Mileva Maric, an unfulfilled career in science

*Matthias Tomczak**
** School of the Environment, Flinders University, GPO Box 2100, Adelaide SA 500, matthias.tomczak@flinders.edu.au*

The following abbreviations are used: Collected Papers, Albert Einstein, Anna Beck, Peter Havas: The Collected Papers of Albert Einstein, vol. 1: The Early Years, 1879–1902, Princeton, New Jersey: Princeton University Press, 1987; ETH, Eidgenössische Technische Hochschule; VFW, Verein Feminist. Wiss. Schweiz: Ebenso neu als kühn: 120 Jahre Frauenstudium an der Universität Zürich. *Schriftenreihe Feministische Wissenschaft* Bd. 1, 1988.

ABSTRACT

In 1990 a controversy developed, and continued into the next decade, about the role of Einstein's first wife Mileva Maric in Einstein's work. This article does not specifically address the controversy but takes it as a starting point to ask whether Maric could have had a career of her own in science and what prevented her from reaching it. Particular focus is placed on the influence of society's norms and expectations on individual behaviour. Maric showed extraordinary promise as a mathematician. Encouraged by a supportive university environment she overcame all hurdles faced by women of the 19th century who wanted to enter an academic career; every step of her student career gives cause to believe that she would have had a successful science career would she not have met Einstein. Her unconditional love for Einstein caused her to divert her energy towards intellectual support of her husband, neglecting her own work. Einstein, who had internalised the social norm that women belong in the kitchen, made use of her mathematical abilities but did not support his wife in developing her potential further; he was the instrument of society that prevented Maric from fulfilling her career hopes.
Keywords: Albert Einstein, Mileva Maric, university access for women, Marie Curie, Pierre Curie, Swiss Federal Institute of Technology, University of Heidelberg

INTRODUCTION

Mileva Maric was born on 19 December 1875 in Titel, a small town in Serbia, as the daughter of a wealthy Serb family of Eastern Orthodox Christian belief. At the age of 20, while studying at the *Eidgenössische Polytechnische Schule* (Swiss Polytechnic, now the *Eidgenössische Technische Hochschule* or Swiss Federal Institute of Technology) in Zürich, she met Albert Einstein. Maric and Einstein become lovers and married in 1903.

The years of Maric's and Einstein's love affair and early marital life were a particularly productive period for the young Einstein, culminating in the publication of five seminal papers in 1905 that laid the foundation for the Theory of Relativity.

Soon after Maric's and Einstein's *Love Letters* were published in 1987[1] a controversy developed about Maric's role in the preparation of some of the papers. Sentences in love

[1] The letters were first published in 1987 in the *Collected Papers*. They were re-edited in 1992 by Jürgen Renn and Robert Schulmann (eds.): *Albert Einstein and Mileva Maric: The Love Letters*. Princeton, New Jersey: Princeton University Press, 1992. – The beginning of the controversy can be traced to a paper given

letters that indicate collaboration between the two lovers[2] and the submission of three of the papers under the name Einstein-Marity[3] (Marity being the Hungarian writing of Maric) were interpreted as indications that the Theory of Relativity might have been developed jointly by Einstein and Maric and that Maric's contribution and co-authorship was suppressed. The controversy has produced a range of publications of serious academic standard[4] and a raft of articles in the fringe world of the internet[5].

Two positions, which one may call the Einstein-defence position and the Maric-rehabilitation position, crystallized over the years. While the latter attempts to collect evidence that Einstein disinherited Maric of her intellectual contributions to modern physics, the former proposes that Maric's stature as a scientist was insufficient to make that contribution and that she played a negligible role in Einstein's work. Both sides base their arguments nearly exclusively on Maric's and Einstein's letters to each other and to friends and on Maric's and Einstein's academic records.

Comparing academic records assumes that the two individuals involved studied under comparable conditions. But it is well known that at the turn from the 19th to the 20th century a woman studying at a university had to accept conditions that were not comparable to those of men. Most studies of the Maric-Einstein dispute acknowledge this in passing but do not investigate the influence of societal conditions on Maric's career as a student and potential scientist in any depth. But academic marks and grades are a reflection of academic achievement obtained under the societal conditions of the time, and a full assessment of a person's life requires in the first instance an analysis of the general conditions of life and the options offered by society. The academic record can then serve as the proof to which extent the person could make use of his or her intellect to overcome obstacles and make the best of the options offered by society, should they exist.

This paper tries to answer the question whether Mileva Maric had the potential to enter into a career as a scientist and if so, what prevented her from reaching that career. In

---

by linguist Senta Troemel-Ploetz and physicist Evan Harris Walker at the annual congress of the American Association for the Advancement of Science of 1990; see Dan Charles, David Dickson and Christopher Joyce: The American Association for the Advancement of Science: Was the first Mrs Einstein a genius, too? *New Scientist* 1706, 3 March 1990; also Senta Troemel-Ploetz: The woman who did Einstein's mathematics. *Women's Studies Int. Forum* 13 (5), 1990, 415-432.

[2] "Wie stolz und glücklich werde ich sein, wenn wir beide zusammen unsere Arbeit über die Relativbewegung siegreich zu Ende geführt haben. Wenn ich so andre Leute sehe, da kommt mirs so recht, was an Dir ist!" ("How proud and happy I shall be when we both together shall bring our work on relative motion to a victorious end. When I look at other people I cannot but notice your stature!" Einstein an Maric, in a letter dated 27 March 1901; transl. M. T.) *Am Sonntag küss ich Dich mündlich. Die Liebesbriefe 1897 - 1903*. München: Piper, 1998.

[3] The papers were eventually published under the name Einstein. See the detailed discussion in John Stachel: Introduction; in : *Einstein's Miraculous Year: Five Papers that Changed the Face of Physics*. Princeton, New Jersey: Princeton University Press, 2005, pp. liv-lxxii.

[4] for example Andrea Gabor: *Einstein's Wife: Work and Marriage in the Lives of Five Great Twentieth Century Women*. New York: Viking, 1995, 368 pages; also in paperback: Penguin1996; Milan Popovic (ed.): *In Einstein's Shadow*. Baltimore and London: The Johns Hopkins University Press, 2003, 304 pages; Carol C. Barnett: A comparative analysis of perspectives of Mileva Maric Einstein. PhD thesis, Florida State University, 1998, 225 pp.

