants." It is doubtful, however, that Jaensch ever attended this seminar, as his name does not appear in the protocol book. In any event, this document gives a detailed and very different impression from that conveyed by Jaensch of what actually went on in the seminar.[42] Among the topics discussed were problems of space perception (Leonard Nelson), the work of J. H. Pestalozzi and J. F. Herbart (Erwin Freundlich), reckoning prodigies and blindfold chess players (Freundlich), Georg Cantor's philosophy of mathematics (Bernstein), and the physiology of space perception (Errera). Klein's keen interest in these questions is evidenced by the fact that this was one of the few seminars for which he wrote out the protocol himself. Moreover, he dominated the podium throughout, discussing the working methods of Gauss, Lie, and other figures. The racial issue did surface on one occasion, when a student named Steckel spoke about his teaching experiences in Eastern Europe. On the basis of these he maintained that Jews and Germans conceptualize differently when performing calculations. To subtract ¾ from 7¼, for example, the Germans would first reduce each by ¼, and then calculate 7 − ½ = 6½. The Jews, on the other hand, would convert 7¼ into ²⁹⁄₄, and then subtract to obtain ²⁶⁄₄. This example was, no doubt, meant to illustrate the usual stereotype: that Jews excelled in logical thinking, whereas Germans thought intuitively. In another meeting, Felix Bernstein stressed that environment and training, even at an advanced level, play a more important role than heredity in determining a mathematician's outlook and style.

But to return to Klein's lectures, perhaps the most telling of his remarks about

[41] Erich R. Jaensch and Fritz Althoff, *Mathematisches Denken und Seelenform* (*Zeitschrift für angewandte Psychologie und Charakterkunde,* Supplement 81) (1939), p. 32.

[42] *Ibid.,* p. 1. The *Protokollbücher* for Klein's seminars are housed in the Mathematics Institute Library at Göttingen University.

a Jewish style in mathematics is a passage on Leopold Kronecker: "In that he was mainly concerned with arithmetic and algebra, in later years however setting up definite intellectual norms for all mathematical work, he appears as the specifically Jewish talent, although in a special, individual form, to be sure."[43] Kronecker was certainly a controversial character who made a great many enemies in the course of his career, Georg Cantor being the best-known case in point. When the time came to appoint his successor, Klein wrote Althoff a lengthy report on Berlin mathematics that began with the following observations:

> Without question the positive aspects have been borne primarily by Kronecker. In this respect I must not withhold my praise. That Kronecker, even in his last years of life, was able to bring new ideas to our science with such youthful ambition, and thereby to uphold Berlin's old fame as a center for mathematical research in a new form, that is an accomplishment one can only admire without reservation. My critique merely concerns the one-sidedness with which Kronecker, from a philosophical standpoint, fought against various scientific directions that were remote from his own. . . . This one-sidedness was probably less grounded in Kronecker's original talents than it was in the disposition of his character. Unconditional mastery, if possible over all of German mathematics, became more and more the goal which he pursued with all the cleverness and tenacity he could muster. Little wonder that there is no one to take his place now that he has left the arena.[44]

There is no question that Kronecker wielded an immense influence as a *Dozent* at Berlin University, a member of the Berlin Academy, and as co-editor of the *Journal für reine und angewandte Mathematik*. In the all-important sphere of academic appointments in mathematics he was probably the most powerful figure in Germany during the 1880s. Thus it is ironic that Klein, the heir to this title during the Wilhelmian era, should have criticized Kronecker's lust for power, a trait that was more than readily apparent in his own character and that he normally admired in others as well. Still, as Klein well knew, power and popularity seldom go hand in hand, and Kronecker's Jewish background meant that he was all the more likely to come under attack. Consider the following remarks made by his colleague Weierstrass in a letter to Sonya Kovalevsky:

