Mathematics in Nazi Germany

Stana Remus
University of Glasgow
Mathematics BSc Honours

Nazi ideology had a profound effect on German society beginning in 1933 with the election of Adolf Hitler as Chancellor of Germany lasting until 1945 with the unconditional surrender of Germany to the western Allies and the USSR. An often neglected area in which this influence manifested itself is that of mathematics. Nazi influences on mathematics were mainly of two different types, starting with the treatment of mathematicians of "unfavourable ethnicity" like Jews and promoting an ideological view of mathematics both of which will be studied in this article.

The passage of the Law for the Restoration of the Professional Civil Service on the 7^{th} of April 1933 mandated that civil servants of "non-Aryan" descent were to be removed from office. This directly affected many mathematicians teaching in German universities, who lost their posts and were forced to emigrate. Shortly after that, on the 25^{th} of April 1933 the Law against overcrowding of German Schools and Higher Institutions was passed which set the maximum percentage of non-Aryan students in German universities at 1.5% of the student body (the law also set the percentage of women at 10% despite it being 18% in 1932)[1].

In addition, not all mathematicians who left Germany did so because of anti-Semitic laws but because of the atmosphere of terror which was generated by the Nazi regime especially those who adhered to political doctrines which were not in line with those of National Socialism[2]. In total 145 mathematicians in academic positions were forced to leave Germany and this list includes Emmy Noether, Richard Courant and Hermann Weyl[3]. Their main destination was the United States of America, where 82 of the 145 went, leading to America becoming the world centre of mathematics[4].

The Law for the Restoration of the Professional Civil Service had an exemption inserted at von Hindenburg's insistence for "non-Aryans" who fought for Germany or her allies in the First World War or who were already employed as civil servants on 1^{st} of August 1914 (these exemptions were removed in 1935 by the Reich citizenship laws). This allowed Jewish mathematicians like Edmund Landau and Richard Courant to maintain their academic positions, although they continued to face discrimination. For example, Edmund Landau's calculus course at the Uni-

[1]Fabian Waldinger, Quality Matters: The Expulsion of Professors and the Consequences for PhD Student Outcomes in Nazi Germany, p. 800

[2]It is important to note that these two groups who were targeted by persecution are not mutually exclusive. An example in this case is Emmy Noether who had Marxist leanings and was a supporter of the Weimer Republic. For this see Reinhard Siegmund-Schultze, Mathematicians Fleeing from Nazi Germany: Individual Fates and Global Impact, p. 69

[3]Reinhard Siegmund-Schultze, Mathematicians Fleeing from Nazi Germany: Individual Fates and Global Impact, p. 19. It should be noted that this number does include Polish or French mathematicians which fled their countries after they were occupied by Germany.

[4]Reinhard Siegmund-Schultze, The historiography and history of mathematics in the Third Reich, p. 871

versity of Göttingen was boycotted by students led by Oswald Teichmüller, which forced him into retirement.

Indeed Oswald Teichmüller presents an interesting subject in his own right. As a brilliant mathematician, who showed his affinity for this subject at the age of three and a half years when his mother discovered that he taught himself how to count using labels from tin cans, he was admitted to the University of Göttingen in 1931 at age seventeen. In his first semester he joined the National Socialist German Workers' Party (NSDAP) and the SA (Sturmabteilung[5]) and he later became the deputy leader of the Nazi organization of mathematics and natural science students, a position from which he led the boycott of Landau[6]. When Landau asked him to explain his reason for the boycott he wrote that the reason was "about protecting German students in their second semester from being instructed by a teacher of a completely foreign race" given that "the possibility... that you [Landau] transmit to your hearers the mathematical kernel without your own national colouration is so small as it is certain that a skeleton without flesh does not run but falls in a heap and disintegrates" and defended his actions as being pro-German and not anti-Semitic: "You [Landau] expressed the assumption yesterday [in our conversation] that it had been an anti-Semitic demonstration... It was, for me, not about making difficulties for you as a Jew..."[7]. The fact that his dedication to the Nazi cause and ideology seemed absolute is proven by his joining the army in 1943, even though he had a post in Berlin in cryptographic work, an act that would lead to his death on the 12^{th} of September 1943 during the German Army's retreat after the fourth battle of Kharkov.

