

The Life of Kurt Gödel - Part I

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1 Childhood in Brno

Kurt Friedrich Gödel was born on 28 April 1906 in Brünn, Austria-Hungary (now Brno, Czech Republic) [DAWSON 2005]. His parents were Rudolf Gödel (1874–1929) and Marianne Gödel (née Handschuh, 1879–1966). The family was part of a German minority living in Austria-Hungary. The mother attended a french lycée and was far better educated than the father. She would provide intellectual stimulus to the children through reading, singing and playing the piano. Gödel was very attached to the mother and kept contact with her through letters throughout his life. A considerable amount of information about Gödel's personal opinions derive from those letters. The father was a businessman, who owned a textile factory. Contact with him was less warm. He was usually absent, due to an intense dedication to the business. As a result of his intense work, the family became very wealthy and the children grew up in privileged circumstances. The brother Rudolf remembers him as a "good father who fulfilled many of sons wishes and provided plentiful for their education".

Although the father was Old Catholic and the mother Protestant, the boys were raised as "freethinkers" and neither of them would later belong to any specific religion. Rudolf became agnostic and Kurt did become a believer. In 1975, he describes his belief as "theistic rather than pantheistic, following Leibniz rather than Spinoza". In a letter to his mother in 1961, he writes that there is much more rationality to religion than we think. Due to books and bad religious teachings in school, we are led to believe otherwise.

As the boys grew older, when Kurt was seven, the family moved to a bigger house. They lived in the ground floor of a Villa with 5 rooms, the furniture was made by a famous shop in Vienna, the garden was large with many fruit trees and provided a privileged view of the city and the surrounding countryside. The family employed several servants of Czech origin, including a governess for the children.

Gödel was first enrolled on 16 September 1912 at the *Evangelische Privat-Volks- und Bürgerschule*. He had courses in religion, reading, writing (in the old script), grammar, arithmetic, history, geography, natural history, drawing, singing and physical education. He usually received the highest marks, however, he was frequently absent due to

rheumatic fever, a serious disease that might cause cardiac damage. Being curious as he was, he devoted a great deal of time reading about the disease and became convinced that his heart had been affected. Although the doctors ensured him that the disease left no lasting physical effects, he would not believe them. According to the brother, that was a turning point in his life, as that was the beginning of his hypochondria, that would accompany him throughout his life.

2 Gymnasium

In 1916, Gödel is enrolled at the *Gymnasium*. The school had only a few students, whose native language was not German. It was a public school that charged tuition and students had to pass an exam to be accepted. Gödel spent his formative years in a social and educational milieu. At that time, he was already very withdrawn. Harry Kepletar, who shared a bench with him throughout the eight years of school, recalls that "from the very beginning ... Gödel kept more or less to himself and devoted most of the time to his studies". He would not accompany the family in their excursions to the countryside and preferred to stay at home reading. As the concerns with his health intensified, in the schoolyear 1917-1918, he was exempted from sports class. Latin and French were required subjects and he chose English and shorthand as electives. The latter is a form of abbreviated writing to speed up taking notes. Scientists at that time used to communicate in shorthand as well. He did not elect to study Czech. Harry Kepletar recalls never hearing Gödel saying a single word in Czech. That could be seen as a sign of prejudice against the Czechs, since they were mostly uneducated and used to live in rural areas. The servants in his home were Czechs. However, in a letter to the mother in 1954, Gödel sates that he did not find the Slavs "*unsympathisch*".

Gödel was very interested in foreign languages. His *Nachlaß* contains books in Italian, Dutch, Greek, Latin, French and English. His personal library contained several foreign-language dictionaries and grammars. Scientific works were found only in German, French and English. It is believed that those were the only languages he attained fluency. Some of the notebooks of science courses have been preserved and from them we have an idea of what Gödel was learning in his adolescence. In physics, there were notes on units of measurement, basic astronomy, the motion of coupled pendulums and details on how to solve second-order linear differential equations. In mathematics, there were notes on algebra, geometry and some calculus. It is difficult to precise what was learnt in school and what was a result of his independent study. His brother attests that Gödel „mastered university mathematics by his final *Gymnasium* years“ through independent study. Gödel graduated from the Realgymnasium in 1924.