> Kronecker is different [from their mutual colleague Ernst Kummer]. He quickly makes himself familiar with everything that is new; his ready ability to grasp enables him to do so, but not in a penetrating manner. He does not possess the talent to engage himself in a good, but unfamiliar work with the same scientific interest that he pursues his own studies. Beyond this he shares the shortcoming that one finds in many intelligent people, especially those of Semitic stock: he does not possess sufficient fantasy (intuition I would prefer to say). And it is true, a mathematician who is not something of a poet will never be a complete mathematician. Comparisons are instructive: an all-embracing vision focused on the loftiest of ideals distinguishes [Niels Henrik] Abel from Jacobi, Riemann from his contemporaries ([Gotthold] Eisenstein, [Johann Georg] Rosenhain [both of Jewish descent]), and [Hermann von] Helmholtz from [Gustav Robert] Kirchhoff (although the latter is without a drop of Semitic blood) in an altogether splendid manner.[45]

[43] Klein, *Entwicklung der Mathematik* (cit. n. 36), p. 281.

[44] Klein to Althoff, 6 Jan. 1892, Rep. 92 Althoff AI, No. 84, Bl. 5–9, ZStA.

[45] Weierstrass to Sonya Kovalevsky, 27 Aug. 1883, cited in Gösta Mittag-Leffler, "Une page de la vie de Weierstrass," *Compte Rendu du Deuxième Congrès International des Mathématiciens*, ed. E. Duporeq (Paris: Gauthier-Villars, 1902), p. 149.

Figure 7. *Klein's severe, almost autocratic personality was captured in this portrait by Max Liebermann, who considered it one of his finest works. One of Germany's leading painters during the Wilhelmian era, Liebermann was also in many respects a characteristic example of the "assimilated" Jew in Prussia during this period. See Peter Gay, "Begegnung mit der Moderne–Deutsche Juden in der deutschen Kultur," in* Juden in Wilhelminischen Deutschland 1890–1914, *ed. Werner E. Mosse (Tübingen: Mohr, 1976), pp. 241–312, on pp. 246–255.*

These remarks, echoed in the very same stereotypes set forth by anti-Semites like Dingler and Bieberbach fifty years later, are a good illustration of how deeply rooted such thinking was in German culture. Indeed, very similar stereotypes were also commonplace in physics. Arnold Sommerfeld, for example, once wrote H. A. Lorentz that Einstein's works seemed to him "almost unhealthy in their nonconstructible and unintuitive dogmatism. An Englishman could hardly have produced this theory; perhaps it expresses, like that of [Emil] Cohn, the abstract conceptual approach of the Semite."[46] What makes this pronouncement especially noteworthy is that Sommerfeld's own institute in Munich was later fingered by Nazi scientists, along with Göttingen, as being at the very hub of the "Jewish conspiracy" in physics. In fact, Johannes Stark was able to prevent Werner Heisenberg from succeeding Sommerfeld in Munich by attacking him as the "Ossietzky of physics" and a "white Jew" in the *Schwarze Korps*.[47]

That men of integrity like Klein, Weierstrass, and Sommerfeld were incapable

[46] Arnold Sommerfeld to H. A. Lorentz, 26 Dec. 1907, Lorentz Nachlass, Rijksarchief, The Hague, cited in Andreas Kleinert, "Noch einmal: Sommerfeld und Einstein," to appear in *Sudhoff's Archiv*. See also Andreas Kleinert, "Nationalistische und antisemitische Ressentiments von Wissenschaftlern gegen Einstein," in *Einstein Symposium Berlin 1979* (Lecture Notes in Physics, 100) (Berlin: Springer, 1979), pp. 501–516.

[47] See Armin Hermann, *Werner Heisenberg, 1901–1976* (Bonn: Internationes, 1976), p. 58. Sommerfeld's Munich school was attacked in L. Glaser, "Juden in der Physik: Jüdische Physik," *Zeitschrift für die gesamte Naturwissenschaft*, 1939, 5:272–275.

