NATIONAL SOCIALISM AND THE DEATH OF GERMAN MATHEMATICS

Lucas Garron

December 2010

For the
Stanford-in-Berlin Program
course "Science, Medicine, and
Technology in Nazi Germany"
by Professor David Holloway

Table of Contents

0 Introduction

> *" Wir müssen wissen.*
> *Wir werden wissen. "*
> *- David Hilbert*

I often cite the above lines as my personal favorite quotation, for their succinct and deep meaning, consequence, and irony. They are the final words from the retirement address of the renowned mathematician **David Hilbert** (at the annual meeting of the Society of German Scientists and Physicians in Königsberg,1930). The words mean:

> *"We must know. We will know."*

However, a simple translation without context belies the technical and historical importance of this quote, and how it represents **Hilbert's** endeavours. In 1930 he was one of the most famous and influential mathematicians, responsible for much of the direction of mathematics at the time, and leader of the world-class mathematical faculty at the University of Göttingen. Yet when he died in February 1943, only 12 people attended his funeral, and the rest of the world did not hear about his death for another six months. (Wikipedia: David Hilbert)

This paper is not about **David Hilbert** alone, but he was such a tremendous figure that his end represents the downfall of the longstanding German mathematical tradition which flourished until its abrupt end in 1933 with the rise of Hitler. While Hitler's Nazi regime is often discussed in terms of its impact on social topics like human rights and politics, or the ethics of cold science, mathematics is often ignored; the goal here is to portray what German mathematics actually *was* in the early 20th century, and what happened to it. *It is rather regrettable that modern mathematicians and historians are rarely concerned with the full Nazi effect on the German mathematical tradition at its peak. Nevertheless, the ruination of the German mathematics was a severe and*

lamentable occurrence with many unrecognizable consequences for academics in the modern world.

0.1 Motivation

I wave very personal concern with this issue because I grew up in Germany for 10 years, and I am very interested in studying mathematics. But in trying to understand myself and the world around me, I've also found great value in trying to understand *why* things are the way they are, and what non-arbitrary things have influenced today's situation. The Nazi regime had far from arbitrary impact on math, yet – for example – most young mathematicians today probably don't realize how many "household names" were disrupted and displaced during that time – many of them to America. I find it hard to write a paper like this without a real purpose, and for me the purpose is to gain a broad understanding of German mathematics during that in-between era between historical and modern. "Early 20th-century mathematics" encompasses several topics with various chronologies; my focus will be on particular aspects that I feel are interesting, compelling, and important but often overlooked by everyone but math historians. In addition, I will **embolden** the names of historical mathematicians so it is easier to follow the breadth of figures affected by this era; it might seem like a lot of name-dropping, but mathematical currents of the time were *strongly* defined by the personal stature of those who promoted them.

0.2 Overview

I will start by explaining the German mathematical tradition leading from **Gauß** into a strong concentration of community of researchers at Göttingen University (Section 1.1). **David Hilbert** was a very able mathematician who eventually focused his efforts on directing the whole of mathematical research (1.2), in particular promoting a program of *formalism* to put mathematics on a proper footing (1.3), leading to some significant mathematical feuds. **Hilbert's** goals had a lot of positive impact, but unfortunately his dreams were dispelled by **Gödel** and in the 1930's, **Hilbert's Göttingen** fell apart.

There were several German mathematical societies and their publications at the time, including notably the *Mathematische Annalen* (edited by **Hilbert**) and the *Jahresbericht der DMV* (yearly report of the *Deutsche Mathematiker-Vereinigung*, the German Mathematical Society) (2.3). **Ludwig Bieberbach**, an editor of the *DMV Jahresbericht*, became increasingly outspoken about his theories and views on the superiority of German mathematics (3). He aligned his views with the rising Nazi party and became the most prominent name associated with with Nazi mathematics, promoting *Deutsche Mathematik* with his more politically involved friend **Theodor Vahlen**. Nevertheless, the times are better remembered for Germany's more practical projects (3.7): while some decent research continued, there were little notable achievements in pure mathematics.