3 University of Vienna

The second phase of Gödel's life begins in the autumn of 1924, when he matriculated at the University of Vienna. No longer an exile living in a provincial town, now he was the austrian citizen of a big metropolis, which shortly before had been the cultural and

political capital of the great Austro-Hungarian Empire. After the partitioning of the empire, however, Vienna had become just an impoverished capital of an insignificant country in the world. Shortages of food, coal and housing were severe. German and Austrian universities did not have dormitories and Rudolf was lucky to find an apartment near the university large enough to provide separate rooms for him and his brother. Despite the war and the shortages, the city's intellectual heritage remained intact and the university retained its prestige.

On the basis of records kept by the University of Vienna, some of the courses Gödel attended from WS 1925/26 to WS 1928/29 were

- History of European philosophy, covering the span of pre-Socratics to the Reformation
- Sequel of history of European philosophy, covering philosophers such as Bacon, Schopenhauer, Descartes, Leibniz, Spinoza, Hobbes, Locke, Rousseau, Kant, Hegel and other minor figures
- *Einführung in die Zahlentheorie* by Prof. Furtwängler
- Kinetic theory by Prof. Kottler

Gödel rigorously saved his library requests slips. He borrowed books of authors such as Riemann, Euclid, Euler, Dirichlet and Kant. Olga Taussky, a fellow student of Gödel who became a famous mathematician in her own right, remembers that he also attended a seminar about Russell's Introduction to Mathematical Philosophy and that might have been the first contact he had with Russell's writings.

3.1 The Vienna Circle

In 1925 or 1926, Gödel meets Prof. Hahn, his dissertation advisor, who would become his main influence, second only to Prof. Furtwängler. Hahn was a scholar of exceptional breadth. He delivered contributions to set theory, set-theoretic geometry, calculus of variations, theory of real functions, Fourier integrals and functional analysis, particularly the Hahn-Banach theorem. He published several books and was a renowned teacher. He was instrumental in bringing Schlick to occupy the chair in Philosophy of Inductive Sciences, a position once held by Ernst Mach. His doctoral students included Gödel, Menger and Hurewicz. Shortly before Gödel arrived to Vienna, Hahn's interests shifted to philosophy and the foundations of mathematics. Although he never delivered any proof in logic, he offered several courses in the subject, so it is not surprising that a logician would choose him to advise his dissertation.

Hahn was one of a small group that gathered once a week in a Viennese coffehouse (Cafe Central) to discuss Mach's positivistic philosophy. Schlick was the leader of the group. He was a philosopher, physicist and the founding father of logical positivism. As the group gained more members, Schlick agreed to establish a more formal colloquium. The meetings happened Thursdays evenings in the mathematical institute (today the meteorological institute). The name "Vienna Circle" was the title of a manifesto published

in 1929 signed by Rudolf Carnap, Otto Neurath and Hahn. The Circle had different topics of interest and it was Hahn who would direct the group's interest towards logic. Admission was invitation-only, so it was presumably Hahn or Schlick who invited Gödel. From then on, Gödel used to attend it regularly. Gödel disagreed with some of their views, specially with the idea that mathematics is a "syntax of language". However, as of his habit, he would avoid open criticism. He mainly listened and only occasionally would intervene with succinct and incisive comments. It may be that the impact the Circle had on him was introducing him new literature and bringing him to contact with more colleagues. Furthermore, listening to contrary views was probably a stimulus that helped him formulate his own ideas more clearly. Later in his life, he says that his friendship with Einstein was based more on their differences of opinion than on their agreements.

Gödel found in the Circle people whose interests and abilities were more in accord with his own. Due to that, he had a larger circle of friends in Vienna than in Brno. Some of the recollections of him by his fellows:

Menger in 1981 recalls, that "he was a slim, unusually quite young man... In the Circle I never heard him take the floor ... He indicated interest solely by slight motions of head - in agreement, skeptically or in disagreement ... His expression (oral and written) was always of the greatest precision and at the same time of exceeding brevity. In nonmathematical conversations, he was very withdrawn".

