

Transforming Tradition: Richard Courant in Göttingen

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Richard Courant had a knack for being at the right place at the right time. He came to Göttingen in 1907, just when Hilbert and Minkowski were delving into fast-breaking developments in electron theory. There he joined three other students from Breslau: Otto Toeplitz, Ernst Hellinger, and Max Born—all, like him, from a German Jewish background.¹ Toeplitz was their natural intellectual leader, in part because his father was an *Oberlehrer* at the Breslau Gymnasium [15]. Courant was 5 or 6 years younger than the others; he was sociable and ambitious but also far poorer than they ([22], 8–13).

Max Born had been the first of these four Breslau Jews to enter the more intimate private sphere that made the Göttingen of Hilbert and Minkowski so special. But Courant was soon to follow, although he got off to a rough start in their seminar. He was asked to report on the derivation of electrostatic and magnetic phenomena based on a paper by Heinrich Hertz; he recalled this harrowing experience many years later for the benefit of his biographer, Constance Reid ([22], 17–18).² Max Born later suffered a similar fiasco when he gave his first talk in the *Mathematische Gesellschaft* ([4], 134–135). In fact, this type of harrowing experience was so commonplace that it must have seemed

like a kind of initiation rite for the young mathematicians who survived it. Even Emil Artin, who came to Göttingen in 1922 when Courant was director of the Mathematisches Institut, complained bitterly about the abuse he suffered from Hilbert, who of course set the tone.³ The mathematical atmosphere in Göttingen was, from the time of Klein and Hilbert, fiercely competitive. One had to be a survivor.

Hilbert's special friendships with Hermann Minkowski and Adolf Hurwitz began during his student days in Königsberg. Both came from Jewish families and both figure prominently in the exhibition "Transcending Tradition" ([2], 56–64). Some assumed that David Hilbert was also a Jew, if only because of his name ([25], 422–423).⁴ Later, when so many young Jews began to gravitate toward Göttingen, the local atmosphere began to change. What Richard Courant experienced there was something new and exciting; indeed, Hilbert's Göttingen was very much a Weimar-culture phenomenon. Its community was uncharacteristically open, affording a young person such as Courant opportunities that would have been unthinkable elsewhere. As the historian Peter Gay long ago pointed out, Weimar culture already took root during the Wilhelmine period [12]. Richard Courant was hardly the type of figure

¹Reinhard Siegmund-Schultze points to the great importance of Breslau for German mathematics and culture in ([36], xviii).

²Reid's books on the lives of Hilbert [21] and Courant [22] relied heavily on oral interviews, making the reliability of the conveyed information highly dependent on the memories of these persons. Not surprisingly, those memories were often colored by subjective factors coupled with the natural conflation of events that occurs with the passing of time.

³"I have now given my lecture, but as far as Hilbert is concerned, I was not lucky. Landau and the number-theorists liked it very much, as they also expressed, while Hilbert was interrupting me frequently.... I could not finish my talk and present the last results of my dissertation...Hilbert has spoiled my joy for work completely..." quoted in ([9], 270).

⁴For example, in 1893 Sophus Lie described the decline of mathematics in Germany in a letter to Gaston Darboux, naming as exceptions "two Israelites: Hilbert and Hurwitz" (S. Lie to G. Darboux, undated 1893, Sophus Lie's Brevsamling, Nr. 14, University Library Oslo). The anti-Semitic philosopher Hugo Dingler harbored deep suspicions for three decades regarding Hilbert's favoritism toward Jews, see ([41], 273) and ([25], 422–424).

Gay had in mind, and yet the subtitle of his book fits him perfectly: “the outsider as insider.”

Opinions about Courant varied sharply, and in some ways his character and approach to mathematics represents an anomaly—he was at once a daring innovator as well as a conservative with a deep belief in the vitality of older traditions. Courant identified very strongly with the Göttingen mathematical tradition he grew up with. If he was in some ways linked to Weimar culture, he had none of the Oedipal urges that Gay saw in the German Expressionists. Quite the contrary, he was the obedient son who honored his forefathers. He lived in and for the Göttingen mathematical tradition, but not as a static relic of the past. He helped transform it into something that lived on right through the Weimar period, and, in Courant’s mind at least, he continued to carry this mission with him when he started all over again in New York. NYU was Courant’s own personal *Stunde Null* (zero hour).

Courant would surely have been puzzled to learn that he would be remembered today at NYU as a “Jewish mathematician in a German-speaking academic culture,” the subtitle of the English-language version of the exhibition [2]. He more likely thought of himself as a “German mathematician in an academic world that spoke *amerikanisch*.” Clearly, his own sense of Jewish identity was far weaker than that felt by other prominent contemporaries whom he knew, for example Einstein, but also Edmund Landau or Otto Toeplitz. He was one of those German Jews who suffered greatly when the Nazis rose to power precisely because he identified so strongly with German culture.⁵ Still, there can be no doubt that he also recognized his outsider status; even as director of the Göttingen Institute he lived in a kind of bubble. Town and gown were anything but philo-Semitic, and those in the so-called Courant clique engendered a great deal of resentment ([25], 445–449). The fact that Courant was a war veteran, who nearly died fighting for Imperial Germany, made no difference; to those who never got over their country’s defeat, he was just another symbol of what had gone wrong: too many Jews.⁶

After his appointment as Klein’s successor in 1920, Courant continued to promote the interplay between pure and applied mathematics, especially by forging a close alliance with his colleagues in physics, Max Born and James Franck. That all three were of Jewish background led to heightened tensions within the Philosophical Faculty. Hilbert and his allies had early on fought ferociously with their more conservative colleagues. Many in the latter camp felt that Courant, Born, and Franck owed their appointments to the turbulent situation in Germany immediately after the war, an attitude that afterward fueled deep resentments and occasional open conflicts.⁷

Anti-Semitism burst into the open during the early years of the Weimar Republic. A prominent target then was Albert Einstein, who had close ties with the Göttingen community, especially with Hilbert. This was the period when Einstein discovered his own sense of Jewish identity ([31], 136–171). In 1921 he came to New York, along with Chaim Weizmann, to raise money for the founding of a Hebrew University in Palestine. Asked by a journalist about the causes of recent anti-Semitism in Germany, Einstein replied, “To some degree, the phenomenon is based on the fact that Jews exert an influence on the intellectual life of the German people altogether out of proportion to their numbers. While in my opinion the economic position of the German Jews is vastly overestimated, Jewish influence on the press, literature, and science in Germany is very pronounced and obvious to even the casual observer” ([31], 150).