[5] For example Allen Esterson at the "Butterflies and Wheels – fighting fashionable nonsense" website (http://www.butterfliesandwheels.org/2006/einsteins-wife/).

particular it addresses the question which general and specific obstacles Maric had to overcome as a woman aspiring to a career as a scientist, to which extent these obstacles existed as a result of society in general, and which, if any, were caused by her husband Albert Einstein. Having completed this analysis it is hoped that the paper can answer the question: Was Mileva Maric's life one of an unfulfilled scientific career sacrificed to social attitudes, or was Maric indeed a woman of mediocre scientific talent married to a singular genius?

EARLY LIFE, ARRIVAL AT THE POLYTECHNIC

The facts about Maric's early years are well known.[6] The young Mileva attended the primary school in Ruma, a small town in the Serbian province of Vojvodina, then belonging to southern Hungary as part of the Austrian-Hungarian Empire. In 1886 she entered the high school for girls in Novi Sad, where in the first year she became the best student of her class. Her parents then moved her to a high school in Sremska Mitrovica, which she left in 1890 with a high school certificate.

The fifteen year old Mileva now encountered the first serious hurdle for a woman interested in university studies. The formal entry requirement for universities in the German speaking area (Germany, Switzerland and Austria-Hungary) was the successful completion of education at a "Gymnasium", the classical high school model built on the principles of Erasmus of Rotterdam and the teaching of Latin and ancient Greek. Such schools existed only for boys; girls were not expected to have the need to study and therefore did not require the classical education. Mileva had shown an early inclination towards mathematics and could be regarded a child prodigy in mathematics, and her parents supported her interests. In 1890 they enrolled her in a Serbian high school in Sabac across the border, a school without specific rules about the exclusion of girls, where the presence of boys would mean that science received more attention than in an all-girls school.

Mileva soon excelled in areas other than mathematics. Normally students at Sabac's high school would study one foreign language (normally German, which for Serbs was a foreign language), but showing an aptitude for languages Mileva received permission to take up French as well.

But Sabac's high school would not open the doors of a university, and after one year Mileva left Sabac when her father obtained special permission to enrol his daughter at the Royal Classical High School (Gymnasium) in Zagreb. At the beginning of the last year Mileva, the only girl at the school, applied for and received permission to attend the

[6] see Andrea Gabor: The forgotten wife. In Donald Goldsmith and Marcia Bartusiak (eds.): *E = Einstein, His Life, His Thoughts and His Influence on Our Culture*. New York: Sterling Publishing, 2006. pp. 33 – 66; Margarete Maurer: Zur Frage der Koautorinnenschaft Mileva Marics an Einsteins Arbeiten bis 1913. www.teslasociety.ch/info/60/maurer_pdf.pdf (accessed 28 July 2010), an expanded version of a paper Weil nicht sein kann, was nicht sein darf … Die "Eltern" oder "der Vater" der Relativitätstheorie? Zum Streit über den Anteil von Mileva Maric an der Entstehung der Relativitätstheorie. *PC News* 48 (11), 1996, pp. 20 – 27; and Roger Highfield and Paul Carter: *The Private Lives of Albert Einstein*, London: Faber and Faber, 1993. 224 pages.

physics class and completed her schooling with the highest grades of the class in mathematics and physics in 1894.

Maric had now reached the second hurdle. She had completed the education required for acces to the entry examination to university. She now had to find a university, preferably a university in the German-speaking area, that allowed women to take up university study. She opted for the University of Zurich – the first academic institution in the German speaking area to allow women to receive an academic degree – and took up medical studies. Still in her first semester, she entered the entry exam for classes in mathematics at the Swiss Polytechnic. Unlike Einstein[7], who failed that exam on his first attempt, Maric passed it and was accepted for the study of mathematics and physics.[8]

To summarize the early years: Being a child prodigy is never a guarantee for an illustrious career in later life; but what can be said with certainty is that when Maric entered the Swiss Polytechnic in 1896 she showed great promise as a future mathematician and physicist, that her teachers would have had the highest expectations for her, that she showed the strongest interest in mathematics and physics, and that she was determined to turn this interest into a career. The question now is: Why did she not succeed?

CONDITIONS AT THE POLYTECHNIC

To envisage the social and academic climate the 20 year old Maric encountered at the Swiss Polytechnic one has to understand what created this illustrious academic institution. The 19th century was a period of great change for Europe, characterized by the transition from autocratic rule of monarchs to the bourgeois republic that removed all feudal constraints on industrial development. The process had begun with the French Revolution of 1789 that led to the establishment of the École Polytechnique, the first institution of higher learning dedicated to industrial training and research, in 1794.

Several countries now aspired to have their own polytechnic institutions, but for the many small German feudal states and Swiss cantons this remained a vain hope. The inspiration to overcome this situation came again from France, where the revolution of 1848 had introduced universal male suffrage and established the Second Republic. Within months the Swiss Confederation was established through adoption of a Federal Constitution. An

[7] Einstein had to take the examination because he required special dispensation, being more than 18 months below normal entry age. He passed the examination at his second attempt.

[8] Gabor (*The forgotten wife*) argues that Maric initially had not planned to study physics but to follow the interest in medicine that ran in the Maric family. But it has to be remembered that many of the few women who entered university in the 19th century began their university life with the study of medicine (Nadezda Smeckaja, the first woman to study at the Polytechnic, was an early example) and that the medical faculty of the University of Zurich had a large number of female students (Verena E. Müller: Warum gerade Zürich? In: VFW, 147) It seems that in an era of general enmity towards women students a career in health services fitted the idea of the serving woman better than a career in the "hard sciences", appeared less offensive and in some way was the logical extension from the work done by nurses. Most women students in 19th century Zurich studied medicine. Maric's entry into medicine could also be the reaction of a shy young woman to perceptions of the role of women of her time, which her experience in Zurich and her ardent interest in science helped her to overcome.