This was due to the loss of most German mathematicians to various fates. Due to strong Jewish associations and general disdain for non-applied mathematics, most of the notable figures were driven out and escaped (to places like Princeton). Those who remained had various political leanings, but all continued under strenuous situations. After some of the remaining mathematicians were drafted, practically nothing remained of the German mathematical tradition. (Section 4)

1 Background & Currents

1.1 The German Mathematical Tradition

I have been using the word "tradition" to emphasize that there was a strong community of mathematics in Germany leading up to and beyond the 19th century, and that it established a certain way of doing mathematics and thinking that feels nostalgic to modern mathematics. Nevertheless, "Germany" was just coming together at the time, so places like Königsberg (part of Prussia, but now called Kaliningrad and northeast of Poland) and Vienna (part of the Austro-Hungarian empire) often contained thinkers with Germanic names who are often associated with the emerging studies that eventually found themselves in *Deutschland*.

Leonhard Euler (1707-1783) spent some of his time in the Berlin, but the tradition in Göttingen begins with **Carl Friedrich Gauß** (1777-1885), who paved the way for **Dirichlet** (1805-1895), **Bernhard Riemann** (1826-1866), and **Felix Klein** (1849-1925), widely remembered for their number-theoretic, analytic, and geometric contributions. **Klein** had large goals for the Göttingen and succeeded in bringing **David Hilbert** (1862-1943), who then attracted many renowned mathematicians to the faculty to bring this to fruition. I will avoid going into the details of the kind of math that constitutes this tradition, but there was a certain strong sense to "German mathematics" and at its culmination Göttingen became renowned for advances related to Hilbert's call for the formalization mathematics. As mathematician Norbert Schappacher laments in a history of the fall of Göttingen:

> *"Nowadays, when someone in the USA talks about (pure) math in Germany, he means Göttingen if he is speaking about the past." (Schappacher 54)*

1.2 Hilbert & Göttingen

David Hilbert was certainly a brilliant figure, and embodied many strong ideas and opinions in his conduct of mathematics, which led to several controversies in his life. He gained notoriety for his *finiteness theorem* in 1888, which was well received by **Felix Klein**, who helped him publish it in Mathematische Annalen despite controversy[1]. **Klein** had been at Göttingen since 1886, and enticed Hilbert to come to Göttingen in 1895. Others like **Hermann Minkowski** (in 1902) and **Carl Runge** (in 1904) followed soon, starting to assemble the acknowledged golden age of Göttingen. (Hanitzsch, Die Universität Göttingen)

---

1 **Hilbert's** theorem was controversial because was an *existence proof* for a high-profile problem posed by **Gordan**. An *existence proof* shows that a certain mathematical object has to exist, without showing giving an exact description of how to *construct* it; one relies on the fact that it's *not* possible for the object *not* to exist. (Wikipedia: David Hilbert, Constructivism (mathematics)) Also see the mention of the Law of the Excluded Middle below. Although this is is a very common technique today, constructivists of the time like **Gordan** viewed it as improper mathematics. It is easy to dismiss constructivists for being narrow-minded, but important to understand that they had a perfectly legitimate claim to their view: this was exactly the time when such definitions of mathematics were decided.

Hilbert is particularly remembered for defining twentieth century mathematics with his *23 Problems* presented at the 1900 *International Congress of Mathematicians* in the Sorbonne, Paris. He presented these problems as his view of the most important challenges for mathematicians in the coming century; the problems were translated to English in the AMS bulletin of 1902, and much prominent mathematical research oriented itself by its suggestions, including that of the burgeoning faculty at Göttingen. (Wikipedia: Hilbert's Problems) In addition, **Hilbert** assumed editorship of the prominent *Mathematische Annalen* journal from 1902 until 1939.

Göttingen was originally not organized to be a center of mathematics; even the great Gauß was technically a Professor of Astronomy. Yet with Klein's vision, the institution gradually developed more roles. After a visit to the economically integrated US, **Klein** was compelled to form the *Vereinigung zur Förderung der angewandten Physik* (*Society for the Advancement of Applied Physics*), which mathematicians also joined. (Hanitzsch, Die Universität Göttingen) The *Mathematisch-Naturwissenschaftliche Fakultät* (*Mathematical-Natural Science Faculty*) eventually separated into its own department from philosophy in 1922. (Neuenschwander)

Mathematics at Göttingen stayed small, but it developed a concentrated faculty with many talented names.[2] The institution was very open, with good student-faculty relations, and frequent collaboration; many academics visited for at least a while.[3] The appeal to physics also led to much of the new physics based on abstract mathematical thinking; by 1930, 44 Nobel prize winners[4] had been associated with the university. (Hanitzsch, Die Universität Göttingen)

---

[2] In addition to many men, Göttingen was even host to arguably the most famous and influential female mathematician in history, **Emmy Noether** (1882-1935).

