

## Reflections

### The Early life of Albert Einstein: Seeking the Mature Einstein in his Youth

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A hundred years have passed since the *annus mirabilis* of modern physics. Appropriately, much attention has been focussed on the path which led Albert Einstein to the many startling and fundamental discoveries linked to his name in the year 1905. How much of the special theory is owed to the works of Poincaré and Lorentz? Did Einstein ignore the contributions of Poincaré or were they unimportant, in his mind, to the path he took to the special theory? Were there any significant contributions from Mileva Maric, Einstein's wife at the time, which studies in the history of relativity have ignored? Such, and many more questions of a similar nature have been explored and written about this year and in the recent past.

Here, I will attempt to describe a somewhat different aspect of Einstein's life leading to the year whose centenary we celebrate. All great figures who attain eminence in their spheres of activity, including scientists, develop particular signatures, particular images, which stamp themselves on the minds of succeeding generations who examine their lives and works. The picture of Albert Einstein we carry in our mind's eye is very different from that of, say, Paul Dirac which again differs so substantially from that evoked by the name of Richard Feynman. It is not only that each of these great physicists worked on a different range of fundamental problems, they also presented different styles and signatures of work. That is only to be expected: great minds do not move along any prescribed trajectories. What interests us here is that in spite of the commonality, at some level of their pursuits, they evolved into very different kinds of personalities, with very different kinds of responses to social, political and human issues of the times in which they lived. However, the intention here is not to indulge in any comparative studies but merely to look at the early life of Einstein and to see, in howsoever imprecise a way, how he became the kind of person he was, responding to the many issues, scientific, philosophical and human in the way he did.

The facts of Einstein's early life are well known. He was born in Ulm, a town in southern



Germany about equidistant from Munich on the east, Stuttgart on the west and from the Swiss border on the south. The region is part of what was Swabia, later part of the state of Wurttemberg. The land is fertile with much agriculture at the time Einstein was born. Swabians are a little more easy going than the reputedly harder north Germans; the German they speak is also a little broader and softer than is spoken in the north. To these assertions must be entered a brief caveat: the famed and much dreaded Desert Fox of the Second World War, Field Marshal Erwin Rommel, was a Swabian.

Albert's father Hermann ran a business in electrical equipment which must have been something of a novelty at the time of Albert's birth in 1879. He was generally interested in scientific and technological innovations and there may have been a bit of a scientific air in the Einstein household. A younger brother of Hermann, Jakob, who at the time lived in Munich was also of a scientific bent. This turned out to be a matter of some importance in young Albert's life for, shortly after his birth, Hermann closed his business in Ulm which had collapsed and moved to Munich to be with his brother. They set up an electrochemical business and it was in Munich that Albert had his earliest education.

In Munich, Albert had his earliest introduction to the wonder of science, at least one he recalled even in 1954 at the end of his life. When he was five and, being unwell, confined to bed, his father entertained him by showing him a magnetic compass. The fact that the compass needle pointed in the same direction no matter which way the compass box was oriented did strike him as very peculiar, as if a force from empty space acted on the needle. It would appear that such an incident did indeed take place, even if, in hindsight, it was invested with more importance than it may have merited at the time. In later life, Einstein had little to say about his childhood and much seems to have escaped his memory with the exception of his experience with the compass.

Einstein's formal education began in Munich when he was enrolled in the Luitpold Gymnasium in 1888 at the age of 9. He was to remain here for the next six and a half years, leaving in the middle of the school year without a diploma in December 1894. Einstein maintained a remarkable silence about the details of his schooling in Munich – he was over fifteen when he left and is unlikely to have completely forgotten his Munich experience. In this reticence, he did not single out his experiences at the Luitpold Gymnasium: it extended to all aspects of his personal life. This was a very conscious decision, not prompted only by forgetfulness and inability to recall details of



personal life with accuracy. He clearly wanted to be remembered – and said so explicitly on more than one occasion – by the trajectory of his mental development. This, he felt, was the only aspect of his life which could possibly interest others.