Einstein had a keen eye for the tensions in this postwar climate. Having experienced politicized attacks by German physicists against his theory of relativity, he also realized that anti-Semitism was not merely confined to uneducated street thugs. Courant hoped it would fade away. Even when he and his friends were forced to step down in 1933, he clung on, hoping for another chance ([36], 167–170). He was also most unhappy that Einstein, who was spending the winter of 1932–1933 in Pasadena at Cal Tech and who would never again set foot in Germany, had issued public statements criticizing the policies of the new National Socialist government. Writing to his friend James Franck on 30 March 1933, Courant vented his anger about this: “Even if Einstein does not regard himself as German, he has experienced a lot of good in Germany. So he should feel obligated to make amends for the trouble he has caused as far as he can” (quoted in [36], 84).⁸

After the Nazis came to power, this so-called “Courant clique” was quickly singled out and dismissed as part of a policy to “purify” the German civil service ([33], 346–354). Courant and his friends tried to fight this dismissal, pointing not only to his patriotism during the Great War but also to his many achievements as director of the Göttingen Institute of Mathematics ([22], 143–152). This was to no avail, of course, which was a turn of events that left their leader devastated and depressed. A few years later, his eyes now fully opened, he realized that he had been lucky that the next chance came in a country that would eventually go to war against Hitler’s Germany.

Biography and Oral History

After Constance Reid completed her biography of Hilbert in 1969, Kurt Friedrichs asked her if she would be willing to help Courant write his memoirs. She had interviewed him earlier for her Hilbert book, which contains a number of

⁵See ([36], 167–170) and ([22], 142–163).

⁶On the destruction of Courant’s institute in 1933 and the infighting thereafter, see [33] and [34].

⁷See ([25], 438) and ([33], 346–349).

⁸Courant’s attitude toward Einstein at this time was common among German Jews, as vividly shown in a letter that Elsa Einstein wrote to her friend Antonina Vallentin in April 1933: “The greatest tragedy in my husband’s life is that the German Jews make him responsible for all the horrors that happen to them over there. They believe he has provoked it all and in their resentment have announced their total dissociation from him. We get as many angry letters from the Jews as we do from the Nazis.” ([38], 224).

favorite Courant stories about his fabled hero, the man Hermann Weyl called the “Pied Piper of Göttingen” ([39], 132). After a brief meeting in New Rochelle, Courant reluctantly assented to this idea ([22] 1–2). He had been happy with the way she handled the story of Hilbert’s life, so he no doubt found it difficult to object to Friedrichs’ plan. Reid soon discovered, however, that this was not going to be an easy task. In fact, when her Courant book came out in 1976, she admitted that it was something rather different from a conventional biography. Courant loved to talk about *certain parts* of his life, but when it came to other parts—such as his first 20 years, growing up under trying circumstances in Breslau—he seemed to remember little ([22], 3–5).

Most of what Reid learned about those years came from written sources: Courant’s father’s unpublished memoir and the family chronicle written by Edith Stein, Richard’s cousin [37]. Nina Courant, née Nerina Runge, tried to help, but she had to admit that Richard generally did not like to talk about his own life, least of all the many hardships he had endured; he was always looking forward, she said, not backward. Probably that applied to Nina, too. Still, to understand Richard Courant’s life one must take into account the hardships he endured before he became engaged to her.

Richard’s problems began when his father, Siegmund, was blamed for his older brother’s suicide following ill-fated business ventures that left the family bankrupt. Estranged from his siblings, Siegmund decided to leave Breslau and settle in Berlin. He took his wife and their two youngest sons with him, while Richard, who was only 16, remained behind. Richard lived alone but occasionally visited the home of his paternal aunt, Auguste Stein, a widow who ran the family’s lumber business after her husband’s death. Edith Stein was the youngest of her eleven children. Edith was also a close friend of Courant’s first wife, Nelli Neumann, a talented mathematician who took her doctorate in Breslau in 1909, one year before him. She then went on to take courses that qualified her to become a secondary-school teacher. But in 1912 she decided to marry Courant, who was teaching as a *Privatdozent* in Göttingen. Nelli had grown up in Breslau as the only child of a judicial official, so Richard had married up: for the first time in his life he enjoyed some modest financial security. The marriage, however, went badly from the start. Nelli grew lonely, and so she asked her friend Edith to come to Göttingen. All this and more can be found in Edith Stein’s *Aus dem Leben einer jüdischen Familie* [37], which offers a vivid portrait of academic life in Göttingen before and during the war. Stein studied philosophy there under Edmund Husserl, eventually taking her doctorate *summa cum laude*.

When the Great War broke out, Courant was quickly called to serve in the army. Nelli then decided to leave Göttingen and she went back to Breslau to live with her father. So Edith inherited the unhappy couple’s apartment, thanks to which we have her fairly detailed description of its more than ample accommodations. Clearly, these had brought no joy; Nelli and Richard officially divorced in 1916. After the war she taught at a girls’ school in Essen, but

lost that position when the Nazis took power in 1933: although a baptized Protestant, she was, according to Nazi law, a Jew. Nelli Neumann was later deported to Minsk where she was executed in 1942. Edith Stein, who converted to Catholicism in 1922 and afterward taught at a Catholic school in Münster, suffered the same fate. She died in Auschwitz and was later made a saint by Pope John Paul II. Richard Courant had some 30 cousins who lived in Germany in 1933. Of these, 19 left and went to live on five different continents, four managed to survive in Berlin, two committed suicide, and five died in gas chambers ([22], 247). He was a survivor, and he did not wish to dwell on the past.

When I first came to New York in 1981, I rented a room in New Rochelle that turned out to be right around the corner from the Courants’ house on 142 Calton Road. So I introduced myself to Nina, who was still going strong at 90 years of age. I told her about my interest in Göttingen mathematics, and she was happy to tell me about those days. She still had plenty of memories and I still have notes from one of our first chats. She dug around her house and offered to give me copies of whatever documents she could find. Best of all, she also invited me to join her when she and her daughter Lori were making music together with friends. I soon was able to meet a number of the women in this extended Courant family, including Nellie Friedrichs, who had just published her moving memoir of her early years in Braunschweig [11]. This ends with the dramatic story of how she and her future husband—“Frieder” as she lovingly called him—plotted their successful escape from Nazi Germany.

The atmosphere in New Rochelle in the early 1980s was no longer so idyllic, but visiting Nina Courant’s home was nevertheless like going back in time. A portrait of Hilbert hung in the dining room, and another Göttingen mathematician could be seen in the living room, near the grand piano: Nina’s father, Carl Runge. She told me how much she had enjoyed the adventure of coming to a new country: it was like starting life all over again. Her husband was always busy, of course, but he really loved it when he could get away from the city; their home was a real sanctuary for him, a place he could unwind, make music, and yes, even occasionally do mathematics.