Act to establish a Federal Polytechnic was passed in 1854, and in the following year the Swiss Polytechnic opened its doors.

In Germany armed revolts in several of the small duchies and principalities led to the convocation of a National Assembly in Frankfurt in 1848, but its attempts to proclaim equal rights for all citizens before the law and adopt a national constitution were crushed by military intervention. By 1851 all German states had reversed the achievements of the revolutionaries of 1848, and equal rights for all citizens were abolished nearly everywhere.

The defeat of the German revolution led to an influx of refugees into Switzerland, among them young and revolutionary minded academics who were looking for employment. They first turned to the young University of Zurich, the first university in Europe to be founded (in 1833) by the state rather than a monarch or the church.[9] But the main opportunity for employment came from the foundation of the Swiss Polytechnic, which had to appoint a large number of new staff. When it started its teaching programme in 1855, the majority of the academic staff were thus foreigners with progressive ideas who supported the opening of university education to women.

These circumstances explain why women found it easier to obtain an academic degree in Zurich then anywhere else in the German speaking area.[10] But they still had to contend with the general difficulties faced by women who wanted to obtain a university education. To begin with, graduation from a classical high school (gymnasium) that opened the doors to the university existed only for males; the highest education women could ordinarily aspire to was an ordinary high school certificate. For a woman gaining access to a university involved the provision of supporting documentation about her excellence at school – often gained from private lessons – and evidence of good character. Both had to be supported by advice from a staff member of the Polytechnic, and if approved, the Polytechnic stated explicitly that the acceptance of the student should not be seen as a precedent for acceptance of women in principle.

The practice continued for many decades. 15 years after the foundation of the Polytechnic its Council granted a woman access to the entry examination with the proviso that this decision should not be taken as "precedent for permanent fundamental settlement of the question of access to the entry examinations" for women.[11] In the following year an alumnus who had enquired about the permission of women for studies received the reply "with explanation of the admission rules that a general rule or obligation has not been established for this, but there would not for the present exist a reason to refuse admission to the entry examinations to ladies of good repute, nevertheless, under the reservation for

[9] Most of these refugees considered the University of Zurich an "academic waiting room" where they would wait to be called to appointments at more famous universities. (Verena E. Müller, 147.)

[10] The universities of Paris and Zurich were the first European universities to confer degrees on women; the first woman to receive her degree (in medicine) from the University of Zurich was Nadezda Suslova. Angela Graf-Nold: Weiblichkeit in Wissenschaft und Wissenschaftspolitik. In: VFW, 29.

[11] ETH-Bibliothek, Archive, SR2:1870, Schulratsprotokolle. Beschluß des Schweizerischen Schulraths vom 12.12.1870, Trakt. 117, 110-111; transl. M. T.

their well-being, to return to the matter in principle."[12] When the President asked the Council to revisit the question, the Council reaffirmed its position again.[13]

Having successfully been admitted to the entry examination was not the end of the matter. For over 60 years women could not enrol at the Polytechnic as ordinary students; the official student statistic shows the first enrolled woman for 1917.[14] Before that year women could only sit in at lectures as auditors ("Gasthörer") with the permission of the lecturer, so the decision whether a woman could attend a course rested in the end with the individual member of the academic staff.

The requirement of being of "good repute" and the responsibility of the institution to guarantee "well-being" meant that women students had to conduct themselves in the most exemplary manner. While their male counterparts enjoyed regular drinking parties and the typical excesses of student life, women had to make sure that they were not particularly noticed. They had to keep a low profile, not only at the university but just as much when facing the Swiss public, which in any case had misgivings about the concentration of revolutionary fervour and liberal thinking at the Polytechnic. It has to be remembered that while women (most of them from outside Switzerland) had the right to university studies since the 1860s, Swiss women were not allowed to vote in federal elections until a century later (in 1971).

Developments in the early 1870s did not help the situation of women students. The abolition of serfdom in Russia in 1861 had not only brought the liberation of the peasants but also the new need to earn a living for many daughters of the land-owning aristocracy.[15] But the Russian university statute of 1863 had abolished the right of women, granted only four years earlier, to attend university lectures. As a result, a wave of young women from the Russian empire – Russians, Poles, Georgians and others – arrived in Zurich to take up studies, predominantly in medicine. The trickle swelled into a stream after the rise and downfall of the Paris Commune in 1871, which reverberated with the Russian intelligentsia, led to increased repression and a rise in emigration. As a

---

[12] ETH-Bibliothek, Archive, SR2:1871. Präsidialverfügung vom 7.3.1871. Trakt. 56, 32; transl. M. T.

[13] "The Swiss School Council, on the suggestion of its President that the administration may return to its decision of 12 December 1870 concerning admission of ladies to studies at the Polytechnic, after relevant discussion resolves: that until further notice Council's said decision be upheld." ETH-Bibliothek, Archive, SR2: 1872. Schulratsprotokolle. Beschluß des Schweizerischen Schulraths vom 8.8.1872. Trakt. 145, 137; transl. M. T.

[14] There is some confusion about the enrolment status of women between 1867 and 1917. The official student statistic of the Polytechnic/ETH does not show any enrolled women before 1917. (Lars Leemann and Daniel Speich: Anzahl Studierende an der ETH Zürich 1855–2002, Statistischer Überblick Nr. 3. http://www.ethistory.ethz.ch/statistik03Anzahl_Studierende.pdf, 2004.) Other sources (Regula Schnurrenberger: Namen, Daten, Fakultäten. In: VFW, 195; and Marianne Müller: Frauen an der Universität Zürich von 1864 bis 1988: Zahlenmäßige Entwicklung. In; VFW, 197.) mention occasional enrolment of women students in the context of graduation since 1867. Gugerli et. al. write: "The first Swiss woman, Marie Vögtlin, who enrolled at the University of Zurich in 1868 and passed the state examination in 1873, was an exception. (David Gugerli, Patrick Kupper and Daniel Speich: Die Zukunfsmaschine. Konjunkturen der ETH Zürich 1855-2005. Zurich: *Cronos*, 114. transl. M. T.) In view of the official student statistics this has to be understood in the sense that before 1917 women enlisted as auditors (*Gasthörer*) with the university.