Despite Einstein's own reticence, quite a bit is known about his school, his teachers and what kind of instruction he received. However, we do not know with any certainty which part of his experience here was so distasteful as to engender his lifelong aversion to the German school education he received. It needs to be recalled that school education in Germany was the subject of a very vigorous and acrimonious debate in the last two decades of the nineteenth century. The debate centred principally around curriculum reform in the Gymnasia, particularly in Prussia in the north; however, since Prussia set the tone for most such things in the rest of Germany, the debate affected Munich schools as well. The debate related to the reformists' plea to downgrade the central role of the classical languages Latin and Greek in a Gymnasium's curriculum and replace it by a similar role for the natural sciences and mathematics. In an address given in 1886, the physicist-philosopher Ernst Mach found it entirely anomalous that future scientists, engineers and doctors should have their school education monopolized by classical philology. To quote from his address: “.. in modern times, the Greeks and Romans are simply two objects, among others, for archaeological and historical research.” Instruction centred around mathematics and natural sciences could provide a better general education, since these disciplines alone showed how to elucidate “the economical organization and organic association” of new concepts. The opposing point of view is to be found in a petition circulated by Gustav Uhlig, a Gymnasium professor at Heidelberg, a petition which received over 4000 signatories including a third of German university Dozents. It asserted that the German nation had reason to be grateful for the education imparted in the Gymnasium, that this was built around the classical languages and that there was every reason to retain this successful formula. Only minor changes in the curricula were acceptable to these signatories.

Where did the Luitpold Gymnasium at the time of Einstein's school days stand in relation to these debates? On the whole, it seems, on the side of reform. True, Latin and Greek continued to be a compulsory and important part of the instruction. But under a liberal rector, Dr. Wolfgang Markhausen characterized by more than one student of the times as a kind and generous man, the school placed considerable emphasis on the teaching of the natural sciences and mathematics as well as in mastering German language and literature. In his last year and a half in the school, Einstein used as a text



Josef Krist's *Essentials of Natural Science*. Unlike the dominant view in Prussian schools, Krist did not subscribe to the view that physics could be taught essentially as a part of mathematics. Instead, he emphasized the empirical basis of physics, and the other natural sciences and treated the deduction of physical laws as exercises in inductive logic. While we do not know how effective his physics teacher Joseph Ducrue was in conveying these empiricist basis of the sciences, we do know that from 1888 to 1891 Einstein studied with an outstanding teacher of mathematics, Adolf Sickenburger, a vocal supporter of school reform. He had authored a *Textbook of Elementary Mathematics*. This book, which was published in parts, was used at Luitpold throughout Einstein's stay at the school. He based his book on twenty years of pedagogy and gave his experience as a teacher precedence over theoretical schemes. He made use of recent pedagogical literature published in *Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht* which was the leading pedagogical journal in mathematics in Germany at the time. He tried to present all ideas in the simplest and most intuitive forms without worrying too much about mathematical rigour which he thought was out of place in an elementary text. Additionally, he sought to show in mathematics not only the prime role of pure reason but also its connections with and utility in everyday life.

When Einstein was twelve he got hold of a 'small book on geometry' at the beginning of the school year which he studied on his own and which, in Einstein's own words "made an indescribable impression" on him. There is no clear evidence as to which book this was, but it was a book on plane geometry. He remembered even late in life that it was "not too particular" in logical rigour but "made up for this by permitting the main thoughts to stand out clearly and synoptically". There is some reason to believe that this book was the plane geometry part of Sickenburger's text, though the evidence is not unambiguous. In any case, Sickenburger was an outstanding teacher and his book widely admired.

Luitpold was then a good school of its type and for its times. Einstein's grades were also excellent, in Latin, Greek, mathematics and German. Why, then, did he come to hate the school and all it stood for? Shortly before his death, Einstein characterized the Munich system as "authoritarian" to be contrasted strongly with the education he received in the school in Arrau, Switzerland later. The Munich system was based on "drill, external authority, and ambition". He goes on to say that "True democracy is not an empty illusion", possibly paraphrasing a statement on which he wrote an essay for his German course at the same school, to the effect that "The truth is no empty illusion." It



is possible that Einstein's extreme dislike of all forms of authority was born in his school experiences in Munich, though this can only be posited as reasonable speculation. So strong was Einstein's distaste that shortly after his family had departed for Italy, he obtained, in December 1895, in the middle of the school year, what was essentially a fabricated Doctor's certificate about the possibility of nervous exhaustion requiring him to take leave. Franck suggests that even before he could present this to the school authorities he was asked to go by one of his teachers because his disruptive presence disturbed his fellow pupils. Taking excellent testimonials from his mathematics teacher, Einstein left Luitpold without taking his final examinations. He must have been perfectly well aware that in leaving as he did he was taking a very grave risk for his academic future.