I was also able to interview Kurt Friedrichs back then [24], which was a memorable occasion for me. He still had vivid memories of Göttingen going back to 1922, the year he first arrived on the scene. Friedrichs had a keen sense for mathematical traditions and how they were transformed through the course of his career. His picture of Courant clearly dominates throughout Constance Reid’s book. Richard Courant was a truly enigmatic figure, even for many who knew him well. His mathematical tastes spanned the gamut from classicism to romanticism, and although he admired number-theorists such as Edmund Landau and Carl Ludwig Siegel, his own work was eclectic, at times even sloppy. As Friedrichs once put it: Courant “always considered himself the mathematical son of Hilbert—and he always played down what he owed to Klein—but in fact he was the son of Klein” ([22], 241). Friedrichs thought of him as “Hilbert in the spirit of Klein,”

which is an image that rings true if we remember that Hilbert was fundamentally an algebraist whereas Klein was a geometer, and yet both published heavily in analysis. So Courant, who was indeed an analyst, could see himself as carrying the heritage of Hilbert forward, even though his romantic style was far closer to Klein's.

Courant's research on conformal mapping, boundary-value problems, and Riemann surfaces combined methods and perspectives he learned from both of his mentors.⁹ He admired the ideals these two giants stood for and later, after he assumed the reins of power, he strove to conserve the core values that lay at the heart of their Göttingen tradition. Yet his interests in applied mathematics reflected a broader outlook, a view consonant with the work of two other Göttingen figures, Ludwig Prandtl and Carl Runge. Their arrival in Göttingen in 1904 represents the crowning achievement in Klein's efforts to wed mathematics with modern scientific and technological developments, a move that eventually led to a longer-term transformation away from traditional pure research [26]. Nevertheless, Courant remained open to both directions, pure and applied; thus he also took a deep interest in fields such as analytic number theory, a discipline cultivated by Göttingen's Edmund Landau. Courant resembled Klein in another important respect: he liked to appeal to the vitality of an idealized Göttingen mathematical tradition. When Felix Klein attended the Chicago Mathematical Congress in 1893 he spoke of a desire to return to the great tradition of Gauss and Wilhelm Weber. On other occasions, Klein held up Riemann as the key figure in the Göttingen tradition ([20], 310–312). For Courant, the great names were Riemann, Klein, and, above all, Hilbert. Courant never tired of telling stories about Hilbert, and of course a good story deserves to be exaggerated, at least a little.¹⁰

Courant and the “Jewish Question”

Courant's love for storytelling also helps explain the confusion surrounding the circumstances that led to his own professorial appointment in Göttingen in 1920, a turn of events that has much to do with a former rival, Hermann Weyl. Among Hilbert's many distinguished students, Weyl stood in a special category all his own. His personal relationship with Hilbert, on the other hand, was highly ambivalent, in part because Weyl much preferred research to teaching [28]. After joining the faculty at the ETH in Zürich in 1913, he afterward turned down a series of attractive offers from leading German universities, preferring to remain in Switzerland until 1930 [10]. In that year he was offered Hilbert's chair, an honor even Weyl could not refuse. Courant, of course, knew Hermann and Hella Weyl very well from their student days in Göttingen. Later in life, however, he may well have forgotten that his own career owed much to Hermann Weyl, in particular the latter's reluctance to leave the beautiful surroundings of Zürich for the buzz saw of mathematical activity in Göttingen. In this

respect, he was the polar opposite of Courant, who loved to be at the center of the storm.

In Constance Reid's biographies of Hilbert and Courant, she relates a curious fable about a new professorship that Courant “apparently negotiated” in 1922; this was supposedly offered to Weyl, who then declined ([22], 90). One might naturally wonder how the Prussian Ministry of Education could have funded a new professorship in the midst of the galloping inflation at this time and the general scarcity of financial resources; moreover, if Weyl had in fact turned this position down, why was it then not offered to someone else? But, in fact, the true situation can be easily clarified and corrected: the year was 1920 and the position was Klein's former chair, the professorship Courant ultimately obtained ([10], 33–48). Moreover, contrary to what one reads further on in Reid's book, Courant's call to Göttingen came about not through some carefully orchestrated plan hatched by Klein and Hilbert, but rather as the result of a complicated series of events that no one could have foreseen at the time. These complications arose, in part, because of two vacancies in Prussia: Erich Hecke's professorship in Göttingen and the chair formerly occupied by Constantin Carathéodory in Berlin. The actual course of negotiations in both Göttingen and Berlin can, in fact, be reconstructed from extant ministerial and faculty records, sources we can assume to be far more reliable than human memory. These documents not only clarify the chain of events that led to Courant's appointment but, even more, they throw fresh light on the surrounding circumstances as well as the truly abysmal living conditions in Germany at this time.

Given the prestige attached to these two vacant professorships, the faculties in Göttingen and Berlin naturally set their sights on the most accomplished mathematicians of the day. Both universities focused on three outstanding candidates: the Dutch topologist L. E. J. “Bertus” Brouwer, Leipzig's Gustav Herglotz, and Hermann Weyl. In Göttingen, these three were nominated in just that order, whereas the Berlin faculty placed Weyl after Brouwer but ahead of Herglotz.¹¹ Clearly, a strong consensus of opinion had been reached about these three men, but then something happened that would have been unthinkable in earlier times: all three candidates turned down *both* offers, preferring to remain in Amsterdam, Leipzig, and Zürich, respectively. In view of the ongoing political unrest in Berlin, which culminated with the unsuccessful Kapp Putsch in March 1920, one can easily understand their reluctance to reside in the Prussian capital. Weyl eventually dismissed this possibility, but not the idea of leaving Switzerland for Göttingen. It took him nearly six months before he finally declined, thereby opening the way for Courant's dark-horse candidacy ([10], 46–48).

In the meantime, Courant's personal ties to Göttingen had become stronger than ever. Immediately after the war, he was eking out a living as *Assistent* to Carl Runge,

⁹For an overview of Courant's mathematical work, see [16].

¹⁰For an impression of Courant as a storyteller, see [6].

¹¹The complications in Berlin are described in ([3], 192–194). The original list of candidates for Göttingen can be found in Rep. 76 Va. Sekt. 6, Tit. IV, 1, Vol. XXVI, Bl. 423–424, *Geheimes Staatsarchiv Preußischer Kulturbesitz*.