This episode involving Oswald Teichmüller with his remarks on the inappropriateness of a professor of different race teaching German students highlights an example of the application of Nazi ideology in mathematics and highlights the portrait of the sincere Nazi mathematician who applies National Socialist racial theories to their subject. The idea that different ethnicities have affinities for different areas of mathematics did not originate with the Nazi regime; such views were exposed by Henry Poincaré who remarked that Frenchmen have difficulties understanding Maxwell or by Felix Klein in his 1893 lecture at Northwestern University: "It would seem as if a strong racial space intuition were an attribute presumably of the Teutonic race, while the critical, purely logical sense is more fully developed in the Latin and Hebrew races. A full investigation of this subject somewhat on the lines suggested by Francis Galton in his research in heredity might be interesting"[8].

Perhaps the most important mathematician who promoted an ideologization of mathematics is Ludwig Bieberbach, professor at the University of Berlin who applied the theories of Erich Rudolf Jaensch called psychological typology to mathematics to reach the conclusion that there exists "Nordic"(or German) mathematics which is different from, for example Jewish mathematics or French mathematics. Bieberbach stated in a lecture in 1934, later published in a short version as "Persönlichkeitsstruktur und mathematisches Schaffen"(Personality Structure and Mathematical Creativity) in Forschungen und Fortschritte and a more detailed version in the Unterrichtsblätter für Mathematik und Naturwissenschaften, applying Jaenschian categories to mathematics, that mathematicians can be divided into S-types and J-types. As G.H. Hardy pointed out in his critical response in Nature[9] the S-type is basically the French and

[5]Paramilitary wing of the NSDAP

[6]Sanford L. Segal, Mathematicians under the Nazis, p. 443

[7]Sanford L. Segal, Mathematicians under the Nazis, p. 444

[8]Felix Klein, The Evanston Colloquium Lectures on Mathematics Delivered From Aug. 28 to Sept. 9, 1893 Before Members of the Congress of Mathematics Held in Connection with the World's Fair in Chicago, p.46

[9]G.H. Hardy, The J-type and the S-type among Mathematicians, p.250

Jewish mathematician while the J-type is the German. The S-type is described as someone who understands reality through his preconceptions while the J-type understands reality as it is. Bieberbach gives an example of the difference between the S-type and the J-type in the ways in which the Frenchmen Augustin Cauchy and Édouard Goursat define complex numbers in an inorganic way compared to the German Carl Friedrich Gauss who proceeded in an organic way. According to Bieberbach, Cauchy and Goursat define complex numbers by using the symbols $\alpha + i\beta$ where α and β are real numbers, on which they later defined operations such as addition, multiplication and division (this is a slightly more abstract point of view by referring, according to Bieberbach, to complex numbers as a two-dimensional real vector, which in itself has no concrete meaning). Gauss, on the other hand, defined a complex number by $\alpha + i\beta$ where α and β are real numbers and i is equal to $\sqrt{-1}$, which, according to Bieberbach, gives complex numbers a more concrete meaning[10]. It should be noted that a closer inspection of Cauchy's and Goursat's works in which they define complex numbers reveals that both give a similar definition to that of Gauss and Bieberbach was successful in highlighting a difference between them only using a selective reading[11].

Furthermore Bieberbach used psychological typology to justify the expulsion of non-Aryans from academic posts in Germany and gives a justification of the student boycott led by Teichmüller of Landau's calculus course, stating that Landau is an S-type and gives an example of how he defined the trigonometric functions sine and cosine using series and not the geometric definition and π as twice the smallest positive root of the cosine function: "Our nature becomes of itself in the malaise produce by alien ways. There is an example in the manly rejection of a great mathematician, Edmund Landau, by the students of Göttingen. The un-German style of this man in teaching and research proved intolerable to German sensibilities. A people which has understood how alien lust for dominance has gnawed into its vitals must reject teachers of an alien type"[12].

In contrast to Bieberbach and Teichmüller who were sincere promoters of Nazi ideology it must be noted that there existed a group of mathematicians who used ideological language in order to justify mathematics. An illustrative example from this group is the Jena mathematician Robert König who although he did not adhere to the National Socialist ideology[13] gave a speech in 1940 later published as "Mathematik als biologische Orientierungsfunktion unseres Bewusstseins"(Mathematics as a biological orientation function of our consciousness), in which he describes the purpose of the lecture as developing "a new biological conception of mathematical science" where mathematics is the "strongest-orienting function of our consciousness and, as such, is necessary for the effective success of our existence as a people"[14].