of freeing themselves from the conventional racial thinking of their day is certainly suggestive of how pervasive these prejudices must have been. On the other hand, it is important to distinguish the views of someone like Felix Klein from those of Bieberbach, Stark, and the like. Although Klein believed that Jews probably had innately different mental capacities than most Germans, he recognized their legitimacy as a minority within the society and their positive contribution to German culture. This was certainly not the case with Bieberbach and his group, who identified the dominant style of Jewish mathematicians with a degenerate form that was poisoning the soul of "Deutsche Mathematik." Theirs was a politically activated form of racism that sought to avenge the betrayal of the Reich by the international conspiracy of Jews, who they believed aided and abetted its enemies both at home and abroad. Thus Bieberbach and Jaensch sought to discredit the French liberal tradition by including Descartes, Laplace, Augustin Cauchy, and Henri Poincaré as S-types along with the Jews. And when Edmund Landau, formerly one of Klein's trusted colleagues, was driven from his post as Göttingen's senior mathematician after belligerent Nazi students organized a boycott of his classes, Bieberbach justified this travesty as a healthy reaction of German youth against "Jewish mathematics." Landau, he pointed out, was so imbued with the Jewish spirit that in one of his textbooks he even defined the number π by means of an infinite series.[48]

IV. GÖTTINGEN MATHEMATICS AND WEIMAR CULTURE

One of the characteristic features of Felix Klein's mathematics was that his ideas were very much "in the air" at the time he expounded them. Unlike many of the great mathematicians of the nineteenth century—Gauss, Cauchy, Abel, Riemann, Weierstrass, and Lie—Klein was the antithesis of the lonely genius working away in his study. For him, mathematics was essentially a matter of communication, and much of his best work was undertaken in consultation with his colleagues and students. Thus he longed for an environment with as much human interaction as possible, and at Göttingen he realized this lifelong ambition. During the Weimar era Göttingen inaugurated a quiet revolution that has since placed a giant gulf between the mathematics of the nineteenth century and mathematics as it is practiced today. I am referring here not so much to the content of the new mathematics that came out of Göttingen, important as modern algebra, quantum mechanics, and metamathematics certainly were. What I have in mind is rather the development of a fundamentally new type of mathematical community that has by now rendered the traditional nineteenth-century modes of communication and invention largely obsolete. Mathematics today is essentially an oral culture: to keep abreast of it one must attend conferences and workshops or, better yet, be associated with a leading research center where the latest developments from near and afar are constantly being discussed. By the time an important result actually appears in print today, it is probably no longer new; in any case, it will probably be impossible to understand the work without the aid of an "interpreter" who already knows the thrust of the argument through an oral source.

[48] Bieberbach, "Persönlichkeitsstruktur und mathematisches Schaffen" (cit. n. 6), p. 236. On the racial typology of "Deutsche Mathematik" see Lindner, "'Deutsche' und 'gegentypische' Mathematik" (cit. n. 6), p. 97.

Thus somewhere along the line there was a revolutionary shift from a static, print-oriented mathematical culture to a dynamic oral culture, and no one played a more decisive role in this transformation than Felix Klein, the architect of the modern Göttingen tradition.

Klein had a unified vision of an open-ended scientific milieu that was grounded in mathematics but spanned the gamut of the natural sciences and their applications to technology. Shortly after the turn of the century, when Schwarzschild, Prandtl, Runge, and Wiechert were all in Göttingen, Klein began conducting a series of joint seminars with his new colleagues on topics like hydrodynamics, elasticity theory, technical mechanics, electrotechnology, and the motion and construction of ships. Hilbert and Minkowski also took a profound interest in mathematical physics. But their activity never reached beyond the purely theoretical sphere; it was Klein who provided the real glue that held the diverse aspects of the Göttingen enterprise together.

The point I would like to emphasize here, however, is that this Göttingen scientific community had a distinctly modern social and political orientation that scandalized many conservative academicians, and not just those who attacked it from afar. Although its university was founded on Enlightenment principles in 1737, Göttingen was anything but a bastion of liberalism. In fact, during the Weimar era it became one of the strongest northern outposts for the Nazi party, which had founded a local organization in Göttingen in 1922 and by the end of 1923 already had 200 *Sturmabteilung* men in uniform.[49] The city's largest newspaper, the *Göttinger Tageblatt*, helped fuel the flames of racial resentment during the 1920s by praising Erich Ludendorff on his sixtieth birthday as a warrior against Jewry and calling Kurt Tucholsky a Hebrew *Schmutzfink*. Tucholsky, the leading critic for Carl von Ossietzky's *Weltbühne* and generally regarded as the most brilliant satirist in the German language after Heinrich Heine, was not only slandered but even threatened by the *Tageblatt*, which wrote: "Unfortunately no one has yet been found who was willing to mark the Star of David on this guy's face with a riding-whip."[50] By 1925 Göttingen's first newspaper had openly come out in support of the Nazi party; its readers were not long to follow. In national elections the Nazis always fared much better in Göttingen than in the country at large. In 1930, when they garnered only 20 percent of the vote across Germany, they won 38 percent in Göttingen; and in the great Nazi victory of July 1932, when the party polled 37 percent of the vote nationwide, Göttingen gave it an absolute majority.[51]