Göttingen's Professor of Applied Mathematics. His relations with the Runge family grew even closer when in January 1919 he married their daughter, Nina. Housing being scarce, the newlyweds resided with her parents, and early the following year Nina gave birth to their son Ernst. Not long afterward, Courant was offered a professorship in Münster, the chair formerly occupied by Wilhelm Killing. He accepted, despite the drudgery of travelling back and forth from Göttingen. At this time he had no idea that he might be offered Klein's former position, although he probably knew that Hilbert and Klein were agitated about Weyl's inability to reach a decision. Still, there was no inside plan to recruit Courant from Münster, contrary to Reid's version of the ensuing events ([22], 78). In fact, the extant documentary evidence suggests a very different picture.

When Hecke left for Hamburg in the fall of 1919, Arthur Schoenflies wrote to Hilbert, offering him advice about potential candidates.¹² As a former protégé of Klein and Hilbert, Schoenflies was well aware of their general views regarding academic appointments. He thus left Courant's name off his list on the assumption that he could not be promoted from a mere titular professor, a status he acquired in 1918, to an *Ordinarius*. Even more to the point, Schoenflies explicitly noted that such a nomination would contravene the principle prohibiting *Hausberufungen* (in-house selections), because Courant had never held a position outside of Göttingen. Schoenflies thus understood very well that Courant had strong support, but he also knew that his candidacy would have encountered great resistance, if only on purely formal grounds. Schoenflies did not need to raise another inevitable hurdle, one that that he, as a Jew, knew all too well ([25], 433–436). The Philosophical Faculty in Göttingen had long been willing to accept Jewish colleagues with the understanding that there should never be more than one in a given field. Thus when Minkowski suddenly died in 1909, he was succeeded by Landau, one of three Jews nominated for the position (the others were Otto Blumenthal and Adolf Hurwitz). This suggests an implicit understanding that Minkowski's chair—which was created especially for him in 1902 to induce Hilbert to stay in Göttingen and turn down an offer from Berlin—was reserved for Jewish candidates. Landau's presence clearly posed a potential obstacle for Courant's appointment to the chair vacated by Hecke. Indeed, to gauge what was at stake here in 1920 requires taking into account the larger issue of the “Jewish question” as this relates to career opportunities in mathematics.

Ethnic and religious factors had always played major roles in academic appointments at the German universities, but in this new political climate the “Jewish question” took on a special urgency that strongly shaped and influenced concurrent deliberations over suitable candidates including

the two positions that remained to be filled in Göttingen and Berlin. In the meantime, the situation in Göttingen had become quite complicated because of the departure of the Dutch theoretical physicist Peter Debye, who chose to accept an attractive offer from the University of Zürich. Debye had worked closely with Hilbert, who was intent on finding a suitable successor. His first choice was Max Born, now teaching in Frankfurt. In mid-February Hilbert wrote to Einstein, asking him to send a letter assessing Born's abilities as well as his suitability for the position in Göttingen. Einstein was happy to sing the praises of his friend, whom he once regarded as primarily a mathematical talent. Einstein now thought, however, that Born's more recent work showed a strong sense for physical reality.¹³ This letter, written the very day the Philosophical Faculty convened, may well have given Hilbert the ammunition he needed. In any case, Born's name appeared second on the faculty's list, behind Arnold Sommerfeld's. No one imagined the latter would be tempted to leave Munich, as proved to be the case, so Born quickly emerged as the candidate of first choice ([13], 95–99).

Born wrote Einstein for advice—his friend assured him that “theoretical physics will thrive wherever you are”¹⁴—then plunged into a series of complex negotiations with the Berlin Ministry as well as the Göttingen faculty. Hilbert had already signaled to Born that he would have the opportunity to recommend an experimental physicist to fill another vacancy, so he already had a bargaining chip in hand. He played it forcefully by making it plain that he would not leave Frankfurt unless the Göttingen faculty agreed to a double appointment; furthermore, he insisted that the second chair in experimental physics had to be offered to his friend James Franck, then director of the physics division at the Kaiser Wilhelm Institute for Physical Chemistry in Berlin. Franck found this plan highly amenable, but various complications quickly ensued. Because both men were of Jewish background, this bold venture was bound to encounter resistance within the Philosophical Faculty—more than Born bargained for. As it turned out, the negotiations dragged on for several months. Some years later, Hilbert recalled how Born's appointment proved to be “the most ruthless and hardest fight [he] ever had to endure in the faculty.”¹⁵ There had been many such fights, in fact. Hilbert had a well-deserved reputation as a fearless warrior when it came to academic politics, a prime reason why he was much admired by those in the liberal camp and so loathed by his conservative colleagues.

This particular battle had not yet ended when, in early July, Weyl's letter finally arrived; after much soul-searching he had decided to reject the Göttingen offer.¹⁶ Now that the original list of candidates had been exhausted, the idea of calling Courant from Münster could at last come into play. Klein decided to lay all his cards on the table. He composed

¹²Schoenflies to Hilbert, 1919, Hilbert Nachlass 355, NSUB Göttingen.

¹³See Hilbert to Einstein, 19 February 1920, and Einstein to Hilbert, 21 February 1920, in [7].

¹⁴Einstein to Born, 5 March 1920, in [7].

¹⁵Hilbert to Hermann Wagner, 1926, Cod. Ms. H. Wagner 27, Niedersächsische Staats- und Universitätsbibliothek (NSUB) Göttingen.

¹⁶Weyl later recalled how he was still undecided the very day he sent a telegram to Göttingen declining the position ([40], 650). Reid was under the mistaken impression that this took place 2 years later in 1922.

a letter to Courant, which he read in Hilbert's presence, setting forth the mutual understanding he assumed all three of them shared. This began: "As you may have heard from other sources, I intend to advocate your appointment in Göttingen. It would be extremely helpful for me if you would confirm explicitly in writing that you are willing to promote energetically tasks which, in my opinion, have long been unduly neglected in our educational system as well as new demands which I can foresee as coming up" ([22], 83). He then proceeded to enumerate the reforms he had in mind, and he summarized by saying he was sure that none of these points would come as any surprise. Klein thereby obtained the proper assurances from Courant, who surely realized he would be assuming an awesome responsibility.