[15] Monika Bankowski-Züllig (Zürich – das russische Mekka. In: VFW, 127 – 146.) documents the lives of several women students of the time, daughters of generals, landowners and police inspectors.

result the number of Russian students in Zurich rose from 14 during the winter of 1870/71 to 94 during the winter of 1872/73 and to 109 in the following summer, when the "Russian colony" topped 300.[16]

Further growth of the colony was stopped in 1873 by a decree of the Russian government that effectively banned women from studying in Zurich, by declaring that women who graduated in Zurich would not be allowed to enter employment in Russia.[17] Bankowski-Züllig writes about this period: "The Russian woman student determined the image of the woman student generally; the amalgam of nihilism and the studying woman meant 'that for the timid minds of those who clung to convention the image of a woman attending medical lectures at the university caused the same shudder as that of a woman dangling from the gallows for murdering the Tsar.'"[18] Mathematics student Elizaveta Litvinova of St. Petersburg wrote: "You can say that they [the Russian students] begin to populate, if not all of Zurich, yet the entire area around the university such as Fluntern, Hottingen etc. The locals do not like the newcomers at all! They prefer order and quiet, and now 'everything in Zurich is so noisy and untidy.'"[19]

For the Polytechnic the Russian influx produced a setback in the movement towards general admission of women. Many of the Russian students lacked the level of education required for university entry but were taken in nonetheless. Opposition from within the university culminated in a submission of the general student assembly to require a graduation certificate from a classical high school for admission to the university[20], but the situation was still not resolved when the Tsarist decree of 1873 eliminated the urgency to adopt concrete measures and find a more permanent regulation for the admission of women. The entry procedures were tightened, but for the next 40 years until 1914 Russian women, many with connections to socialist or anarchist circles, contributed a substantial contingent of students at the University and the Polytechnic.[21]

More than 20 years had passed since the "Russian episode" of 1871/73 when Mileva Maric received permission to attend lectures at the Polytechnic, but the conditions for women students were very much the same. Maric attended the same lectures as Albert Einstein and was allowed to take the same exams, but her status as a student differed substantially from Einstein's, and she had to be aware of her proper conduct at all times.

Maurice Solovine, a close friend of Einstein and member of the group of friends known as the "Olympia Academia", mentioned Maric's presence at the discussions after her marriage to Einstein: "This event occasioned no change in our meetings. Mileva, intelligent and reserved, listened intently but never intervened in our discussions."[22]

---

[16] Monika Bankowski-Züllig, 127/128.

[17] Verena E. Müller: *Marie-Heim-Vögtlin – die erste Schweizer Ärztin (1845-1916)*. Baden: hier+jezt Verlag für Kultur und Geschichte, 2007. 142.

[18] Monika Bankowski-Züllig, 127; transl. M. T.

[19] Monika Bankowski-Züllig, 137/138; transl. M. T.

[20] Verena E. Müller.

[21] Monika Bankowski-Züllig, 127. – During the 1860s, 1870s and 1880s the majority (53%) of students at the Polytechnic were foreigners. This percentage fell to 44% in the 1890s and 37% for 1900-1909, still a considerable number. Leemann and Speich.

[22] Solovine, M and Einstein, A. (1987). *Albert Einstein: Letters to Solovine*. New York: Philosophical Library, p. 13.

Supporters of the Einstein-defence position have interpreted this as evidence that Maric was not as outstanding a student as the members of the "academy". An equally valid interpretation could be that she simply followed the rules of behaviour of the time. Any woman student, intelligent or not, had to show reserved composure in the presence of men. Maric was shy by nature; her interest in physics made her listen intently but did not push her to overcome the rules of proper conduct.

Another development held against Maric by supporters of the Einstein-defence position is her decision not to seek an assistantship at the Polytechnic. Becoming an assistant to a professor was the normal avenue for anyone hoping to enter into a career in science, and on face value declining an offer of an assistantship can be seen as lack of interest in an academic career. It is thus important to understand what may have motivated Maric to let the opportunity of an assistantship slip by.

Helene Kaufler, a lifelong friend of Maric's, wrote in a letter to her mother that Maric was "offered an assistantship at the Polytechnic, but because of the students she did not wish to accept it; she would rather apply for an open position as librarian at the Polytechnic."[23] To understand Maric's reasoning one has to take a look at the situation in the classroom. Serafima Panteleeva, a student of medicine from St. Petersburg, described her experiences thus: "Only a few students, mostly higher semesters, had learnt to meet our task and our work with respect. Some women students had to endure the pranks of the freshmen, which culminated in attaching pieces of paper to the students' dress or, as they did in Geneva, smearing their buttons from behind with ink. At a university party the students began to sing obscene songs. When someone remarked that the students would be unlikely to dare doing the same in the presence of their sisters, the impertinent as well as incredibly stupid answer was: Sisters are sisters, but you are women students."[24]

Maric was born with a dislocated hip, had to wear orthopaedic shoes to correct a difference in the length of her legs and walked with a limp.[25] Being shy by nature she would have found it impossible to stand up, in a laboratory setting, to student pranks at her expense. She hoped to stay close to academia by opting for a position in the Polytechnic library, even though that would not allow her to practice her skills as a mathematician. Her love of science and mathematics may also explain why she eventually hoped for employment as a mathematics teacher in a girls' high school,[26] away from male students.

To come to a final judgement about Maric and the "Olympic Academia" or about her decisions and hopes for her career may not be possible. But during the crucial years at the Polytechnic that preceded her decision not to apply for an assistantship Maric provided a very strong argument in support of her academic interests: She decided that the quality of physics instruction at the Polytechnic was not of a level expected from an academic institution of world standing. The teaching staff of the Polytechnic followed established

---

[23] Popovic, 61. Maric was offered a (provisional) assistantship in the physics section of the Polytechnic even before the results of her final diploma exam in 1900 was known, whereas Einstein was not, even when he had obtained the diploma.

[24] Monika Bankowski-Züllig, 139; transl. M. T.

[25] Popovic, 4.