The other major experience of his Munich childhood which left a mark for a lifetime was his introduction to music. Albert's mother Pauline, nee Koch, came from a Stuttgart family of grain merchants with a comfortable financial background. She was a lover and a keen student of classical music and from his sixth year onwards Einstein took lessons on the violin. Early on it may have been a chore but soon he developed an abiding love for music, particularly the music of Mozart and Bach, which was to be his principal recreation for the rest of his life. He was never a violinist of professional standards. This was only to be expected, given the intensity of his thought and work in science which could not possibly leave time for the kind of engagement with music required to attain the levels of a professional. But the satisfaction he drew from music, sometimes playing in quartets with professionals, was immense. Sometimes he spent musical evenings with other physicists interested in music. During his Berlin years in the twenties, Max Planck, a more than competent pianist, would often play with him for their own pleasure and that of friends. Einstein owed much to his mother for the pleasure and serenity that this love of music gave him. Indeed, in one of his meetings with Rabindranath Tagore in the thirties, when both were world figures of eminence, the conversation centred around the different structures of music of the west and of India and how, in spite of their very different roots and evolution, they satisfied the deepest unspoken longings in man.

Einstein completed his schooling in Italy and Switzerland before entering the Swiss Federal Polytechnic School (ETH) in Zurich in 1896. He secured his admission after a failed attempt a year earlier and at an age which was low for one seeking admission to a university. The more important fact of his life from the point of view of this narrative



was that he persuaded his father, when he went to spend the Christmas of 1895 with his family, to write to the appropriate authorities in Germany to allow him to give up his German citizenship. This request to his father may have been made even earlier but his father had possibly done nothing about it. At this point, he was not qualified to apply for the Swiss nationality which he later acquired, after a wait of more than five years – he became a Swiss citizen only in October 1901.

What could have prompted a young boy, a little more than sixteen years in age, to renounce the citizenship of the land of his birth and that of his forefathers and become stateless? It has been suggested – without any documentary evidence – that Einstein wished to avoid the compulsory military service required of all German youth. Yet we must remember that at this point in his life there was no suggestion of his later pacifism. Indeed, after becoming a Swiss citizen he voluntarily offered himself for military service and was turned down on medical grounds. Was it, then, specifically, a detestation of German military service?

Such could be the case, for then it would tie in with his dislike of what may have appeared to him as the unnecessary rigidity and discipline he found at the Gymnasium in Munich. In any event, we find here for the first time, the singular individuality that characterized many of the important turns in Einstein's life. Never did he later ask for his German citizenship to be restored to him. When he moved to Berlin, persuaded by Nernst and Planck to contribute to what was then the most important centre of physics, he had German citizenship thrust upon him by virtue of the chair he occupied. He never renounced his Swiss citizenship, even after he had willingly become a citizen of the United States.

Contrast Einstein's experience in Luitpold with that in the only school he attended in Switzerland. This was the cantonal school in Arrau in the canton of Aargau, to which he was referred by one of the professors who saw his admission papers in his failed attempt to enter the ETH in 1895 at the somewhat young age of 16. This school was a small one compared to the one in Munich and was divided into a Gymnasium (in which Latin was mandatory and Greek was optional), a Realgymnasium or trade school (in which Einstein registered and in which both Greek and Latin were elective subjects) and an Oberrealschule which was a two year commercial school. Einstein was thus freed from the clutches of Latin and Greek: no doubt this was his reason for registering where he did. The school had an outstanding rector in Dr. August Tuchschnid who was also an



