The Unknown Hurwitz

NICOLA M. R. OSWALD

Years Ago features essays by historians and mathematicians that take us back in time. Whether addressing special topics or general trends, individual mathematicians or “schools” (as in schools of fish), the idea is always the same: to shed new light on the mathematics of the past. Submissions are welcome.

The little-known Julius Hurwitz, elder brother of Adolf, defended his Ph.D. thesis at the University of Halle in 1895. Although his more-famous sibling overshadowed him, Julius was an interesting figure in his own right. Indeed, Julius was on familiar terms with some of the best mathematicians of his time and his career sheds light on them.

Two Brothers: Two Pathways

When Julius and Adolf Hurwitz were growing up in Hildesheim, a tranquil town near Hanover, nothing indicated that their lives would develop along very different routes. Adolf, Julius, and their elder brother Max were born into a Jewish merchant’s family. Tragically, in 1862, when they were 3, 5, and 13 years old, the boys lost their mother, Elise Wertheim-Hurwitz. They were subsequently raised by their father, Solomon Hurwitz, who was helped by his sister Rosette. Solomon was a hard-working man and was the owner-manager of a local textile manufacturing company. Although the family lived modestly, he was determined to provide his sons with a good education. Both Adolf and Julius attended the Realgymnasium Adreanum, established in 1850 as a new kind of high school with a curriculum that focused on modern languages, mathematics, and the natural sciences. Their father had also attended this school briefly, thanks to financial support from wealthy relatives [29, p. 2]. Despite receiving top grades, however, Solomon was forced to leave the school to earn his living in the business world.

His two youngest boys also performed very well at this school, although one of Julius’s school certificates noted that “Julius visited a tavern without permission.” According to a biographical memoir by Adolf Hurwitz’s wife Ida Hurwitz-Samuel, both boys showed unusual talent for mathematics at a very early stage [29, p. 4]. This was soon noticed by their teacher, Hermann Caesar Hannibal Schubert, the inventor of the Schubert calculus in enumerative geometry. He offered to give the Hurwitz boys extra lessons on Sunday afternoons. These circumstances were particularly fortunate, as Schubert only taught for a few years in Hildesheim—in 1876 he obtained a more prestigious teaching position in Hamburg ([4, 5]). Shortly before departing for Hamburg, as Ida Hurwitz-Samuel later wrote, “Schubert took the trouble to visit the father to convince him to let both sons take up the study of mathematics […]. [Solomon] talked to a very wealthy and childless friend, E. Edwards, who offered to bear the costs of the studies for one of the sons. Dr. Schubert selected Adolf.” As a consequence, “Max and Julius had to become businessmen after graduation…. The pecuniary situation as well as the future
plans of the father for his sons did not allow for even considering an academic profession” [29, p. 4]. From this point onward, the professional lives of the two younger brothers diverged.

The case of Adolf, crowned with sudden success in the world of mathematics, is well known. Following Schubert’s advice, he enrolled in 1877 at the Munich Institute of Technology (Technische Hochschule), where he began his studies under Felix Klein. He then spent the academic year 1878–1879 in Berlin attending lecture courses offered by Karl Weierstrass and Leopold Kronecker, before returning to Klein, who had just accepted a new chair in Leipzig in 1880. Hurwitz completed his dissertation on elliptic modular functions the following year. For decades this was the only doctoral thesis ever accepted for publication in *Mathematische Annalen* [8]. Adolf then began his habilitation in Göttingen. Klein had hoped he could remain in Leipzig, but the faculty accepted as candidates for habilitation only graduates from a traditional classical Gymnasium trained in Greek and Latin. Hurwitz’s diploma from a Realgymnasium disqualified him from the Leipzig faculty.

Thanks to an unusual turn of events, Adolf did not have to remain a Privatdozent in Göttingen for very long. In 1882 Ferdinand Lindemann, another pupil of Klein, resolved the most famous problem of classical antiquity—the quadrature of the circle—by proving that \( \pi \) is a transcendental number. A year later, he was appointed to succeed Heinrich Weber at the University of Königsberg, where a second associate professorship (Extraordinariat) would soon become vacant. Knowing that Klein had the highest regard for Hurwitz’s talent, Lindemann named him as his first choice for this position. Thus, in 1884 Hurwitz was called to Königsberg.