[26] In a letter to Helene Kaufler she writes in the winter of 1901: "What is to happen to me, whether I will really get a job in a girls' high school, is all in God's hands." (Popovic, 72.)

tracks in their teaching, while the new revolutionary ideas in physics were developed elsewhere. Unlike Einstein, who was prepared to make do with the conditions in Zurich, Maric decided in 1897 to go to Heidelberg and attend the lectures of Philipp Lenard, a world-leading physicist whose research on cathode rays brought him the Nobel Prize for Physics in 1905. Maric spent only one semester, the winter semester of 1897/98, in Heidelberg, enough time to make it necessary to study the conditions for women at the University of Heidelberg in some detail.

CONDITIONS AT HEIDELBERG UNIVERSITY

The defeat of the German revolution of 1848 stifled not only political life in general but also any attempt to give women regular access to university studies for decades. In 1871, when over 100 women were studying in Zurich, the university of Heidelberg answered a query from the university of Königsberg relating to the admission of women with the categorical sentence: "It has never occurred here yet that women were enrolled or graduated; and any application to do so will not be accepted."[27]

The negative attitude of German universities hardened in 1873 when the Russian edict against studies in Zurich drove many women to seek admission to university studies in Germany. The university of Tübingen answered such requests with the decision: "The organization of our university as well as its external circumstances [do not permit] the admission of women to attendance of lectures."[28] The university of Heidelberg, where women had been allowed to attend lectures as auditors on special permission of the lecturer since 1869, reacted to attempts of Russian students to be admitted to its courses by revoking the possibility of special permission; the academic senate resolved "not to allow women access to the university under all circumstances" and had this information published in several newspapers.[29] The uncompromising attitude was upheld in 1883 when Luise Lenz, the widow of a Swiss factory owner, offered 100,000 Mark to establish a bequest, on the condition that its interest should be used to establish three scholarships for gifted women – the university declined the offer.[30]

The years between 1891 and Maric's arrival in Heidelberg in 1897 were characterized by a confrontation between the faculty of mathematics and physics and the university senate. The faculty had been established in 1890 and had received a request from a woman to be admitted to its courses. It wanted to use this as an opportunity to move the university towards general acceptance of women students. The senate rejected the application, but ministerial intervention forced the university to allow admission of women to the

---

[27] Hans Krabusch: Die Vorgeschichte des Frauenstudiums an der Universität Heidelberg. *Ruperto Carola (Mitteilungen der Vereinigung der Freunde der Studentenschaft der Universität Heidelberg e.V.)* 1956, 135. transl. M. T.

[28] Edith Glaser: Sind Frauen studierfähig? Vorurteile gegen das Frauenstudium. In: Elke Kleinen und Claudia Opitz (eds.): *Geschichte der Mädchen- und Frauenbildung* vol. 2. Frankfurt and New York: Campus-Verlag. 1996, 299. transl. M. T.

[29] Werner Moritz: Die Anfänge des Frauenstudiums in Heidelberg. In: Helmut Knüppel, Manfred Osten, Uwe Rosenbaum, Julius H. Schoeps und Peter Steinbach: *Wege und Spuren. Verbindungen zwischen Bildung, Wissenschaft, Kultur, Geschichte und Politik. Festschrift für Joachim-Felix Leonhard.* Berlin: Verlag für Berlin-Brandenburg, 2007, 792. transl. M. T.

[30] Werner Moritz, 794.

faculty's courses under the rules that operated before 1873, i.e. as auditors with permission of the lecturer. The faculty of mathematics and physics was thus the first faculty of the university were women were allowed to study again. General admission of women to the university had to wait until 1900.[31]

It might appear from these developments that when Maric arrived in 1897 to sit in at Lenard's lectures she could expect a sympathetic welcome from a faculty that was very supportive of a woman's right to study. But not every staff member shared the position of the majority. Philipp Lenard, the professor from whom Maric had to receive permission, would have given permission most grudgingly and probably only to avoid confrontation with his more enlightened colleagues. Lenard had strong views on race and gender and considered that the role of women is to bear children and run the household. Gerta von Ubisch recalls her meeting with Lenard in 1923, when Lenard had to act as an examiner of her habilitation thesis[32], in her autobiography: "First he let me wait for a considerable time and then received me, without offering me a chair or offering his hand, holding my visitor's card in his hand. 'You made a sad decision' he said. The woman is destined for something entirely different. You are not married? If you would have sent me your engagement card I would have been very happy, but like this … I replied quite calmly that his daughter did study, too, but he shouted: 'No!' In fact she studied to become a teacher."[33]

Maric's letters to Einstein do not indicate that she had serious run-ins with Lenard, whose upbringing in Hungary may have mollified his behaviour towards her.[34] In her correspondence with Einstein she mentions how "the good prof. calculated and calculated, set up eq[uations], differen., integrated, substituted"[35], giving the impression that as a mathematician she enjoyed her time in Heidelberg.

To summarize Maric's life to this point: Until her return from Heidelberg to Zurich in 1878 Maric's decisions about her education and her outlook on life were well thought out and principled. Through personal determination and with the help of enlightened staff at the Polytechnic and at the University of Heidelberg she had overcome several obstacles women faced during her time. Unlike Einstein, who was not motivated to move to one of the centres of modern physics (even though he wrote in a letter to Maric of 1901: "Unfortunately, no one here at the Technikum is up to date in modern physics & I have

---

[31] Werner Moritz, 794-800.

[32] In the German academic system a person aspiring to a career as a professor has to obtain a doctoral degree (PhD or DPhil) followed by a habilitation (Dr habil) degree before being allowed to teach unsupervised.

[33] Susan Richter: Ein Fräulein Professor? Herkunft, Familienstand und finanzielle Unabhängigkeit von Frauen als Voraussetzung für die Wissenschaft als Beruf in der ersten Hälfte des 20. Jahrhunderts, In: Susan Richter (ed.): *Wissenschaft als weiblicher Beruf. Die ersten Frauen in Forschung und Lehre an der Universität Heidelberg*. Heidelberg 2008, 18-30. Quoted from Gerta von Ubisch's autobiography typoscript of 1955, Universitätsbibliothek Heidelberg, Heid. Hs.402. transl. M. T.