[3] It bears relevance to go into a little detail about the German academic system, especially *Habilitation*. Almost the entire school system in Germany, up to and including universities like *Göttingen*, was and still is public. Students would enter either the practical *Volksschule* or the more academic *Gymnasium*, from which one could move on to university. After their doctorate, prospective mathematicians would have to finish further research for a *Habilitation* to become a *Privatdozent*. *Privatdozenten* make their living from student fees from teaching until they are offered tenure. This intermediate step creates a longer, dedicated process to professorship, and shaped a lot of careers at this time. (In particular, when the Nazis dropped the position of *Privatdozent* in 1938, people like **Gödel** were forced to find elsewhere to work.)

[4] There is no Nobel prize in mathematics, so a "Nobel prize" among the sciences should be understood to refer mainly to recipients for the prizes in physics and chemistry (or eventually economics).

> *„Hilbert's Göttingen is still remembered as a Camelot for mathematics and physics. All roads led to Göttingen from 1900 to 1933, just as the mathematical community there had designated a point on the town square 'the origin of the coordinates'." (quote in Huckle Jews, 2)*

1.3 Ism Schism: Constructivism, intuitionism, and Formalism

Hilbert was famously atheist, but mathematics at the time often bordered on philosophy. In particular, **Hilbert** was known for for promoting *formalism* in mathematics, which eventually led to his 1920 proposal of what is known as *Hilbert's Program*: prove that all of mathematics can be reduced to several axioms, and prove that this system is free of contradictions[5]. Many followers shared his goal, but unfortunately the hopes fell apart with **Gödel's** incompleteness theorem in 1930; unfortunately, the mathematical community was slow to realize the impact of the result before the war subsumed their concerns.

As logical as it might seem to reduce the study of mathematics to a safe footing with **Hilbert's** approach, some mathematicians fiercely objected to his program. The opposition came as of *constructivism*[6], which was represented by the Dutch mathematician **L. E. J. Brouwer** (1881-1966) as *intuitionism*. **Brouwer** insisted that all valid mathematics must consist of straightforward constructive proofs in order to demonstrate that something exists or a statement holds. The difference in philosophy is often summed up in the approach to the *Law of the Excluded Middle*, which claims that a statement is always either true or false, but not both. This becomes relevant when "X doesn't exist" is proven false. *Formalists* like **Hilbert** would take this as perfectly valid proof that X has to exist; *intuitionists* like Brouwer would insist that the X has still not been demonstrated, and it is a reckless step to assume that it must exist.

> *"In dieser Streitfrage überlagerten sich die Rivalität der beiden Universitäten, die Rivalität der in Göttingen und Berlin gepflegten mathematischen Theorien (Intuitionismus von Brouwer versus*

---

[5] Hilbert's approach sometimes called *foundationalism* because it tried to reduce everything to a formal foundation. However, intuitionists were in a sense also looking for a foundation, so this is a bit ambiguous.

[6] *Constructivism* has roots in such views as **Leopold Kronecker's** famous statement "God made the integers; all else is the work of man." Kronecker was a *finitist* who believed that all of mathematics should be built up directly from whole numbers as first principles. (Wkipedia: Leopold Kronecker)

> *Hilbert'schem Formalismus), und die verschiedenen politischen Überzeugungen (liberal versus deutsch-national)." (Huckle Jews, 3)*
>
> *("Over this contentious question layered the rivalry between the two universities, the rivalry between the mathematical theories cultivated in Göttingen and Berlin (Brouwer's intuitionism and Hilbert's formalism), and the two different political convictions (liberal versus German-national).")*