exemplary teacher of physics. The school had a most modern physics laboratory and workshop, equipped with a dynamo, an AC motor, a lathe, galvanometers, etc. Dr. Tuchshmid's demonstration experiments on electric currents were scintillating and his lectures compared favourably with those in the smaller universities. His mathematics teacher was Heinrich Ganter, somewhat more conventional in his approach than Tuchshmid. He was a good mathematician but not, in his own reckoning good enough to pursue a career in higher mathematics. But he could teach, "something that many speculative gentlemen cannot do". Ganter, together with a professor at the polytechnic, wrote a text on Analytical Geometry, a text used by Tuchshmid in his teaching in Arrau. In the trade school that Einstein attended, Ganter "never treated us demeaningly, but taught us as men", said another of his students. Another pupil, Ernst Meissner, who was to become a polytechnic professor, remembered him as a teacher who, far from transmitting mere information to prepare a pupil for a career, educated the heart and character and truly civilized his charges. If all teachers were like Ganter, Meissner felt, there would be no need for school reform.

Einstein also had a true practising scientist among his teachers here. This was the geologist Friedrich Muhlberg, whose classes in geology and physical geography Einstein attended. At 55 he was one of Switzerland's great geologists. He wrote a definitive flora of Aargau, a treatise on the glacial geology of the canton and descriptions. At the time Einstein was among his pupils, he had over 1000 pages in print. Einstein made an impression on this scholarly teacher who remembered him as a clever pupil.

Later in life, Einstein remembered the year at Aarau fondly and asserted that the school remained for him "the most satisfying image of this kind of cultural institution", with great freedom of learning and instruction. It was a freedom traditional at Aarau and, despite superficial resemblances, one not emerging from the process of school reform in northern Germany. In this freedom, Einstein prospered. At the final examinations, his grades were perfect in physics and mathematics, excellent in chemistry, German and natural history and poor only in French. His examination essays were models of simplicity and lucidity; his approach to mathematical problems was as simple as possible.

Einstein entered the Aarau school as a precocious and somewhat tentative youngster of 16. He left a year later as a mature young man, confident that he wanted to spend the next years "in the study of mathematics and physics". Possibly this year's schooling was



of the greater importance in his mental growth than the formal aspects of his education at the Zurich polytechnic. It may even be speculated that in Einstein's experience with secondary education in Switzerland lie the origins of his prejudice for approaching physical reality as a whole subject and for the view that mathematics, in itself, is not able to give us Nature's laws.

Einstein lived in Zurich more or less continuously until he left for Berne in the summer of 1902 to take up his position at the Swiss patent office. His studies at the ETH – his successes and failures as a student – have been described in his many scientific biographies. But what kind of life did he lead? Who were his friends? What were their common interests? And what sort of city was Zurich at the end of the nineteenth century where Einstein grew to manhood?

At the turn of the century, Zurich was a small city with a population of about 150,000. It was a city with a markedly cosmopolitan atmosphere – in the European sense, at the intersection of many of the revolutionary movements then current in Europe. In particular, Russian revolutionaries of all kinds – Marxists, anarchists, nihilists and Zionists – either made Zurich their temporary home or passed through it at various stages in their revolutionary activities. Too often, many students gave up their texts for the pamphlets of Marx, Bakunin and Proudhon. In 1873, the Russian government had warned Russian students to avoid Zurich and its climate of argument, debate and professed revolution. Rosa Luxembourg came to Zurich in 1889 to study at the University of Zurich, where Einstein was later to hold his first academic position: she was to become the most ardently leftist thinker of the German Social Democratic party. Einstein admired her deeply. In 1898 came Alexandra Kollontray from Russia, an admirer of Rosa Luxembourg: later she was to be the Soviet ambassador to Norway and Mexico. Eduard Bernstein, an exiled German socialist editor, friend of Engels gave public lectures on socialism. And Switzerland generally – not only Zurich but also Berne, Basel and Geneva – was host to Lenin, Plekhanov and Chaim Weizmann, the father of modern Zionism. The atmosphere of the student and intellectual community in Zurich as elsewhere in Switzerland was one of great ferment in the major social, political and philosophical ideas in currency at the time.

How was the young Einstein placed with regard to this intellectual ferment? There is every reason to believe that he was fully immersed in it. While there cannot be any doubt that the focus of his interests was the natural sciences, he was fully alive to the



social and political ideas floating around him.