Klein and Hilbert now took their case to the faculty, but there they encountered a potential roadblock: Edmund Landau was not to be persuaded.¹⁷ Landau saw no reason to doubt Courant's abilities, but he expressed strong reservations with regard to what he perceived as an unhealthy trend in Göttingen, one that was creating an imbalance between pure and applied mathematics. As a number-theorist, Landau had long felt isolated in a community where analysis, mathematical physics, and applied mathematics dominated the scene, so he saw no reason to appoint yet another applied type such as Courant. Instead he pushed for a pure mathematician, nominating Berlin's Isai Schur in a strongly supportive letter. This went out to the Ministry on 12 July (just four days after Weyl had declined the offer) together with the counterproposal, signed by Klein and Hilbert, with very different arguments in favor of Courant (including his bravery during the war).¹⁸ Even now, no one could have been sure that the Ministry would agree to either of these two candidates, although soon thereafter Courant received the good news.

What transpired afterward in Berlin would also eventually have profound consequences for mathematics in Germany. Following the initial failure to fill Carathéodory's chair, the Prussian Ministry opened negotiations with Hamburg's Erich Hecke. However, he too declined, forcing the Berlin faculty to reconvene to start the search process all over again. It took until the end of 1920 before they could agree on a new list ([3], 193–194). This time they named the Austrian geometer, Wilhelm Blaschke, Frankfurt's Ludwig Bieberbach, and the geometer Gerhard Hessenberg, who taught in Tübingen. After Blaschke declined the position, Bieberbach agreed to accept the post, one that accorded with his ambitions and inflated self-esteem ([3], 197–198). These personal attributes would become increasingly evident as time passed.¹⁹ Bieberbach was, in many respects, the polar opposite of the more unassuming Courant, although they managed to stay out of

each other's way for a long time to come. With Courant's return, followed by the double appointment of Born and Franck, Göttingen suddenly acquired an impressive trio of talent; they were not only gifted but also, just as important, all three got along with each other exceptionally well. That they all happened to be secular Jews did not escape notice either; each got to know firsthand about various forms of local anti-Semitism.²⁰

Courant as Innovator

Courant's sense of loyalty to Klein, Hilbert, and Runge ran very deep. No doubt his sincerity and sense of belonging was fully appreciated when they chose him. Diminutive and soft-spoken, Richard Courant must have appeared as the least likely imaginable successor to Felix Klein, and yet he promoted the legacies of both Klein and Hilbert brilliantly. As a pupil of Hilbert, he took up classical analysis—variational methods, Dirichlet's principle and conformal mapping—a program that kept him busy all his life. What he accomplished in Göttingen was due in large part to his ability to build on the shoulders of Klein and Hilbert, the giants who dominated the scene during the prewar years.

In choosing to entitle this account "transforming tradition," I have in mind a rather subtle process in which things clearly change and become transformed, but hardly in line with some great master plan. Courant was a brilliant innovator, but he was also in many ways a traditionalist, and this makes him an especially intriguing figure. His famous yellow series, for example, was largely drawn from or inspired by the lecture courses of former years. Even just the names of his coeditors—Blaschke, Runge, and Born—are enough to make one realize that this postwar project had both a progressive as well as a distinctly conservative objective.

In the period from 1919 to 1925, mathematics publishing took on a vital new importance for Germany, both scientifically and economically. In an era of growing international contacts, German mathematicians and scientists were generally barred from attending congresses and meetings held in the countries of their wartime enemies. Many thought of German science as the last bastion of national prestige, yet this sphere of power, too, was clearly vulnerable, particularly if the products of German intellectual activity never found their way to the marketplace. Engineering and the applied sciences were hard pressed, but in the case of an ivory-tower field such as mathematics, the situation was particularly acute given the adverse political climate. A more aggressive approach to marketing the products of German mathematicians and scientists was needed—an approach embodied in the business practices of the firm of Julius Springer. Taking advantage of the vacuum created when B. G. Teubner pulled back from the

¹⁷Documentation on the faculty deliberations can be found in Universitätsarchiv Göttingen, UAG.Phil.II.36.d, Besetzung von Professorenstellen.

¹⁸The two faculty recommendations can be found in Ministry, Rep. 76 Va Sekt. 6, Tit. IV, 1, Vol. XXVI, Bl. 427–431 (signed by Landau) and Bl. 432–434 (signed by Klein and Hilbert), Geheimes Staatsarchiv Preußischer Kulturbesitz.

¹⁹For a portrait of Bieberbach's career, see [14].

²⁰These experiences would come to haunt them in the United States, too. In the winter of 1935–1936, Courant received a disturbing letter from Franck, who urgently warned him not to become overly involved helping European émigrés, adding that "we must not forget that we once deceived ourselves about the safety of the ground we were living on" (Franck to Courant, 1 November 1935, quoted in ([36], 212).

mathematics market after the war, Springer soon emerged as a bold new player in this small niche within the publishing industry, promoting a surge in productivity that provided “mathematics made in Germany” with an enduring allure (see [23]).²¹

Courant had already met Ferdinand Springer during the war, when he was temporarily stationed in Ilsenburg, a village in the Harz Mountains, working on terrestrial telegraphy ([32], 262). The editor of *Die Naturwissenschaften*, Arnold Berliner, whom Courant had known growing up in Breslau, facilitated this meeting, which took place on 28 September 1917.²² By the following year, plans for Courant’s *Grundlehren der mathematischen Wissenschaften*—better known as the “yellow series” or, in Göttingen, as the “yellow peril” (“die gelbe Gefahr”)—were already underway. Courant not only lined up Hilbert’s support for this project, but he also persuaded Hamburg’s Wilhelm Blaschke and his father-in-law, Carl Runge, to join him as associate editors. By 1921 the first volume, Blaschke’s *Vorlesungen über Differentialgeometrie I*, was already in print with several more to follow. That same year Springer opted to put Courant on his payroll as a consultant; he was paid the generous sum of 1500 marks (ca. 450 gold marks) quarterly ([32], 264).

Courant’s yellow series had just been launched when Otto Neugebauer showed up in Göttingen. Not surprisingly, he soon became an integral part of this local publishing project.

Neugebauer was still only a student without a doctorate when Courant took him under his wing. Yet, beginning already in the winter semester of 1923–1924, he began to assume various administrative duties at the institute while helping Courant to write some of his books. Years later, he offered a vivid account of a typical scene during the end phase of this production process:

A long table in Runge’s old office was the battleground on which took place what Courant’s assistants used to call the “Proof-Reading-Festivals” (“Korrekturfeste”).... During this period Courant wrote his first group of famous books, the second edition of the “Hurwitz-Courant,” the first volume of the “Courant-Hilbert,” and the “Calculus.” All of his assistants during these years participated at one or the other time in the preparation of the manuscripts: [Kurt] Friedrichs, [Hans] Lewy, [Willy] Feller, [Franz] Rellich, [B. L.] van der Waerden, and others; red ink, glue, and personal temperament were available in abundance. Courant had certainly no easy time in defending his position and reaching a generally accepted solution under the impact of simultaneously uttered and often widely divergent individual opinions about proofs, style, formulations, figures, and many

other details. At the end of such a meeting he had to stuff into his briefcase galleys (or even page proofs) which can only be described as Riemann surfaces of high genus and it needed completely unshakeable faith in the correctness of the uniformisation theorems to believe that these proofs would ever be mapped on *schlicht* pages ([19], 6–7).