This is particularly relevant to mathematics in the Nazi times because the schism between **Brouwer** and **Hilbert** led to a fight about the content of the *Mathematische Annalen* publication: the *Annalenstreit* between German mathematicians, mainly between the group in Göttingen (Huckle lists **Hilbert**, **Landau**, **Noether**) and a group in Berlin that adhered to Brouwer's views (**Bieberbach**, **Schmidt**, **von Mises**). This also gave rise to the nationalist *Deutsche Mathematik* movement, an attempt to legitimize the subject under the Nazis by **Bieberbach**, and characterized by the idea that mathematics should be not only *intuitive* but also *anschaulich* (*~visual*). The leanings of mathematicians under the Nazis cannot be understood without this intuitive-formalist schism, leading to *Annalenstreit* and the rise of *Deutsche Mathematik*.

2 Nazi Beginnings

> *Regarding the attempt to dispel the "general but perverse social view of mathematicians as disembodied intellects": "Certainly no period in history seems more appropriate to be considered in this respect than Nazi rule in Germany, when neither the most apolitical and aloof stance nor the most opportunistic attitude would have helped a mathematician get along with the regime, or even to survive, if he/she happened to be a Jew." (Siegmund-Schultze)*

National socialism struck all aspects of life in 1930's Germany, and not even mathematics, the purest and most abstract subject, could keep its distance from a cold reality. Countless mathematicians lost their positions, and the few that remained – describes Siegmund-Schultze in his review of Sanford Segal's book *Mathematicians under the Nazis* – could count themselves lucky to have the opportunity to stay intact as an academic, but fraught with guilt for going on despite their colleagues. Nevertheless,

several mathematicians like **Bieberbach** and **Vahlen** tried to develop this into opportunism for themselves and their subject.

Mathematics suffered in particular because the Nazi stance towards mathematics was not supportive. In his famous manifesto *Mein Kampf*, Hitler devotes a section to education, where he admits its importance, but stresses:

> *"Erstens soll das jugendliche Gehirn im allgemeinen nicht mit Dingen belastet werden, die es zu fünfundneunzig Prozent nicht braucht und daher auch wieder vergißt." (Hitler 464)*
>
> *("First of all, the young mind should in general not be overloaded with things that it 95% doesn't need and therefore forgets again.")*
>
> *"Es liegt im Zuge unserer heutigen materialisierten Zeit, daß unsere wissenschaftliche Ausbildung sich immer mehr den nur realen Fächern zuwendet, also der Mathematik, Physik, Chemie usw. So nötig dies für eine Zeit auch ist, in welcher Technik und Chemie regieren und deren wenigstens äußerlich sichtbarste Merkmale im täglichen Leben sie darstellen, so gefährlich ist es aber auch, wenn die allgemeine Bildung einer Nation immer ausschließlich darauf eingestellt wird. Diese muß im Gegenteil stets eine ideale sein." (Hitler 469)*
>
> *("It follows in the present materialistic times, that our scientific education turns only to the real subjects, that is: mathematics, physics, chemistry, etc. But as important as this is for an age in which technology and chemistry reign and whose prominently visible features portray them in everyday life, it is dangerous when the general education of a nation sets itself exclusively upon them. This [education] must, to the contrary, be an ideal one. [including more humanities]")*

It becomes gradually clear through the Nazi regime that pure and abstract mathematics, besides being associated with "Jewish" thinking, is dismissed as highly unnecessary and impractical. Mathematics went on, and **Bieberbach** tried to fight for it within the regime, but ultimately the subject was subsumed among other concerns when most mathematicians had left or were drafted.

2.1 International Issues

The *International Congress of Mathematicians* (*ICM*) was the first regular and prominent conference among the mathematical nations, and Germany was involved

from the very beginning; indeed, the idea for it is often credited to the German mathematicians **Felix Klein** and **Georg Cantor**. The first congress took place in 1897 in Zürich, and from 1900[7] on every four years. Unfortunately, the congress was shaken by both world wars; there were no meetings in 1916 or 1937-1949. (Wikipedia: ICM) In addition, even though the 1920 meeting took place at Strasbourg on the French-German border, mathematicians from the Central Powers were not allowed to participate. In fact, Germans were not invited again until 1928, and at this time the several German mathematicians wanted to stage a retaliatory boycott. **Bieberbach** and the intuitionists remained at home in Berlin, while the Göttingen contingent (including **Hilbert**, **Landau**, and **Courant**) attended enthusiastically. Thus, many of the national issues were tangled in international scientific politics. (Huckle Jews, 3).