These justifications were in order to counteract irrationalism, a philosophical worldview of the 19^{th} and the beginning of the 20^{th} century which had an important contribution to the intellectual foundation of fascism in general and Nazism in particular. The roots of irrationalism can be traced back to the period at the end of the 19^{th} century called the "fin de siécle", which was marked by a revolt among many intellectuals in Germany, France and Italy against modernity

[10]For Bieberbach's comparison see "Stilarten mathematischen Schaffens", Sitzungsberichte der Preussischen Akademie der Wissenschaften, p.351-352

[11]Compare Carl Friedrich Gauss, Werke Band II, p. 171 with Édouard Goursat, A Course in Mathematical Analysis Vol II Part I. , p. 3 and Robert E. Bradley, C. Edward Sandifer, Cauchy's Cours d'analyse: An Annotated Translation, p.118

[12]G.H. Hardy, The J-type and the S-type among Mathematicians, p.250

[13]Sanford L. Segal, Mathematicians under the Nazis, p. 215

[14]Sanford L. Segal, Mathematicians under the Nazis, p. 214

and some of the values which arose out of the Enlightenment such as rationalism and positivism. In Germany one of the proponents of this new philosophy was Julius Langbehn, whose main work "Rembrandt als Erzieher" (Rembrandt as educator) is centred on the idea that German culture is being diminished by science and intellectualism and only art can restore it and as a result hatred of science dominates Langbehns work. One of the reasons for this negative view of science is its capacity to reveal the world which Langbehn would prefer to remain shrouded in mystery: "Has the scientific, specialized, microscopic culture of today advanced the human soul in any important way?"[15]. This disparaging view of science (and implicitly mathematics) and the elevation of the humanities above them found a distant echo in Hitler's opinion on this subject expressed in Mein Kampf: "It is the characteristic of our present materialized epoch that our scientific education is turning more and more toward practical subjects - in other words, mathematics, physics, chemistry, etc. Necessary as this is for a period in which technology and chemistry rule - embodying at least those of its characteristics which are most visible in daily life - it is equally dangerous when the general education of a nation is more and more exclusively directed toward them. This education on the contrary must always be ideal. It must be more in keeping with the humanistic subjects and offer only foundations for a subsequent addition education in a special field. Otherwise we renounce the forces which are still more important for the preservation of the nation than all technical or other ability"[16].

A prime example of the lack of concern that the Third Reich had for mathematics is given by an episode that involved the drafting of mathematicians during the Second World War. Werner Osenburg, the leader of the machine-tool group at the Technical University of Hanover, wrote at the beginning of the war in favour of exempting mathematicians from being drafted and when he was named on the 24^{th} of June 1943 by Herman Göring as the chief of the planning office for scientific matters within the National Research Council, a position from which he would recall 5000 scientists from service[17]. After D-Day and the Allied invasion of Normandy, many of the people deferred by Osenburg were redrafted and his complaints with respect to this action were met with mixed results. Only on the 23^{rd} of July 1944 Heinrich Himmler cancelled the redraft order with the purpose of preserving German science.

In order to evaluate the effect that the National Socialist policies had on the standing of mathematics in Germany we must first see what was the position of German mathematics on the world stage before the Nazi policies were implemented. German universities suffered greatly under the Nazi regime. For example, Richard Courant writing to his former student Helmut Ulm in December 1933 remarked that "our institutions, which were unequalled in the world, are destroyed – even Cambridge cannot compare to the old Göttingen". The fate of the University of Göttingen, perhaps the most important centre of mathematics in Germany in the 19^{th} and the beginning of the 20^{th} century is highly indicative: after the beginning of the war the faculty at the mathematical department was significantly reduced and in 1943 the rooms where lectures would have been given were occupied by the navy[18].

Mathematical journals in Germany experienced a paradoxical change of fortune during the first part of the National Socialist regime (especially given the general decline of German mathematics during the same period) generated by the decision of the German government to subsidize German journals after 1935 and by the Nazi regime's imposing restrictions on importing foreign

[15]Fritz Stern, The Politics of Cultural Despair, p.122
[16]Adolf Hitler, Mein Kampf, p. 384
[17]Sanford L. Segal, Mathematicians under the Nazis, p.227
[18]Sanford L. Segal, Mathematicians under the Nazis, p.212

literature which resulted in German libraries subscriptions to foreign journals decreasing and to German journals increasing[19].