Olga Taussky-Todd in 1987 tells that, "he was well trained in all branches of mathematics and you could talk to him about any problem and receive an excellent response. If you had a particular problem in mind he would start by writing it down in symbols. He spoke slowly and very calmly and his mind was very clear ... It became slowly obvious that he was incredibly talented. His help was much in demand ... and he offered it whenever it was needed ... But he was very silent. I have the impression that he enjoyed lively people, but did not like to contribute to nonmathematical conversations".

Feigl in 1969 recalls, that "his great abilities were quickly appreciated ... He was a very unassuming, diligent worker, but his was clearly the mind of a genius of the very first order".

From those recollections we see that Gödel was extremely withdrawn and always avoided being the center of attention. So when he publishes his famous incompleteness theorems, we can imagine how traumatic it must have been to be publicly attacked by several other prominent figures.

3.2 Interest in Parapsychological Phenomena

After the World War I, Vienna had an influx of mediums. Families of the people who died in the war were eager to contact the dead. Séances became common in the city. Once two of Hahn's university colleagues, members of the physics faculty, tried to ridicule the mediums by faking a séance. That led to great indignation of the intellectual community and prompted a group including Schlick, Hahn and other prominent figures to form a committee for the serious investigations of the parapsychological phenomena. When Hahn actively participated in a séance, other members of the Circle strongly expressed their

disapproval. Hahn's attempt to use „stricter scientific methods of experimentation“ was a behaviour that would only ”strengthen super-naturalism“, as Neurath wrote. Carnap and Hahn defended themselves arguing that scientists should have the „right to examine objectively all processes or alleged processes“. The committee ended shortly after its formation and Hahn writes that ”in many cases one [was] dealing with a genuine phenomenon of some kind”.

Gödel clearly believed in occult phenomena. Although there is no record that he participated in the committee, a memorandum that appears to be a shorthand record of a seance was found in his papers. Library slips include *Aberglaube und Zauberei* borrowed twice from the University of Vienna. He writes that every person has the ability to predict numbers that will turn up in games of chance. He says his wife Adele possessed that ability to an exceptional degree. She verified that in two hundred trials. Apart from that, Gödel also believed in the possibility of telepathy. Later in his life, he made a remark to Oskar Morgenstern ”that in several hundred years it would seem incomprehensible that 20th century investigators had discovered the elementary physical particles and forces that hold them together but had failed even to consider the possibility that there might exist elementary psychic factors”.

This view is in accord with Gödel's belief that mind is distinct from matter and his later defense of mathematical Platonism. Gödel says that „despite their remoteness from sense experience, we do have something like a perception of objects of set theory” and he saw no reason „why we should have less confidence in that kind of perception, i.e. in mathematical intuition, than in sense perception“. Intuition should not be regarded as something „purely subjective“ just because „they cannot be associated with actions our sense organs“.

3.3 Adele

At that time, Gödel meets his future wife, Adele Thusnelda Porkert. At the time she was married, but would soon become divorced. Gödel's family strongly disapproved the match. In their eyes, Adele had many faults: she was divorced, six years older, came from a lower class family, her face was disfigured by a port wine stain and the worst: she was a dancer. According to several accounts, she was working at a Viennese nightclub. Adele herself claimed she was a ballet dancer. But whether cabaret or nightclub, the prejudice against dancers was the same: they were prostitutes. Stefan Zweig writes in ”The World of Yesterday” referring to Vienna after the World War I, that ”a ballet dancer ... was available for any man at any hour in Vienna for two hundred crowns”. Marrying such a person could destroy even a well-established career. It is comprehensible, that the parents, who carried the prejudices of the previous generations, could not tolerate their son marrying such a person. Eventually they married.

3.4 Dissertation

Evidence suggests that Gödel started writing his dissertation some time between 1928 and 1929. It is hard to say what brought Gödel's attention to the completeness question.