Understandably, the Hurwitz family was ecstatic when they received this news. In a letter to Julius on April 1, 1884, Solomon Hurwitz wrote: “It is an extraordinary event, and we cannot thank destiny enough that our Adolf is so gifted, so acclaimed, and is already being recognized by the most important mathematicians as an excellent person. [...] So your youngest brother is a professor by the age of 25 and after only two years of being private lecturer in Königsberg!” [27]. His son had also acquired an unusual breadth of knowledge through his familiarity with different schools of mathematics, first through Klein, then in Berlin, and finally in Göttingen. He was, indeed, highly respected by some of the most influential mathematicians of his time, and was well on his way to becoming a leading member of the German mathematical community.²

This remarkable story contrasts sharply with Julius’s uneventful career. Leaving school without the certification needed to study at a university or any other institution of higher education, he apprenticed at a bank in Nordhausen, a small village in what is today Thuringia in Germany. To his good friend Luigi Bianchi, whom he had met as a student in Munich, Adolf reported on October 30, 1885, that “my second brother Julius is working as an exporter in Hamburg.” [2, p. 96] Later, Julius and his older brother Max took over the banking business in Hanover from their uncle, Adolph M. Wertheimer. According to the family memoir of Ida Hurwitz-Samuel, this business turned out to be very profitable and eventually permitted Julius to leave banking for a career in mathematics.

**Königsberg: The Mathematical Environment**

Adolf Hurwitz could not have expected the remotely situated city of Königsberg to offer mathematical stimulation comparable to Berlin, Leipzig, and Göttingen. Yet there he immediately met and befriended two of the emerging figures of his own generation, Hermann Minkowski and David Hilbert, who were students there. Both benefited enormously from the broad mathematical knowledge that their dedicated teacher generously imparted. In an obituary for Hurwitz, Hilbert recalled how Hurwitz exposed his students to the contrasting research traditions of the day, in particular the geometrical school of Klein and the algebraic-analytical school of Berlin. On their nearly daily walks over a period of eight years, Hurwitz guided Hilbert and Minkowski through nearly all corners of mathematical knowledge [7, p. 162]. Hilbert further described how Hurwitz’s friendly and open personality quickly won the hearts of all those who got to know him [7, p. 167].

But Hilbert didn’t mention that he and Minkowski also spent time conversing with Julius Hurwitz, who frequently visited his brother in Königsberg. Hints of this can be found in their correspondence, for example in a letter Minkowski wrote on December 22, 1890, which ends with “Best greetings to Hurwitz the older and Hurwitz the younger [...]” [14, p. 42]. More interesting still, Ida Hurwitz-Samuel reported that Julius was “studying mathematics under the supervision of his younger brother” [29, p. 8]. Evidently his mathematical passion had continued to grow through the years. Indeed, he took great pleasure in his brother’s company and popularity with the local mathematical community. Hints of these connections can be found in other correspondence from this period, including a letter written by Hans von Mangoldt, who had studied under Adolf Hurwitz in Göttingen. Von Mangoldt learned of Adolf’s appointment in Königsberg through Julius, and so wrote from Hanover to congratulate him on April 7, 1884: “your brother [told me] about the news of your call ...and he will have informed you about my well-being’” [31].

Julius’s sister-in-law says he felt uncomfortable in the banking business. Julius didn’t want to take up mathematics just as a hobby, he wanted to become a professional mathematician. That meant returning to school to take the examination required for entrance to the universities [29, p. 8]. Although he was now 33 years old, Julius Hurwitz enrolled at the Realsymnasium in Quakenbrück, a small town in northern Germany. We can only speculate why his choice favoured this type of school despite his brother’s difficulties; by the end of the 19th century such institutions had earned a positive reputation and were finally officially accepted as prerequisites for obtaining a university position.

²For further details about his life see [15].