2.2 National Issues: WWI, Gleichschaltung

First of all, in addition to ideological differences, there were a few practical issues that emerged in German academia in progression to the Nazis. WWI was tragic, but a mere blip compared to WWII for German mathematics, which mostly stayed intact during the former. However, due to long process toward professorship[8], it was difficult for students to enter an abstract career in the short, intervening Weimar years (WWI to 1933). Not only were there fewer young lads who had made it through the war, but those who made it through were probably disillusioned about the possibility of a non-applied career in a very real, gritty world. *Insurance* and *Economics* were two emerging mathematical fields in the new Republic, and drew numerous would-be pure mathematicians concerned about their career. And while it is unclear if Nazi ideology had a significant impact on academic interests, aspects like rising anti-Semitism made it more difficult to enter the field for the kinds of people who had done so in the earlier 1900's.

The Nazis also brought with them a *Gleichschaltung*, which means about as much as "synchronization" or "bringing into line," among academics. During the

---

[7] Recall that the 1900 ICM in Paris was when Hilbert presented his famous 23 problems.

[8] see Appendix A1.1 Academia in Germany: Habilitation

Gleichschaltung, easily 1/3 of scientists were forced out of work, and there is talk of the idea of a defensive *Selbstgleichschaltung*, the idea that scientists could dissolve their old ways and join the party ideology to prevent the full impact of a coercive reform (Peckhaus 62-63). However, the *Gleichschaltung* did not have as large an impact as the *Berufsbeamtengesetz* (*Law for Civil Servants*), which extended to academics: it excluded Jews from professorial eligibility, and required able men to be ready for a draft at a moment's notice. The net affect of such regulations led to the gradual dismissal of many professors, and increasing strain for those who remained.

2.3 National Issues: Associations, Publications, and the *Annalenstreit*

Needless to say, there was a lot of mathematics going on; the *Reichsverband Deutscher Mathematischer Gesellschaften und Vereine* (*National Association of German Mathematical Societies and Associations*)[9] had 16 member organizations by 1930, many of them with regular journals for publication of mathematical results in German. The most prominent journal was the *Mathematische Annalen* (founded 1868, and subsequently edited by **Klein** and then **Hilbert**), and the most prominent organization was the *Deutsche Mathematiker-Vereinigung* (the *German Mathematical Society*, founded 1890 by **Cantor** after difficult efforts to follow suit after other countries) with its yearly *Jahresbericht*. Both of these journals are still going strong in the present day, but figured strongly in power struggles of Nazi mathematics.

The *Annalenstreit* was philosophically charged, but it actually stemmed from national politics instead of intuitionism vs. formalism. In 1925, when the *Mathematische Annalen* was compiling a volume in memory of **Bernhard Riemannn**, there was a vocal opposition to allowing contributions by "foreign" French mathematicians, led by **Brouwer**[10] and strongly supported by **Bieberbach**, who first emerges as a figure around this time. Apparently, they were successful in excluding the French, but the

---

[9] The *Reichsverband*, interestingly enough, was founded in Göttingen in 1920, and as a meta-organization became a prominent aspect of the mathematical *Selbstgleichschaltung*. (Peckhaus 67-68)

[10] Recall that **Brouwer** is Dutch. It is unclear how much he was considered a part of German mathematics, but he was certainly involved enough to be an editor of the *Annalen* in 1925, along with Hilbert, and the less-remembered **Blumenthal** and **Hecke**.

divide over exclusivity of German mathematics widened. The aforementioned ICM in Bologno continued the *Streit*, and increased animosity between the factions: when the time came to renew the contract for the *Annalen*, **Hilbert** (who had good relations with publisher **Ferdinand Springer**) arranged for **Brouwer** to be removed as an editor. (Heibel 2.2)

In contrast, the DMV was an association, with yearly meetings, a president, and a *Jahresbericht*, and would not be drawn directly into the *Streit* until the advent of *Deutsche Mathematik*.