In footnote c of his dissertation, he refers to a related completeness result in an unpublished manuscript by Carnap. So it is plausible to assume, that Gödel talked to Carnap before choosing the topic. Another possibility is that Hahn who have suggested him the topic. However, Gödel later tells Hao Wang that he had completed the dissertation before even showing it to his advisor, but in footnote 1, Gödel thanks Hahn "for several valuable suggestions that were of help in writing this paper". A third possibility is that he came to the topic on his own through books and the discussions in the Vienna Circle.

Gödel asserted that at the time of his completeness and incompleteness papers, „a concept of objective mathematical truth ... was widely rejected as meaningless“. One could think that this was just an expression of his paranoia, but when Carnap invited Tarski to speak on the subject in 1935 at the International Congress for Scientific Philosophy, Carnap comments "at the Congress it became clear that there was vehement opposition even on the side of our philosophical friends [to the concept of objective mathematical truth]", he goes on saying that "it may be difficult for young readers to imagine how strong the skepticism and active resistance was in the beginning". Tarski was willing to confront such resistance, but Gödel was not.

During the writing of the dissertation, the father passes away and there is no record on how much it affected Gödel. By 1929, economic situation in Austria was severe and Rudolf recalls that in spite of that, they were both spending their inheritances freely, in order to have a good life. This would later cause Gödel financial problems. Moreover, already in 1926, "because the autonomy of the university forbade the police to enter the buildings ... at more or less regular intervals, socialist and jewish students were dragged out of the classrooms and severely beaten". Gödel himself was not Jewish, but his advisor was and in the eyes of the Nazis, he was tainted. Gödel did not express his political views openly (fact that would cause him problems in acquiring a visa to the United States later). According to Carnap, Gödel was at that time for socialism and was reading Lenin and Trotsky.

On 6 July 1929, the dissertation was approved by Prof. Hahn and Prof. Furtwängler. Although Gödel had his Ph.D, that was no guarantee for an academic career and a regular income. He needed to obtain the *Habilitation*. Only then he could begin teaching as an unpaid *Dozent*. In order to make his dissertation results known to a wider audience, Gödel spoke about it at the Conference on the Epistemology of the Exact Sciences, in Königsberg, East Prussia. Later he would also give a speech at a meeting in the Vienna Mathematical Society. His completeness theorem was a great accomplishment, since it gave the answer to a question presented in a famous book. However, the method of proof was similar to those previously employed by Löwenheim and Skolem. For the *Habilitation*, it was desirable to find a topic that would attract more attention and at that time an obvious source of problems was the list that Hilbert had put together in 1900. The problem Gödel chose was the second one: "the problem of giving a finitary consistency proof for the axioms of analysis as the first step to secure the foundations of mathematics". Hilbert believed that there is no unsolvable problem. Yet, by the fall of 1930, Gödel had found that the program Hilbert proposed to validate this idea could not be carried out as he first imagined.

3.5 The Incompleteness Theorems

Gödel announced the discovery of the incompleteness theorems to Carnap, Feigl and Waismann at the Cafe Reichsrat on 26 August 1930. The meeting lasted around ninety minutes. From later memoranda, it is clear that Carnap did not fully understand it. Besides, the meeting had been arranged to discuss the preparations for the Conference on the Epistemology of the Exact Sciences. The event ran for three days. Gödel's talk took place on a Saturday and lasted 20 minutes. Afterwards, there was a roundtable discussion and Gödel posed the following question: if „one can give examples of propositions that, while contentually true, are unprovable in the formal system of classical mathematics“. Surprisingly, Carnap and Hahn pretended to not know about Gödel's discovery. Later, on correspondences between Carnap and von Neumann, Carnap writes that the discovery was so recent and raised so many fundamental issues that they thought it was better to leave the topic as it was. No one proposed an answer to the question Gödel raised and evidence suggests that only John von Neumann, who had a legendary quickness of mind, could grasp the importance of that question.