Almost all of the friendships that Einstein formed at this stage of his life were with fellow students with an interest in mathematics and the natural sciences. Among them, the first who demands attention in this context was Friedrich Adler. Adler, a fellow student at the ETH, became one of Einstein's closest friends in Zurich. They met for the first time possibly in 1897, a year after Einstein entered the University. Adler made a deep impression on Einstein. Einstein's son-in-law Anton Reiser described their friendship in the following way:

*With Albert, in Zurich, at the same time, was a young, blonde, sensitive student, the purest and most idealistic spirit Einstein had ever encountered. This was the Austrian socialist Friedrich Adler, who much later became privatdozent at Zurich, and appeared as a sort of saint in life and conduct. As a student he displayed the utmost zeal and patient devotion even during the most tedious lectures. For a long time Einstein believed that Adler was the only person who had really assimilated the tiresome matter of the course in astronomy.*

However, his devotion to lectures was not the only thing that endeared Friedrich to Einstein. Friedrich was the son of the leader of the Austrian Socialist Democratic party, Dr. Victor Adler and believed that his true calling was that of a radical political activist. As a youngster, Friedrich had been excited not only by his readings in science but also by the classics of Marxist ideology. His father was dismayed by his desire for a life of political activism and ultimately persuaded him to enter a course of technical studies. At the time he became Einstein's close friend, he was a physicist-philosopher with a sublimated desire for political activism. Indeed, he lived in the very same rooms which had, at one time, been the lodgings of Rosa Luxemburg. What did the friends talk about? Adler believed in the Marxist political philosophy, but as a philosopher-physicist, he was an ardent admirer of Ernst Mach. In the words of Reiser

*Einstein learned a great deal about socialist teachings from his friend Adler, with whom he lived in the same house in Zurich. Indeed, were all people so conscientious, disciplined and helpful as this Adler, the socialist paradise could certainly be realized. Adler was not only a socialist and physicist, but an enthusiastic philosopher. Like the young Lenin, he was a follower of the empirical-critical philosophy of Ernst Mach...Adler believed that natural science should come purely from experience...*

Adler was, in fact, trying to combine Marxist and Machian ideas. There can be little



doubt that Einstein's early initiation into Machian philosophy and adherence to it in the earlier phase of his philosophical stance in relation to physics owes much to his friendship with Adler. We must also not forget that Einstein described himself as a socialist all through his life even though he never called himself a Marxist and had deep misgivings about the methods used by the Bolsheviks.

Adler continued to play an important role in Einstein's life even much later. This was not in any scientific sense, for Einstein soon found himself in disagreement with the scientific-philosophical views of Adler: he found these views naive and romantic. However, in a very practical way Adler helped him obtain his first academic position. When Einstein became a candidate for a position at the University of Zurich in 1909, the position was instead offered to Adler: the city and university was, at the time controlled by socialists who were swayed by Adler's socialist lineage. But when Adler realized that Einstein was also seeking the position he immediately stood down, for he truly felt that Einstein's promise as a physicist far exceeded his own.

Einstein and Adler's paths intersected again fatefully just before the World War began. Adler was involved in the political assassination of the Austrian Prime Minister and was sentenced to death. Einstein was ready to appear as a witness on behalf of Adler but the onset of the war saved Adler's life. Einstein stood by his faith in the sterling qualities of his friend for the rest of his life.

More is generally known about the other close friends of Einstein at this stage of his life. They were like him, students of physics and mathematics, given to discussions of a philosophical nature, seekers after truth in their individual ways. Most of them were somewhat adrift in the academic world and, like Einstein, looking for academic positions after completing their studies. Einstein began work at the patent office in Berne on 23 June 1902, two years after he graduated. During this period he had failed to get an apprenticeship with any of his professors in Zurich. With his friends Conrad Habicht and Maurice Solovine he formed the "Olympia Academy". They had as "corresponding fellows" Paul Habicht and Michele Besso as well as Marcel Grossman in Zurich. The group usually met in Einstein's rooms – he was by now married to Mileva Maric – drinking Turkish coffee. They read and discussed Mach, John Stuart Mill, David Hume and Poincaré. This was their own scientific society, away from the scientific establishment of the time, to which they were in any case outsiders. Were they also rebels? It would seem that that was the case, if we look at what Einstein wrote to