3 Nazi Mathematics

Formalism	*Intuitionism*
Hilbert	**Brouwer** / **Bieberbach**
Göttingen	Berlin
liberal / international	*Deutsche Mathematik*
abstrakt	*anschaulich*

Heading into the 1930's, approximately the above dichotomy held sway, and paved the way for **Bieberbach** to push his agenda. He is generally remembered for his moderately successful intentions to advocate for mathematics in Nazi Germany. Although quite a few less-remembered mathematicians joined the party, and **Theodor Vahlen** was more responsible for political involvement, it is usually **Bieberbach's** name that is associated with Nazi mathematics, as – ironically – he exactly intended, but later renounced. By looking at his actions, we can understand how the German mathematical tradition was subsumed, and what the meagre attempt at "Nazi mathematics" actually was.

3.1 Ludwig Bieberbach

Ludwig Georg Elias Moses Bieberbach (1886-1982) studied under **Klein** at Göttingen until 1910, then spent the next decade in Königsberg, Basel, and Frankfurt before settling at the University of Berlin from 1921 until the end of the war. He was

certainly an able scholar; mathematicians will be familiar with the 17 symmetry groups of the plane, and **Bieberbach** was the first to prove that such an exact result holds for any dimension, published in the *Mathematische Annalen* in 1911 (Bieberbach Räume), partially solving the 18th of Hilbert's 23 problems. Nevertheless, in addition to his significant mathematical output, he developed strong political views that he mixed with his mathematical goals:

3.2 Nationalist and Racist Mathematics

On his website, Heiner Stauff asks

> *"Ist Mathematik nicht - sogar mehr als jede andere Wissenschaft -* neutral*, also* international *und in* diesem *Sinne absolut »*un-deutsch*«?"* (Stauff)

> (*"Isn't mathematics - even more than any other science* – neutral*, thus* international *and in* this *sense "un-German"?"*)

Triangles having an angle sum of 180 degrees, he notes is a universal property of Euclidean space, and has *absolutely nothing* to do with nations. Indeed, it seems much more reasonable to nationalize the *politics* of mathematics like **Brouwer**[11]. Nevertheless, **Bieberbach** wanted to promote a uniquely German mathematics exactly by taking up the more difficult task of aligning abstract mathematical facts to actual culture. At first, **Bieberbach** was simply an early German nationalist in mathematics, along with even quite a few Jews like **Richard von Mises** (Huckle Jews, 4). However, **Bieberbach's** convictions turned slowly to psychology, and developed an anti-Semitic leanings.

In 1934, **Bieberbach** used ideas from the philosopher **Jaensch** to developed a two-part psychologal "typology" of people – and particularly mathematicians – that echoes the *formalist-intuititionist* dichotomy.

The "S-type" cannot distinguish between symbolic associations and real associations; *formalists*, with their abstract structure and axiomatic reliance, belong to the S-type.

---

[11] It should be noted, however, that while Brouwer might have supported idea
it is generally accepted that the Dutch Brouwer was not a

The “J-type”, in contrast, is more deeply grounded. The *intuitionists* preferred real, geometric-visual mathematics; they wanted mathematics to be *anschaulich*.

In fact, the J-type is also described as *Aryan*. **Vahlen**, in fact, tried to justify Bieberbach’s dichotomy by describing mathematics as the “mirror to/of the race.” (Wikipedia DE: Deutsche Mathematik). Nazi mathematicians finally had a system to align themselves with the obligatory anti-Semitic slant necessary for the promotion of ideas in Germany at the time:

> *"... the spatial imagination is a characteristic of the Germanic races, while pure logical reasoning has a richer development among Romanic and Hebraic races. ... In the intellectual sphere the race shows in the manner of creation, the evaluation of the results, and I guess also in the standpoint considering foundational questions. ... Formalism wants to build a realm of mathematical truths which is independent of man, whereas Intuitionism is based on the idea that mathematical thinking is a human endeavor and thus cannot be separated from man.” (Wikipedia: Ludwig Bieberbach)*

3.3 Mathematical Nazi Politics and Vahlen

Bieberbach tried hard to justify the political relevance of mathematics in the Third Reich. He associated the decline of the old Reich with the new formalistic math that was part of the successor of the foundational science of the old intellectual elite. (Wikipedia DE: Deutsche Mathematik) He amassed significant individual power, and when he once stated that “I find it surprising that Jews are still members of academic commissions.” his fellow Berlin mathematician Issai Schur was immediately let go from the Prussian Academy. (Huckle Mathematicians)