The fraternal organizations that dominated student life in Göttingen had a long history of anti-Semitism and were known for their reactionary politics. When the Prussian Minister of Culture, Carl Heinrich Becker, brought out a constitution for a National Student Union that made discrimination by race and religion illegal, 86 percent of the Göttingen student body voted against it. Rather than accept

[49] Helga-Maria Kühn, "Die nationalsozialistische 'Bewegung' in Göttingen von ihren Anfängen bis zur Machtergreifung (1922–1933)," in *Göttingen unterm Hakenkreuz*, eds. Jens-Uwe Brinkmann and Hans-Georg Schmeling (Göttingen: Stadt Göttingen, Kulturdezernat, 1983), pp. 13–46.

[50] Peter Wilhelm, *Die Synagogengemeinde Göttingen, Rosdorf und Geismar, 1850–1942* (Studien zur Geschichte der Stadt Göttingen, 11) (Göttingen: Vandenhoeck & Ruprecht, 1978), pp. 38–39.

[51] Fritz Hasselhorn and Hermann Weinreis, "Göttingen's Weg in den Nationalsozialismus, dargestellt anhand der städtischen Wahlergebnisse, 1924–1933," in *Göttingen unterm Hakenkreuz*, pp. 47–58, on p. 47.

a Student Union in which Jews and other undesirables would be granted free access, they evidently preferred to have none at all. Five years after the Nazis founded their own student organization in Göttingen in 1926, they had attained an absolute majority in the student congress. This shift to the right largely met with the approval of the Göttingen faculty, as its members too had strong leanings in this direction. Although they were not as radical as the students, most of those who were politically active belonged to the two traditional parties of the right: the German National Peoples' Party (DNVP) and the German Peoples' Party (DVP). The DNVP was the more reactionary of the two, and throughout the 1920s it attracted increasingly greater support. In 1920, 36 percent of the 98 Göttingen professors were politically active, either as party members or by having made speeches for a particular party. The breakdown was as follows: 15 DNVP (42 percent), 11 German Democratic Party (DDP) (31 percent), 9 DVP (25 percent), 1 German Communist Party (KPD). In 1927 the activity rate was 42 percent and the breakdown 54 percent DNVP, 23 percent DVP, and 15 percent DDP; by 1931 the DNVP was even stronger.[52]

The Göttingen philosophical faculty was composed of two *Sparten*—one for mathematics and the natural sciences, the other for humanities—which until 1922 voted together on all major matters of business. In most cases this system functioned smoothly enough, as the concerns of the one group were usually a matter of indifference to the other. Starting around 1910, however, a series of conflicts arose that ultimately made this working arrangement untenable. One of these concerned Emmy Noether, who became a test case for the issue of whether women would be allowed to assume the duties of a *Dozent* at a German university. The fact that Noether was Jewish and had decidedly left-wing political leanings was, in this instance, of relatively little importance; the key problem was her sex. In 1915 Klein, Hilbert, Landau, Runge, and Carathéodory forwarded Noether's candidacy for the *Venia legendi* in a memorandum presented to the Ministry. This request never got off the ground, however, as it was repudiated by a number of their colleagues in a separate report that effectively stymied the action. Two years later the same group of mathematicians, together with the physicists Woldemar Voigt and Peter Debye, petitioned the Ministry again, this time voicing their concern that Noether might be inclined to habilitate at the newly founded university in Frankfurt if she were not allowed to do so in Göttingen. The Ministry responded by assuring her supporters that there was no need for alarm, as there was no possibility that Noether, or any other woman, would be allowed to teach at any German university. Only with the fall of the Reich two years later did this situation improve. Emmy Noether was promptly made a *Privatdozent,* but even so she was never promoted beyond the level of an unofficial *ausserordentlicher Professor.*[53]

Beyond this particular conflict within the Göttingen philosophical faculty there were a number of other open disputes regarding the admission and promotion of foreign students, the preparatory education to be required of all students, and the

[52] Barbara Marshall, "The Political Development of German University Towns in the Weimar Republic: Göttingen and Münster, 1918–1930" (Ph.D. diss., Univ. London, 1972), pp. 229–232, 117–118.