Following the conference, von Neumann continued reflecting about Gödel's ideas and on 20 November, he writes that he had come to a remarkable result: "that in a consistent system any effective proof of the unprovability of the statement $0=1$ could itself be transformed into a contradiction". Unfortunately, Gödel's reply did not survive. On 23 October, one month before that letter, Gödel had already submitted both incompleteness theorems to the Vienna Academy of Sciences. And on 29 November, von Neumann answers him: „since you have established the unprovability of consistency as a natural continuation of your earlier results, of course I will not publish on that subject“. Von Neumann was so fascinated from the incompleteness theorems, that on two occasions he lectures on Gödel's discoveries instead on their own work. On the second occasion, Stephen C. Kleene was present and that was the first time he heard of Gödel.

Outside Vienna, the first lecture about the incompleteness theorems was at the German Mathematical Union in Bad Elser in 1931. That lecture was important, because Ernst Zermelo in person was there, his first and most vocal "enemy". Zermelo was at the time 60. He was accustomed to conflicts with other scholars and due to disagreements over the Axiom of Choice, he had had a nervous breakdown some years before. Zermelo writes Gödel continuously that he had found a gap in the proof and even raised his criticism in print. Gödel always tried to clarify the matters, but eventually gave up. Afterwards, by reading the exchange of correspondences, Carnap attests that Zermelo had "completely misunderstood" Gödel's explanations.

Others also challenged Gödel's result in print. Rudolf reported that „shortly after the publication of his famous work“, his brother showed signs of severe depression. Fearing that he might become suicidal, the family committed him against his will to a sanatorium in Pukersdorf bei Wien for a few weeks.

3.6 Habilitation

One might expect that Gödel would have submitted the incompleteness theorems as his *Habilitationsschrift* almost immediately. However, he does so only nine months later. The reason is unclear. At the time, he was busy contributing to Hahn's seminar on mathematical logic and to Menger's colloquium. Maybe he could not say "no" to his mentors and for that reason he could not submit his *Habilitationsschrift* earlier. Another idea is that he was going through financial problems - since there are records that he had to cash some Czech bonds before their maturity dates - and that was the reason he had to quicken the process to get access to a stable income.

It was Prof. Hahn who recommended Gödel to the faculty. In the official report, Hahn writes, the *Habilitationsschrift* was „an achievement of the first rank that had attracted the greatest attention in scientific circles“, that made its mark on the history of mathematics. Gödel's accomplishments had exceeded by far what was expected from a *Habilitationsschrift*. For the *Dozentur*, Gödel had 51 „yes“ and 1 „no“ votes. The only "no" vote was from Prof. Wirtinger. He claimed that the incompleteness paper overlapped too much with the dissertation. Prof. Wirtinger worked in an area very distant from logics and his opinion was reportedly of not much value. The *Probenvortrag* was approved by simple majority and *Venia legendi* was granted. Gödel had finally become a *Privatdozent*.

4 Invitation to Princeton

Oswald Veblen was an American mathematician, who advised Alonzo Church known for the lambda calculus and the Church-Turing thesis. Veblen was involved with the organization of the Institute for Advanced Studies in Princeton. He was very impressed by Gödel's work and sent him an invitation to work at the institute during its first academic year (1933-34). Veblen offered 2500 dollars/year and the possibility of covering travel expenses. Gödel could offer a seminar, but he was actually more interested in letting Gödel cooperate with Church to "improve the mathematical situation" of the institute. Gödel answers that he needed a few months to improve his English before being able to offer a course in the language.

At that time, the Nazis had come to power and Austria was disintegrating politically. The Law for Restoration of the Professional Civil Service sanctioned the dismissal of all officials of non-Aryan descent. Jewish professors were among the first to be expelled (Prof. Hahn). As previously mentioned, the situation for Gödel was also not good, since the Nazis would surely be after him due to his association with a Jewish professor. The political crisis in Europe could not be more fortunate to Princeton as they state: the „timing could not have been more propitious ... the rise of Nazism and Fascism sent to America's shores a flood of refugee scholars“. The institute was envisioned as a haven for scholars throughout the world to work with the greatest intellects. Einstein and Veblen were appointed as the first professors. On 6 October 1933, Gödel arrives in New York and from there he would be transported to Princeton.

References

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