Maurice Solovine close to the end of his life in 1953:

*TO THE IMMORTAL OLYMPIA ACADEMY*

*In your brief and active existence you took a childlike joy in all that was clear and intelligent. Your members created you in order to make merry over your eminent, old and puffed up sisters. How much they thereby hit the truth, I have learned to appreciate fully through painstaking observations through the years.*

The Zurich–Berne circle around the Olympia also drew in the wives of the members. There was, in addition to Mileva, the Russian wife of Adler, Katya Germanischkaya who was studying physics at the University of Zurich. This circle was also composed largely of people of Jewish origin: Einstein, Adler, Besso and Solovine were Jewish. Was this of any significance? These were all gifted young men, “renegade” Jews who had escaped from the traditional, conservative Jewish environment. Thorstein Veblen has argued that such young “renegade” Jews were “particularly among the vanguard, the pioneers, the uneasy guild of pathfinders and iconoclasts, in science, scholarship, and institutional change and growth”. They came to science, he said, with a “*sceptical animus*”: the young Jew “is a sceptic by force of circumstances over which he has no control”.

Such, then, was the life of the young Albert Einstein, not yet in his twentyfifth year, in Zurich and Berne. He was, successively, student, jobseeker, casual school teacher and finally a patent clerk. He was always hard up, particularly after he was a married man with a child. But nothing seemed to dampen his spirits and that of his friends. Nothing stopped their vigorous engagement with ideas in science and philosophy. In the case of Einstein, he was engaged in a rediscovery of the fundamentals of statistical thermodynamics of Boltzmann for himself, using most fruitfully his love of thermodynamics. The basic ideas of thermodynamics were, he felt, so broad based that no subsequent discoveries were likely to lead to their overthrow. In his own words:

*A theory is the more impressive the greater the simplicity of its premises is, the more different kinds of things it relates and the more extended is its area of applicability. Therefore the deep impression that classical thermodynamics made upon me. It is the only physical theory of universal content concerning which I am convinced that, within the framework of applicability of its basic concepts, it will never be overthrown.*



There can be little doubt that we can see the Einstein of his mature years, the creator both of legendary science and of legends, in this founder of the Olympia Academy. With his circle of earnest friends, with a breadth of interests in science and philosophy, seeking answers not to minor problems here and there but to questions tied to the fundamentals, we have the Einstein we can recognize as the familiar and loved figure in the history of the twentieth century.

### Suggested Reading

- [1] Don Howard, *Physics and the Philosophy of Science at the Turn of the Twentieth Century*, <http://www.nd.edu/~dhoward1/Phil-Phys-1900.pdf>
- [2] Anton Reiser, *Albert Einstein – A Biographical Portrait*, Albert and Charles Boni, NY, 1933.
- [3] Peter L Galison and D Graham Burnett, *Einstein, Poincare and Modernity: A Conversation*, Daedalus, Spring 2003.
- [4] Denis Overbye, *Science Historian at Work: Peter Galison; The Clocks that Shaped Einstein's Leap in Time*, The New York Times, June 24, 2003.
- [5] *Tracing Back the Sources of Einstein's Political Convictions*, [www.steinmuller.de/pages/Einstein+DGEK.pdf](http://www.steinmuller.de/pages/Einstein+DGEK.pdf)
- [6] Peter Galison, *Einstein's Clocks, Poincare's Maps: Empires of Time*, W W Norton, 2003.
- [7] Lewis Pyenson, *The Young Einstein*, Adam Hilger Ltd., Bristol and Boston, 1985.

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Through the release of atomic energy, our generation has brought into the world the most revolutionary force since prehistoric man's discovery of fire. This basic force of the universe cannot be fitted into the outmoded concept of narrow nationalisms. For there is no secret and there is no defense; there is no possibility of control except through the aroused understanding and insistence of the peoples of the world. We scientists recognise our inescapable responsibility to carry to our fellow citizens an understanding of atomic energy and its implication for society. In this lies our only security and our only hope – we believe that an informed citizenry will act for life and not for death.

*Albert Einstein, 1947*