[53] See Fakultätsakten IIPh Nr. 4e, UAG; see also Auguste Dick, *Emmy Noether, 1882–1935,* trans. H. I. Blocher (Boston/Basel/Stuttgart: Birkhäuser, 1981).

qualifications of various candidates who were being considered for chairs in philosophy. According to a spokesman for the humanists, writing in 1918, the two *Sparten* had "completely different principles and viewpoints" regarding these and other matters, which would make it impossible to avoid friction in the future. This situation clearly indicates the limitations of Fritz Ringer's assumption "that in their attitudes toward cultural and political problems, many German scientists followed the leads of their humanist colleagues."[54] Far from following in the footsteps of their colleagues in the *Geisteswissenschaften,* the Göttingen scientific community actively opposed the politics of this academic "mandarin" caste.

The figure consistently singled out by the humanists as their archenemy and the real ringleader among the scientific faction was David Hilbert, who was by no means an ivory tower dreamer or the naive eccentric popularly remembered today. To be sure, he was a colorful character, but he was also a hardheaded negotiator who was deeply engaged in academic politics, and his views carried considerable weight with friendly colleagues as well as in the Prussian Ministry. In 1915, for example, not long before his unsuccessful campaign on behalf of Emmy Noether, he singlehandedly prevented Johannes Stark from being called to the chair in experimental physics at Göttingen. Hilbert had immense prestige by this time, but all the same this was a remarkable incident motivated by sheer politics. Not only was Stark's candidacy strongly backed by the right-wing physicists Willy Wien and Phillip Lenard, but nearly everyone regarded his scientific credentials as superior to those of his competitors. Even Hilbert acknowledged this, but he insisted that Stark, as a *völkisch* nationalist and outspoken anti-Semite, was simply unacceptable for Göttingen. After he apparently persuaded Debye to his view, no one was in a position to argue otherwise.[55]

Hilbert's last and most spectacular collision with the humanists at Göttingen was part of a long-standing feud concerning the philosopher Leonard Nelson. Nelson was a true "counterculture" figure and a constant thorn in the side of the *Geisteswissenschaftler,* not only because of his unorthodox philosophical views, but also because he was considered a radical fanatic who agitated for causes like pacifism and socialism. The fact that he was of Jewish extraction probably did not help matters either. Within the philosophical faculty his sole supporters were mathematicians and scientists. In fact, Hilbert and Klein alone voted in his favor when he made his first, unsuccessful attempt to habilitate in 1906. His *Habilitation* was approved three years later, but he appeared to have almost no prospects for promotion, as his name was anathema to most professional philosophers. Nevertheless, he had unusual dedication and gifts as a teacher and, with time, became a cult figure in Göttingen. He and his devotees had numerous run-ins with fraternal organizations and other nationalist-oriented student groups, scenes that became more frequent and intense after the war broke out. Nelson's fights with the Göttingen faculty were mostly of a petty nature, but his notoriety spread

[54] Memorandum of 10 Aug. 1918, sent by the historische-philologische Abteilung to the Ministry, Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXV, Bl. 400–402, ZStA; see Ringer, *Decline of the German Mandarins* (cit. n. 7), p. 6.