[34] Lenard's position on the role of women was only one aspect of his political ideas. In his youth he was an ardent Magyar nationalist. He later became an equally ardent supporter of national socialism. He joined the Nazi party years before party membership became opportune. In 1936/37 he published *Deutsche Physik* (German Physics), a four volume textbook that covers classical physics up to the late 19th century and promoted "Aryan Physics" against the "Jewish Physics" of Einstein and others.

[35] *Collected Papers*, 34-35.

already tapped all of them without success"[36]) Maric decided to obtain the best university education she could get. She was not yet intimate with Einstein – in her letters she did not move from the formal "Sie" and "Lieber Herr Einstein" to the informal "Du" and "Albert" until 1899 – but kept contact with him because both shared the same intense interest in modern physics. There is no reason to believe that she could not have led a successful academic career or, at a minimum if her apprehension of student attitudes could have kept her from a university, become a mathematics teacher in one of the classical girls' high schools that began to appear in Europe.

EINSTEIN'S INFLUENCE

Maric returned to Zurich in the spring of 1898. In January 1902, unmarried, she gave birth to a girl, fathered by Einstein. Her plans for an academic future fell apart during these four years, so it is of prime importance to understand what happened during that period.

To begin with, it was a period of close collaboration between Maric and Einstein. While Einstein grappled with revolutionary ideas of physics, Maric applied her mathematical skills to his notes and drafts. That Maric went through Einstein's calculations has given rise to much speculation and controversy about her role in Einstein's discoveries and Einstein's mathematic capabilities. Whatever the value of these arguments and counterarguments, the fact remains that Maric assisted Einstein's at least in the preparation of lecture notes and occasionally corrected them[37] and that during these years both Einstein and Maric considered themselves a team.[38]

How Maric saw her role in the team can be judged from remarks in her correspondence with friends. In a letter to Helene Kaufler dated 20 December 1900 Maric wrote: "Albert wrote a paper in physics that will probably soon be published in *Annalen der Physik*. You can imagine how proud I am of my darling. This is not just an everyday kind of paper but is a very important one; it deals with the theory of liquids. We also sent a copy to Boltzmann, and we would like to know what he thinks of it; I hope he'll write to us."[39] Maric did not claim the ideas of the paper for herself, but as someone closely involved in its gestation she had of course an interest in Boltzmann's opinion on it.

The academic collaboration brought the young people closer together and developed into a love affair. Maric's letters and her actions during and after her marriage are a clear indication that her love was deep and sincere. Maric was of plain appearance, and given her physical disadvantage and limp she was not immediately attractive. Her deepening relationship with Einstein allowed her for the first time in her life to dream that a man might take an interest in her as a woman. Her actions during the next ten or more years

---

[36] Albert Einstein, Anna Beck, Peter Havas, 174.

[37] The *Collected Papers* contain a photo copy of one of his college notebooks with corrections made by Maric, and several of Einstein's friends of the time bear witness to this.

[38] Throughout his letters to Maric from this period and the first time of their marriage Einstein refers to "our work", "our research" and "us" when he talks about science.

[39] Popovic, 70. The paper was published as Albert Einstein: Folgerungen aus den Capillaritaetserscheinungen, *Annalen der Physik*, 4 (3), 513-523, 1901.

indicate that this experience caused her to sacrifice her life to the career of her lover and husband.

Einstein's feelings for Maric were more ambiguous. Comments from friends and students suggest that Einstein saw her primarily as a convenient helper for his research interests and that physical intimacy came about as the logical consequence of being close together so frequently; Maric's friends clearly felt that he exploited her.[40]

Although Maric was happy in her new relationship, pressure began to mount. Her support for Einstein's work led her to neglect exam preparations and her own research work, which had been accepted in proposal form by her professor.[41] Being in love with Einstein created another severe problem: Einstein's mother was violently against the liaison and made Maric's life as unbearable as possible. In early 1900 Maric wrote: "Will you believe me that Albert's mother cannot stand me? Did she ridicule me? For a moment I looked wretched to myself, so completely miserable, but then I comforted myself that the main actor, as we know, is of a different opinion and, when he sketches for me beautiful images of the future, I forget all that wretchedness."[42]

But the damage had already been done; Maric's misguided love and submission to Einstein's interests had caused her to fail her diploma exam in the previous year. She received permission to sit the exam again on 29 July 1899, with a sitting date for October.[43] She did not attempt to repeat the exam and did not try again in the following year. She became pregnant and now had to face the fact that Einstein was not prepared to stand up to his mother and marry her. In December of 1901, one month before the birth of her daughter Lieserl, she wrote to Helene Kaufler: "Do not be afraid, dear, I am still alive and even quite cheerful again, and so is my darling. All my wretchedness was due to the charming behaviour of my dear mother-in-law. This lady seems to have set as her life's goal to embitter as much as possible not only my life but also that of her son. Oh, Helene, I would not have thought it possible that there could exist such heartless and outright wicked people! They thought nothing of writing to my parents a letter in which they reviled me so much that it was shameful."[44]

The birth of her first child out of wedlock in January 1901 led to the formal end of Maric's hopes for a scientific career. In August she left the Polytechnic. She continued to assist Einstein with his research and hoped to overcome Einstein's reluctance to proceed to marriage. When they finally married in January 1903 her support for Einstein intensified. Not only had she now to run their household, including cooking for student lodgers who they took in to improve their income, but she continued to go through Einstein's mathematics deep into the nights. This continued even after the birth of Maric's two sons in 1904 and 1910. Gabor reports: "Svetozar Variak, a student who lived

---

[40] Desanca Trbuhovic-Gjuric: *Im Schatten Albert Einsteins: Das tragische Leben der Mileva Einstein-Maric*. Bern: Paul Haupt, 5th ed. 1993, 55. Trbuhovic-Gjuric's book has been judged as unreliable by some. Carol C. Barnett evaluates it critically and concludes that it is of variable reliability but that the statements based on interviews with friends of the Maric family are generally trustworthy.

[41] To Helen Kaufler, 9 March 1900: "Professor Weber has accepted my proposal for the diploma dissertation, and he was even quite pleased with it." (Popovic, 60)

[42] Popovic, 56.