One particular case deserves special attention: Volume III by Hurwitz and Courant, mentioned earlier. Its full title already hints at an unusual undertaking: “*Vorlesungen über allgemeine Funktionentheorie und elliptische Funktionen* von Adolf Hurwitz, herausgegeben und ergänzt durch einen Abschnitt über *Geometrische Funktionentheorie* von Richard Courant.” As Courant explained in the introduction to the first edition, Hurwitz had planned to publish these lectures before his death in 1919, so little by way of editing was actually needed. The contents of this first part of Hurwitz-Courant drew much of their inspiration from Weierstrass’s lecture courses, offered during the late 1870s and early 1880s, which Hurwitz himself had attended.²³ Young Richard Courant had the opportunity to hear Hurwitz lecture on function theory before he came to Göttingen. So did another student from Breslau, Max Born, who called these “perhaps the most perfect [lectures] I have ever heard.”²⁴ Other *Ausarbeitungen* of Weierstrass’s lectures were in circulation, of course, but it is surely ironic that Hurwitz, who was Felix Klein’s star pupil, proved to be such an influential conduit for the ideas of the once revered Berlin *Meister*.

Courant, however, was not content to publish a volume that contained nothing but Hurwitz’s version of Weierstrass’s theory. As the new standard-bearer for Göttingen mathematics, he felt compelled to add a dose of Riemannian function theory into the mix. In the preface to the first edition he wrote: “The viewpoint of the Weierstrassian theory can today no longer alone satisfy the student, despite the inner consistency with which it is erected.”²⁵ Courant’s supplementary text, however, did not meet with the same high critical acclaim as did Hurwitz’s lectures. In response, Courant engaged Neugebauer to help him rewrite the Riemannian portion of the book, which came out in 1925 as the second edition. Several more editions of Hurwitz-Courant appeared after this, and the book grew thicker and thicker each time. Courant’s motivation in producing this work was thoroughly Kleinian²⁶; he was guided by the notion that geometric function theory contains vital ideas that keep on providing life, whereas Weierstrassian complex analysis, although beautiful, was already complete and hence lifeless. Tributes to Klein abound in the yellow series, beginning with the first volume in which Blaschke wrote: “May F. Klein’s Erlanger Programm serve us as a guiding

²¹The famous “yellow series” founded by Courant in 1920 continues to occupy a central niche in Springer’s publishing program, although its character changed dramatically after 1945 when English became the dominant language for international publications in mathematics.

²²Berliner’s *Die Naturwissenschaften* often published articles celebrating Göttingen mathematics, such as those published in January 1922 for Hilbert’s sixtieth birthday ([2], 79–87).

²³Hurwitz’s original *Ausarbeitungen* from that time can still be found among his scientific papers: they are numbers 112, 113, and 115 in his Nachlass at the ETH.

²⁴In ([4], 72); Born also relates that he gave Courant his notebook for use in preparing the Hurwitz-Courant volume.

²⁵“Bei aller inneren Konsequenz des so errichteten Gebäudes kann der Lernende sich heute mit den Gesichtspunkten der Weierstraßschen Theorie allein nicht mehr begnügen” (Hurwitz and Courant 1925, v).

²⁶Courant’s personal view of Klein’s legacy can be seen in [5].

star” (“Als Leitstern möge uns F. Kleins Erlanger Programm dienen”).²⁷ Courant prepared new editions of Klein’s *Elementarmathematik vom höheren Standpunkte aus* (Vols. XIV–XVI); he had Neugebauer and Stephan Cohn-Vossen edit Klein’s wartime lectures on the mathematics of the nineteenth century (Vols. XXIV–XXV), and he published authorized editions of several of the lecture courses that Klein had earlier circulated locally through mimeographed copies.

All of this presented a strikingly conservative, if not to say nationalistic, tendency. Throughout his life, Courant saw himself as the great protector and defender of the Göttingen legacy associated with Klein and Hilbert, both of whom possessed far more mathematical breadth than did he [26]. During the Weimar years Hilbert’s star continued to shine brightly, in no little part because of the reverence Courant held for him. Indeed, Hilbert’s name and fame continued to grow long after his heyday in mathematical research had passed. Thanks to his assistants, Hilbert continued to pursue his research program in foundations of mathematics throughout the Weimar period. The legendary old man, who became increasingly eccentric with the years, remained a living symbol of past glory even after the demise of Göttingen as a world-class center in 1933.

Yet Courant was hardly a hidebound traditionalist, even if his mathematical tastes ran toward classicism. The single most famous volume in the yellow series, his “Courant-Hilbert” *Methoden der mathematischen Physik*, attests to a vision that went far beyond the legacies of his teachers. In the preface to the first edition, Courant decried the tendency among analysts to focus undue attention on “refining their methods and finalizing their concepts” at the cost of forgetting that analysis has its roots in physical problems. At the same time, he emphasized that theoretical physicists had begun to lose touch with the mathematical techniques most relevant to their own research. As a result, two new disciplinary cultures had developed, each with its own language and methods, neither able to communicate in a meaningful way with the other. Courant, writing in February 1924 just after the country had nearly succumbed to runaway inflation, saw this not just as an unfruitful use of resources; to him this represented a familiar danger that both Klein and Hilbert had earlier tried to counteract: “Without doubt this tendency poses a threat to all science; the stream of scientific developments faces the danger of dissipating further and further, to seep away and dry up.”²⁸ In preparing this volume, Courant relied on Hilbert’s publications and *Vorlesungen* from the period 1902–1912. He also leaned heavily on the support of his own school of *Mitarbeiter*. These young men remained anonymous in 1924, but in the preface to the revised second edition from 1930 he gave credit to Kurt Friedrichs, Franz Rellich, and Rudolf Lüneburg, among

others. He also alluded to the mathematical difficulties that had caused him to delay the publication of Courant-Hilbert II, which finally appeared in 1937.²⁹

As principal editor of Springer’s “yellow series” Courant turned local oral knowledge—in the form of the edited lectures of famous mathematicians such as Hurwitz, Klein, Hilbert, and others—into internationally accessible knowledge in print form. The scope of this undertaking eventually went far beyond the intellectual confines of the Göttingen tradition, and, although its range was truly encyclopedic, Courant’s brainchild exerted a far deeper and more lasting influence than Klein’s massive *Encyklopädie der mathematischen Wissenschaften*. The latter was a reference work, comprised of lengthy scholarly reports filled with footnotes that pointed to the vast specialized literature; it reflected Klein’s penchant for detail rather than the needs of working mathematicians. The best volumes in the yellow series, on the other hand, were living mathematics of a kind that a younger generation of mathematicians could not only learn from but also build on. That was precisely what Courant and his *Mitarbeiter* showed in producing the various new editions of Hurwitz-Courant and Courant-Hilbert, books that drew on research traditions with a long and rich history.