[55] The impression of Hilbert as a naive eccentric tends to dominate, e.g., in Reid's *Hilbert* (cit. n. 26). For Hilbert's campaign against the appointment of Stark, see the documentation in Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXIV, Bl. 341–376, ZStA. This contains a letter from Stark, dated 1 Feb. 1915, from which it is clear that he would have accepted the call had he received it. At the time he was running torpedo tests in Kiel for German U-boats.

after the *Göttinger Tageblatt* falsely reported that he had evaded military service by feigning illness. He took the paper's editor to court, and the ensuing trial, which lasted over a year, was reported in considerable detail by the *Tageblatt*.[56]

In 1917 a vacancy as *ausserordentlicher Professor* for philosophy opened up in Göttingen, but Nelson was not among those nominated by the majority of the faculty—hardly a surprise. Hilbert felt this was a gross injustice, however, and drafted a minority report in which Nelson alone was named. Still, only five of his colleagues agreed to sign it, not nearly enough to induce the Ministry to intervene. But then something unexpected happened: before this position could be filled an *Ordinariat* in philosophy also became vacant, giving Hilbert just the operating room he needed. This time he and nine others filed a minority report in which they agreed to leave the humanists' candidate for the *Ordinariat* uncontested if the Ministry would agree to convert the other chair into a permanent position for philosophy of the exact sciences—that is, place it under the purview of the scientists. Hilbert explained his motives in a letter addressed to Carl Heinrich Becker in the Ministry. Having earlier fought in vain to keep Edmund Husserl in Göttingen, he wrote, he was determined that Nelson, too, would not be forced to leave.[57] Before the Ministry could respond, however, these deliberations led to an open break between the two *Sparten*. In a fateful joint session the scientists had demanded that they be entitled to choose a voting member to serve on the commission charged with the initial selection of candidates for the vacancy in philosophy. Neither faction was willing to budge on this issue, and shortly afterward the humanists urged the Ministry to initiate the process that they had been contemplating for some time, namely, the formal division of the faculty. In the meantime the scientists' recommendation was approved, and in 1919 Nelson was appointed *ausserordentlicher Professor*.[58]

These are only some of the events and circumstances that can be cited in support of the thesis that the Göttingen scientific community was a true phenomenon of Weimar culture. As one of the world's leading centers for mathematics and physics, Göttingen attracted students and scholars, many of whom became world-renowned; many among them were women, foreigners, or Jews. Certainly there was no deliberate policy behind this—much less an international Jewish conspiracy, as Hugo Dingler would have it. But then neither was it entirely an accident. It was, to a large extent, the indirect result of a principle that Felix Klein had followed from the beginning of his career, a principle that knew only one criterion for evaluating a mathematician's worth—talent. Klein's legacy lived on in the world of mathematics, but not through Aryan supremacists and Nazi spokesmen like Ludwig Bieberbach. Nor was its home in Göttingen. When the Nazi Minister of Culture Bernhard Rust attended a banquet in Göttingen in 1934,

[56] Ekkehard Hieronimus, *Theodor Lessing, Otto Meyerhof, Leonard Nelson: Bedeutende Juden in Niedersachsen* (Hanover: Verlag für Literatur und Zeitgeschehen, 1964), pp. 97, 101–107. One of Nelson's many fights with the humanists on the Göttingen faculty is documented in Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXVI, Bl. 275–276, 330–335, ZStA. On the course of Nelson's lawsuit, see the newspaper clippings in Personalakten Leonard Nelson, 4Vb, Nr. 292, UAG.

[57] David Hilbert to C. H. Becker, 30 July 1918, Rep. 76 Va Sekt. 6, Titl. IV, 1, Vol. XXV, Bl. 451, ZStA. For Hilbert's attempts, see the documents in Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXV, Bl. 155–160, 307–309, 400–402, ZStA. On Hilbert's earlier efforts to keep Husserl in Göttingen, see Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXII, Bl. 234–236, ZStA.

[58] See the Dekanatsakten, "Spaltung der Fakultät," II Ph/1k, UAG; see also Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXV, Bl. 452–476, ZStA.

he asked Hilbert whether it was true, as rumored, that the Mathematics Institute had suffered after the removal of the Jews and their friends. Hilbert's famous reply: "Suffered? It hasn't suffered, Herr Minister. It just doesn't exist anymore."[59] The Göttingen tradition had gone underground; like so many other remnants of Weimar culture, it reemerged a short time later in the United States. There Hermann Weyl joined Albert Einstein at the Institute for Advanced Study, Emmy Noether taught at Bryn Mawr until her unexpected death in 1935, and Richard Courant gave the Göttingen tradition its most lasting reincarnation by founding a mathematics institute at New York University.

[59] Reported in Fraenkel, *Lebenskreise* (cit. n. 17), p. 159.