[43] ETH-Bibliothek, Archive, SR2: 1899. Präsidialverfügung of 29 July 1899, Trakt. 472.

[44] Popovic, 78-79.

with the Einsteins for several months in about 1910, remembered how Maric, after a day of cleaning, cooking and caring for the children, would then busy herself with Einstein's mathematical calculations, often working late into the night. Varical said he remembered feeling 'so sorry for Mileva' that sometimes he helped her with her housework."[45]

Two years later Einstein exposed his relationship to Maric as what it was, comparing it in a letter to his cousin Elsa Lowenthal to the relationship between a man and his "employee."[46] He had become reacquainted with his cousin during a trip to Berlin and had begun to write to her. Declaring that "I must love somebody"[47] he began an affair with her behind Maric's back and started to plan his divorce. Troemel-Ploetz quotes from two of Einstein's letters to Lowenthal. In July of 1913 he foreshadowed his arrival as the new director of the Kaiser Wilhelm Institute for Physics and professor at the Humboldt University of Berlin: "Next spring at the latest I will come to Berlin to live. I am very much looking forward to the beautiful times we will spend together." In December he already contemplated divorce: "Do you think it is easy to get a divorce if one has no proof of the guilt of the other party?"[48] Soon after he moved in with Lowenthal while Maric and their sons stayed in Switzerland.

The divorce was finally arranged in 1919 with the proviso that, should Einstein win the Nobel Prize, the financial reward should go to Maric. When the prize came in 1922 the money was invested to support Maric and their two sons.[49] Given Einstein's opinion of his relationship with Maric it is hard to think of this decision as an act of residual love. Maybe it was motivated by a bad conscience, maybe by a premonition that keeping the money for himself could have led to a public debate about Maric's contribution to his fame, maybe as an attempt at an "offer one cannot refuse": Maric had previously refused a divorce, and when Einstein tried again to persuade her in 1918 he included the prize money in the deal.[50] Whatever the reason, it did not allow Maric to return to her earlier interests and restore her academic hopes. The deteriorating health of her younger son Eduard, who was eventually diagnosed with schizophrenia, forced her to spend the rest of her life on his care.

It would be tempting to say that no one but Maric herself can be blamed for her failure to fulfil her academic hopes. But a love relationship involves two partners, and if one partner abandons herself to her own detriment much depends on the reaction of the other partner. Einstein placed his science interest above consideration for the life interest of his wife. The question is to what extent his passion for science determined his behaviour and to what extent it was conditioned by society as well.

---

[45] Gabor (*Einstein's Wife …)*, 55.

[46] Gabor (*The forgotten wife)*, 57.

[47] Gabor (*The forgotten wife)*, 57.

[48] in her biography of Mileva Maric at the feminist web site http://www.fembio.org; see http://www.fembio.org/biographie.php/woman/feature/mileva-maric-einstein/europaeische-juedinnen

[49] Their daughter Lieserl was no longer with them. The exact fate of Lieserl is not known. It is generally believed that she was given up for adoption soon after birth.

[50] The divorce agreement stipulated that the anticipated Nobel Prize money should be placed in trust for their two boys, and Maric would draw the interest. She could only draw on the capital with Einstein's permission.

THE QUESTION OF RECOGNITION OF MARIC'S CONTRIBUTION TO EINSTEIN'S PAPERS

In the context of this paper the question whether Maric should have been included as co-author of one or more of Einstein's papers or not is not an issue; its answer, whether in the affirmative or in the negative, does not change its conclusions in any way. However, since the debate between the Einstein-defence position and the Maric-rehabilitation position revolves more or less around it, it appears appropriate to address it here briefly. More importantly, a brief look at the papers of 1905 can provide an answer to the more important question formulated above.

To begin with, revolutionary scientific ideas do not depend on the existence of a particular genius. Scientific discoveries are made when their time is ripe, and when this time comes many scientists contribute to their ripening. Eventually there is an individual that has the intellectual capacity to give their formulation the final form. People find it demanding to understand that the development of society gives rise to new scientific ideas and discoveries and prefer to associate the process with a single name. But before Newton there were Galilei and Hooke, before Darwin there were Lamarck and Wallace, before Einstein there were Lorentz and Poincaré. The latter of Einstein's two contemporaries came very close to the formulation of special relativity (the subject of Einstein's work in 1905), based on Lorentz' work,[51] and if Einstein would not have been born, someone else would soon have formulated it. This does not deny Einstein his standing as a great scientist, but it helps to guard against a personality cult that can cloud normal judgement.

The question in the current context is why the only person who received an acknowledgement in Einstein's papers of 1905 is Michele Besso, an engineer and close friend who helped him to formulate his ideas[52] but did not assist in the formulation of the text or the verification of the mathematics, as Maric did.

It has also been noticed that none of the papers of 1905 acknowledged other peoples' work, giving the impression that they arose entirely on their own. Some defenders of Einstein explain this by saying that it was quite common at the time to publish work without reference to others. Comparison with publications of others from the years immediately before Einstein's papers can shed some light on this. It is then seen that a reference list was indeed not a standard ingredient of a scientific paper, but the work of others was acknowledged in the text or in footnotes. A paper by Wilhelm Röntgen of 1897 refers to the work of Heinrich Hertz and Philipp Lenard, highlighting their names in the text, and mentions the support of his previous student and professor of physics Ludwig Zehnder, again highlighting his name.[53] Hendrik Lorentz's paper "Simplified

---

[51] Henri Poincaré: La théorie de Lorentz et le principe de réaction. *Arch. Néerl.* 5, 252 (1900). Reprinted in *Oeuvres de Henri Poincaré Tome IX*. Paris: Gauthier-Villars, 1956. pp. 464-468.

[52] "In conclusion I wish to say that in working at the problem here dealt with I have had the loyal assistance of my friend and colleague M. Besso, and that I am indebted to him for several valuable suggestions." In Albert Einstein: Zur Elektrodynamik bewegter Körper. *Annalen der Physik* 17, 891 (1905).