Courant’s success as an institution builder had much to do with his unorthodox methods. Some people found him pushy, but those who were willing to be pushed got things done. He also had an uncanny ability to instill tremendous loyalty, a prime example being Otto Neugebauer, his *Oberassistent* in Göttingen [29]. Neugebauer served not only as the real manager of Courant’s “old institute” (founded after the division of the Philosophical Faculty in 1922), he also designed the new building that opened in 1929 (see [17]). A far more direct, even blunt, personality, Neugebauer came to share the same values Courant stood for. Indeed, Neugebauer would ultimately devote himself to the broad study of the mathematical sciences; however, he did this as a mathematical historian exploring these developments within the realm of ancient cultures. Once again, the Springer connection paved the way: its short-lived *Quellen und Studien* series, launched in 1929 and edited by Neugebauer, Julius Stenzel, and Otto Toeplitz, set a new standard for studies in the history of the ancient exact sciences. Like Courant, Neugebauer was a visionary [30], but neither man could have foreseen the explosion of interest in ancient as well as modern mathematics that would make this difficult decade a remarkably productive time for scholarly publications in Germany. Along the way to becoming a historian, Neugebauer gained an ever deeper respect for the unity of mathematical knowledge; much of that came through his interactions with Göttingen mathematicians.

Twenty years later, Neugebauer dedicated his now classic *Exact Sciences in Antiquity* to “Richard Courant, in

²⁷In part II on affine differential geometry (Band VII), Blaschke went even further, writing: “Die erste, ehrfurchtsvolle Verbeugung Herrn F. Klein! Von ihm stammt die auf dem Begriff der stetigen Transformationsgruppen beruhende geometrische Denkart, die allem Folgenden zugrunde liegt.”

²⁸Ohne Zweifel liegt in dieser Tendenz eine Bedrohung für die Wissenschaft überhaupt; der Strom der wissenschaftlichen Entwicklung ist in Gefahr, sich weiter und weiter zu verästeln, zu versickern und auszutrocknen” (Courant and Hilbert 1924, vi).

²⁹Courant-Hilbert II was not listed in the bibliography of the Deutsche Bücherei, the comprehensive library of record. It was still listed in the Springer catalogues, however, in 1940. The *Sicherheitsamt* of the *Reichsführer* of the SS established a liaison office in the Deutsche Bücherei in 1934 to oversee the listing of books by Jewish authors ([32], 353).

Friendship and Gratitude.” Elaborating on that dedication in the preface, he wrote that it was Courant who enabled him to pursue graduate studies in ancient mathematics, and he went on to remark: “more than that I owe [to him] the experience of being introduced to modern mathematics and physics as a part of intellectual endeavour, never isolated from each other nor from any other field of our civilization” ([18], vii). Neugebauer tended to choose his words carefully, so we may be sure that this public acknowledgment of his debt to Courant was far more than just a friendly gesture. His allusion to physics brings to mind the famous Courant-Hilbert volume, which provided physicists with the tools they needed to handle Schrödinger’s equation and related problems in quantum mechanics. Yet, clearly, what Neugebauer had in mind here went far beyond the usual appeal to the unity of mathematical and physical ideas, for he wrote that Courant’s vision saw these fields of intellectual endeavor as “never isolated from each other nor from any other field of our civilization” ([18], vii). This brief remark comes very close to capturing the essence of Neugebauer’s own understanding of what it meant to study the history of mathematics. Regarding his former mentor’s vision, Neugebauer later said this on the occasion of Courant’s 75th birthday: “...the real core of his work [consisted] in the conscious continuation and ever widening development of the ideas of Riemann, Klein, and Hilbert, and in his insistence on demonstrating the fundamental unity of all mathematical disciplines. One must always remain aware of these basic motives if one wants to do justice to Courant’s work and to realize its inner consistency” ([17], 1).

Like Courant, Neugebauer had been molded by his student days in Göttingen. His authoritarian manner complemented his boss’s famous indecisiveness. Yet Courant possessed truly keen insight when it came to judging people, and his reticence, I would guess, was not just a personality quirk. More likely, it was a carefully learned social skill that served him well. Richard Courant had a certain ability to go with the flow of events. This, coupled with a fundamental optimism, gave him the strength to deal with a lifetime full of adversity. He faced very trying circumstances, adapting to difficulties both during the Weimar years, and then to a totally different situation in the mid-1930s, when he began to build up the mathematics department at NYU in the midst of the Great Depression. When he came to New York City, he found inspiration in Abraham Flexner’s vision for higher education in the United States [8], especially the idea that New York contained a vast “reservoir of talent” ([22], 169). So Courant continued to innovate in the name of preserving past ideals. In both settings however, a consistent theme remained: his romantic longing for the Göttingen he had known in his youth.