Of particular interest is the relative autonomy that German journals had with respect to the interference of Nazi authorities and policies in their functioning, especially with regards to attempts to merge different journals which were vetoed, prompting the Nazi supporters to found their own journals. One such example is Ludwig Bieberbach who founded Deutsche Mathematik, a journal dedicated to promoting a National Socialist view of mathematics. He also tried to merge two leading journals, Jahrbuch über die Fortschritte der Mathematik and Zentralblatt für Mathematik, but the merger failed because the publishers vetoed the initiative. Bieberbach also criticized the already established mathematical journals for the fact that they still published articles by and had on their editorial board "non-Aryans" (for example Mathematische Zeitschrift published articles by Emmy Noether). These grievances highlight the fact that, despite the institutional anti-Semitism in Germany after 1933, journals managed to keep contacts with Jewish mathematicians who were forced to emigrate. This situation changed after Kristallnacht in 1938, when Jews were removed from the editorial boards of German journals and their names were edited out of the references to any previously published paper[20], an event which signals the total expulsion of Jews from academic life in Germany which began with the Law of Restoration in 1933.

In conclusion, mathematics in Germany under National-Socialism experienced a decline due to the forced emigration of mathematicians of "non-Aryan" descent and of undesirable political affiliation. Although it is common in totalitarian regimes that groups which are deemed undesirable are persecuted, what sets Germany after 1933 apart is the intrusion of Nazi ideology in mathematics, an area which might seem the least likely to be influenced out of any academic subject, with the labelling of certain fields of mathematics as un-German and as a consequence ignored and suppressed.

References

[1] Bieberbach, Ludwig, "Stilarten mathematischen Schaffens", Sitzungsberichte der Preussischen Akademie der Wissenschaften, 1934: 351-360.

[2] Bradley, Robert E., Sandifer, C. Edward, Cauchy's Cours d'analyse: An Annotated Translation, Springer, 2009.

[3] Gauss, Carl Friedrich, Werke Band II, Göttingen, Königlichen Gesellschaft der Wissenschaften, 1876.

[4] Goursat, Édouard, A Course in Mathematical Analysis: Function of a Complex Valuable, (English Translation: Hedrick, E. R. and Dunkel, O.), Boston, Ginn and Co., 1916.

[5] Hardy, G.H., The J-type and the S-type among Mathematicians, Nature 134, 250-250.

[6] Hitler, Adolf, Mein Kampf, (Translated b Ralph Manheim), London, Hutchinson of London, 1969.

[19] Michael Knoche, Scientific Journals under National Socialism, p.418
[20] Michael Knoche, Scientific Journals under National Socialism, p.423

[7] Klein, Felix, The Evanston Colloquium Lectures on Mathematics Delivered from Aug. 28 to Sept. 9, 1893 before Members of the Congress of Mathematics Held in Connection with the World's Fair in Chicago, New York, American Mathematical Society, 1893.

[8] Knoche, Michael, "Scientific Journals under National Socialism", Libraries & Culture, Vol. 26, No. 2, Reading & Libraries II (Spring, 1991), pp. 415-426.

[9] König, Robert, "Mathematik als biologische Orientierungsfunktion unseres Bewusstseins", Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht 2 (1941): 33-47.

[10] Segal, S. L., Mathematicians under the Nazis, Princeton: Princeton University Press, 2003.

[11] Siegmund-Schultze, Reihard, Mathematicians Fleeing from Nazi Germany: Individual Fates and Global Impact, Princeton: Princeton University Press, 2009.

[12] Siegmund-Schultze, Reihard, The historiography and history of mathematics in the Third Reich, The Oxford Handbook of the History of Mathematics.

[13] Stern, Fritz, The Politics of Cultural Despair: A Study in the Rise of the Germanic Ideology, Berkeley and Los Angeles: University of California Press, 1961.

[14] Waldinger, Fabian, "Quality Matters: The Expulsion of Professors and the Consequences for PhD Student Outcomes in Nazi Germany", Journal of Political Economy 118(4): 787-831.