[53] Röntgen W. C. (1897) Weitere Beobachtungen über die Eigenschaften der X-Strahlen. *Mathem. Naturw. Mitt. Sitzungsber. der k. preuss. Akad. der Wissensch. zu Berlin 392* (submitted 19 March 1897); reprinted in *Ann. Physik Chemie, N. F. 64, 18* (1898).

Theory of Electrical and Optical Phenomena in Moving Systems"[54] contains 15 footnotes with references to the work of others. Pierre and Marie Curie acknowledge the assistance of their colleague Gustave Bémont, head of chemistry at the Sorbonne, in a footnote and help from chemist Eugène-Anatole Demarçay in the text of their note to the Academy of Science of 1898.[55] Henri Poincaré refers to the work of Hendrik Lorentz even in the title of his 1900 paper. Not having a single mention of the work of others related to the topic was certainly not the standard for papers in science.

The case of Pierre and Marie Curie is particularly instructive in the present context. Marie Curie and Mileva Maric were among a small number of women who managed to enter university despite the pervasive and powerful societal bias against tertiary education of women. But Marie Curie completed her university studies and graduated before she met her future husband, and the question of priority between support for a husband scientist and her own scientific interest never arose. This did not shelter her from discrimination. She was given the Nobel Prize for physics in 1903 only after the intervention of her husband at the Nobel Prize committee, who had initially planned to hand the prize only to him and Henri Becquerel. (It was eventually shared between three recipients, Pierre and Marie Curie and Henry Becquerel.) She was not paid for the work that led to the Nobel Prize and not for another few years thereafter. Even after she had become the sole recipient of a second Nobel Prize (in Chemistry) in 1911 the Academy of Sciences still refused to accept her as a member, and it is doubtful whether she would have ever been appointed to a professorship, would Pierre not have suffered a deadly traffic accident and died in 1906 at the age of 47, forcing the university to fill his position.

It is futile to attempt a comparison between the actual career of Marie Curie and the possible career of Mileva Maric, would she not have fallen in love with Einstein. Where the role of the two women is comparable is during the stage of their lives where they supported the work of their husbands in the role of assistants. Pierre Curie's unlimited support for his wife contrasts strongly with Einstein's exploitative attitude. Where Marie Curie contributed to their work, the results appeared under joint authorship. Mileva Maric may not have had the same power of investigative thought and innovative insight as Marie Curie, but her mathematical contributions to Einstein's work were definitely worth at least a footnote of acknowledgement. Stachel, the strongest supporter of the Einstein-defence position, granted Maric the role of a "sounding board" for Einstein's ideas,[56] a role commonly also accepted for Besso. Einstein found it appropriate to acknowledge his friend but not his wife. This indicates that he was fettered by society's attitudes towards the role of women and unable to free himself from prejudice.

Einstein biographer Antonina Vallentin describes Einstein's personality as being focussed on science at the expense of personal relationships.[57] There is much to suggest that to achieve groundbreaking results requires a strong focus on science that can weigh

---

[54] Hendrik Lorentz: Electromagnetic phenomena in a system moving with any velocity smaller than that of light. *Proceedings of the Royal Netherlands Academy of Arts and Sciences*, 1904, 6: 809–831.

[55] Pierre Curie and Marie Curie: Sur une substance nouvelle radioactive, contenue dans la pechblende. *C R Acad Sci Paris 1898; 127: 175-178.*

[56] see Charles, Dickson and Joyce in *New Scientist*.

[57] Antonina Vallentin: *Einstein – a biography*. 1954 London: Weidenfeld and Nicolson.

negatively on human relations. But this cannot explain Einstein's different treatment of Besso's and Maric's contributions to the development of his ideas, which can only have been the result of Einstein internalising the society's role image for women. In that sense it can be said that Einstein was the instrument that allowed society to deprive Maric of a scientific career.

CONCLUSION

When the facts of the first 35 years of Maric's life are considered in the context of the society of her time there can be little doubt that Maric had the ability and motivation to enter a career as a theoretical physicist or mathematician. She showed her talent early at school. Being naturally shy in company she found a supportive environment at the Swiss Polytechnic and at the University of Heidelberg and overcame all obstacles women faced when aiming for tertiary education. On her own decision she left Zurich, where she had the support of good friends, to attend university courses on modern physics in Heidelberg. She was one of only a small group of women who managed to gain access to university education.

Until her return from Heidelberg in 1898 Maric's progress as a student of the Polytechnic and of Heidelberg University supports the conclusion that she would have completed her studies successfully if she would not have met Albert Einstein. After her return from Heidelberg a combination of factors came together to terminate her academic career. Einstein supported her academic hopes in letters and words but exploited her as his assistant, taking possession of her time and making it difficult to progress with her own work. Maric's unconditional love for Einstein made her unable to resist Einstein's demands on her time. The birth of Lieserl out of wedlock, a consequence of hostility from Einstein's mother and Einstein's resulting reticence to marry her, was without doubt a deeply traumatizing event in Maric's life, not made easier by the couple's decision to give the daughter up for adoption.

There can, in balance, be no doubt that it was not Maric's mediocre talent that deprived her of a career as a scientist. Several norms of society stood in her way: Women were not supposed to attend university; women were not expected to work in employment; women were expected to be married before giving birth; women were expected to support their husbands and look after the house and children. Maric broke out of the first of these norms, but her unconditional love for Einstein meant that she could overcome the limitations of the other three only with the support of a strong and progressively thinking husband. She did not get any help from Einstein in that regard; on the contrary, Einstein's attitude to his girlfriend and wife was very much in keeping with the social norm of the role of women in the house. If Einstein would have been as determined to break with social norms as Maric and as supportive of his wife as Pierre Curie he would have given Maric the freedom to follow her own career.

ACKNOWLEDGEMENTS

My thanks go to Evelyn Boesch for valuable assistance in the "deciphering" of 19th century German handwriting in the archives of the ETH, and to Werner Moritz

(Heidelberg) for a reprint of his valuable study of the beginning of women's access to the University of Heidelberg. I am indebted to Allen Esterson's persistent emails that motivated me to research Maric's life in some detail and to his responses to a first draft that helped me with the final formulation of the paper.