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REFERENCES

- [1] H. Becker, H.-J. Dahms, C. Wegeler (Hrsg.), *Die Universität Göttingen unter dem Nationalsozialismus*, München: K. G. Saur, 1987.
- [2] Birgit Bergmann, Moritz Eppe, Ruti Ungar, eds., *Transcending Tradition: Jewish Mathematicians in German-Speaking Academic Culture*, Heidelberg: Springer-Verlag, 2012.
- [3] Kurt-R. Biermann, *Die Mathematik und ihre Dozenten an der Berliner Universität, 1810–1933*, Berlin: Akademie Verlag, 1988.
- [4] Max Born, *My Life. Recollections of a Nobel Laureate*. New York: Charles Scribner’s Sons, 1978.
- [5] Richard Courant, “Felix Klein,” *Die Naturwissenschaften*, 37(1925): 765–772.
- [6] Richard Courant, “Reminiscences from Hilbert’s Göttingen,” *Mathematical Intelligencer*, 3(4)(1981): 154–164.
- [7] Albert Einstein, *Collected Papers of Albert Einstein*, Vol. 9: *The Berlin Years: Correspondence, January 1919–April 1920*, Diana Kormos Buchwald, et al., eds. Princeton: Princeton University Press, 2004.
- [8] Abraham Flexner, *Universities: American, English, German*, Oxford: Oxford University Press, 1930.
- [9] Günther Frei, “On the History of the Artin Reciprocity Law in Abelian Extensions of Algebraic Number Fields: How Artin Was Led to his Reciprocity Law,” in Olav Arnfinn Laudal and Ragni Piene, eds. *The Legacy of Niels Henrik Abel*, Berlin: Springer-Verlag, 2004, 267–294.
- [10] Günther Frei and Urs Stambach, *Hermann Weyl und die Mathematik an der ETH Zürich, 1913–1930*, Basel: Birkhäuser, 1992.
- [11] Nellie H. Friedrichs, *Erinnerungen aus meinem Leben in Braunschweig 1912–1937*, 2nd ed. Braunschweig: Stadtarchiv und Stadtbibliothek, 1988.
- [12] Peter Gay, *Weimar Culture: The Outsider as Insider*, New York: Harper & Row, 1968.
- [13] Nancy Thorndike Greenspan, *The End of the Certain World: The Life and Science of Max Born: The Nobel Physicist Who Ignited the Quantum Revolution*, New York: Basic Books, 2005.
- [14] Herbert Mehrtens, “Ludwig Bieberbach and ‘Deutsche Mathematik,’” *Studies in the History of Mathematics*, Esther R. Phillips, ed. *MAA Studies in Mathematics*, vol. 26, Washington: Mathematical Association of America, 1987, 195–241.
- [15] Stefan Müller-Stach, “Otto Toeplitz: Algebraiker der unendlichen Matrizen,” *Mathematische Semesterberichte*, 61(1) (2014): 53–77.
- [16] Peter Lax, “Richard Courant,” *Biographical Memoirs. National Academy of Sciences*, 82 (2003): 78–97.
- [17] Otto Neugebauer, “Das Mathematische Institut der Universität Göttingen,” *Die Naturwissenschaften*, 18 (1930): 1–4.
- [18] Otto Neugebauer, *The Exact Sciences in Antiquity*, 2nd ed. Providence: Brown University Press, 1957; first edition 1951, Munksgaard, Copenhagen; reprinted 1969, New York: Dover.
- [19] Otto Neugebauer, “Reminiscences on the Göttingen Mathematical Institute on the Occasion of R. Courant’s 75th Birthday,” 1963; Otto Neugebauer Papers, Institute for Advanced Study, Princeton, Box 14, Publications vol. 11.
- [20] Karen H. Parshall and David E. Rowe, *The Emergence of the American Mathematical Research Community, 1876–1900*. J. J.

- Sylvester, Felix Klein, and E. H. Moore, *History of Mathematics*, vol. 8, Providence, Rhode Island: American Mathematical Society, 1994.
- [21] Constance Reid, *Hilbert*. New York: Springer-Verlag, 1970.
- [22] Constance Reid, *Courant in Göttingen and New York: The Story of an Improbable Mathematician*, New York: Springer-Verlag, 1976.
- [23] Volker Remmert and Ute Schneider, *Eine Disziplin und ihre Verleger. Disziplinenkultur und Publikationswesen der Mathematik in Deutschland, 1871–1949*, Bielefeld: Transkript, 2010.
- [24] David E. Rowe, “The Old Guard under a New Order: K. O. Friedrichs Meets Felix Klein,” *Mathematical Intelligencer*, 6(2)(1984): 74–76.
- [25] David E. Rowe, “‘Jewish Mathematics’ at Göttingen in the Era of Felix Klein,” *Isis*, 77(1986), 422–449.
- [26] David E. Rowe, “Klein, Hilbert, and the Göttingen Mathematical Tradition,” *Science in Germany: The Intersection of Institutional and Intellectual Issues*, Kathryn M. Olesko, ed. (Osiris, 5, 1989), 189–213.
- [27] David E. Rowe, “An Interview with Dirk Jan Struik,” *Mathematical Intelligencer*, 11(1)(1989): 14–26.
- [28] David E. Rowe, “Hermann Weyl, the Reluctant Revolutionary,” *Mathematical Intelligencer*, 25(1) (2003), 61–70.
- [29] David E. Rowe, “Otto Neugebauer and Richard Courant: On Exporting the Göttingen Approach to the History of Mathematics,” *Mathematical Intelligencer*, 34 (2)(2012): 29–37.
- [30] David E. Rowe, “Otto Neugebauer’s Vision for Rewriting the History of Ancient Mathematics,” *Anabases—Traditions et réceptions de l’Antiquité*, 18(2013): 175–196.
- [31] David E. Rowe and Robert Schulmann, eds., *Einstein on Politics: His Private Thoughts and Public Stands on Nationalism, Zionism, War, Peace, and the Bomb*, Princeton University Press, 2007.
- [32] Heinz Sarkowski, *Springer-Verlag. History of a Scientific Publishing House, Part I: 1842–1945*. Heidelberg: Springer, 1996.
- [33] Norbert Schappacher, “Das Mathematische Institut der Universität Göttingen 1929–1950,” in [1], 345–373.
- [34] Norbert Schappacher, “Edmund Landau’s Göttingen: From the Life and Death of a Great Mathematical Center,” *The Mathematical Intelligencer* 13(4)(1991): 12–18.
- [35] Reinhard Siegmund-Schultze, *Rockefeller and the Internationalization of Mathematics between the Two World Wars: Documents and Studies for the Social History of Mathematics in the 20th Century*, Science Networks, 25, Basel, Boston, and Berlin: Birkhäuser, 2001.
- [36] Reinhard Siegmund-Schultze, *Mathematicians Fleeing from Nazi Germany: Individual Fates and Global Impact*, Princeton: Princeton University Press, 2009.
- [37] Edith Stein, *Aus dem Leben einer jüdischen Familie*, Freiburg: Verlag Herder, 1965.
- [38] Antonina Vallentin, *The Drama of Albert Einstein*, New York: Doubleday, 1954.
- [39] Hermann Weyl, “David Hilbert and His Mathematical Work,” *Bulletin of the American Mathematical Society*, 50(1944), 612–654; reprinted in [40], 130–172.
- [40] Hermann Weyl, *Gesammelte Abhandlungen*, vol. 4, K. Chandrasekharan, ed. Berlin: Springer, 1968.
- [41] Gereon Wolters, “Opportunismus als Naturanlage: Hugo Dingler und das ‘Dritte Reich,’” in *Entwicklungen der methodischen Philosophie*, hrsg. Peter Janich, Frankfurt a. M., 1992, 257–327.