Nevertheless, **Theodor Vahlen** (1869-1945) was more involved in real politics, as well as other movements like *Deutsche Physik*. He replaced **Richard von Mises**[12] at the University of Berlin in 1933 thanks to *Berufsbeamtengesetz*. **Vahlen** went on to gather several titles, like vice presidency at the Kaiser Wilhelm Society 1933-1937 and president of the Prussian Academy of Sciences in 1938; he also joined the SA in 1933 and the SS in 1936. (Wikipedia DE: Theodor Vahlen) Most important politically was

---

[12] Richard von Mises, you might recall, was somewhat nationalistic; he was also a tenured professor of *applied mathematics*, and had been baptized Catholic. None of this helped him evade his Jewish heritage. (Wikipedia DE: Richard von Mises)

Vahlen, climbed ladder of the *Reichserziehungsministerium* (The *Ministry of Education*, which technically had science, upbringing, and "education of the folk" under its title), where he had influence on university positions. (Huckle Jews, 10) In 1934, he had become the leader of the science branch, but in 1937 he had to leave, due to a power struggle against the prominent *Deutsche Physik* advocate **Johannes Stark** for the presidency of the German Research Society. (Heibel)

However, despite his prominent positions, there is little documentation for the successful elevation of mathematics under Nazi times. This demonstrates the difficulty of promoting the abstract subject about as much as it shows how the strongest efforts to legitimize mathematics during Nazi times seemed strongly tied to the promoter's self-advancement. In fact, sometimes the actions seemed to be outright excuses for appearing politically loyal, as when **Bieberbach** suggested in 1934 that the DMV adopt the *Führerprinzip*. His suggestion was successful, but the notorious Nazi mathematician didn't have much time to get involved with the new mathematical Führership.

3.4 The DMV Letter

Bieberbach's editorship of the DMV *Jahresbericht* ends in 1934 with a notorious "open letter" to Danish footballer and mathematician Harald Bohr (brother of **Niels Bohr**). Bieber. His coeditors **Hasse** and **Knopp** did not want to allow him to publish the letter in the *Jahresbericht*, lest it be construed as a political statement of the journal, but **Bieberbach** snuck it into the final revisions successfully. The letter is caustically titled "Kunst des Zitierens" ("The Art of Quoting"). The letter concerns the following quote.

> *"Ein Volk, das eingesehen hat, wie fremde Herrschaftsgelüste an seinem Marke nagen, wie Volksfremde daran arbeiten, ihm fremde Art aufzuzwingen, muss Lehrer von einem ihm fremden Typus ablehnen." (Bieberbach Zitieren)*

> *("A folk that has realized how foreign ambitions attempt to infringe on its mark/brand, as foreign folks would, by imposing its foreign way, must decline teachers of a foreign type.")*

Bieberbach claims that **Bohr** has misquoted this by stating that Bieberbach advocates a closed German mathematics, so this retaliatory letter is a lesson in "the art

of quoting." In the letter, **Bieberbach** states strong national science can still collaborate internationally, but can conduct more strongly in the world (borrowing an analogy from his beloved Führer: cast a shadow) if it has deeper roots. He goes on to state that "we are proud of our German mathematicians and their accomplishments, but decline to decorate ourselves with foreign glory." He then also goes on to say that "the problem of race" and the Jewish question are "in no way to identify with another," but that Jews simply happened to be most prevalent in Germany and that "no folk in the world has to fight for its existence as hard as the German one." (Bieberbach Zitieren)

These confusing, thinly veiled racist statements did not sit well with the other DMV members, and **Bieberbach** was released from *Jahresbericht* editorship while the remaining members attempted to issue an apology. **Bieberbach** maintained good relations with DMV members like **Wilhelm Süss**, who would hold the presidency for an unusually long period from 1937 to 1945. Even without **Bieberbach**, the DMV was not without its problems; significant issues arose from the issue of retaining continuity in the face of the painfully obvious fact that many mathematicians were now gone. (Remmert DMV) Nevertheless, **Bieberbach** went on: he simply founded his own journal.

3.5 *Deutsche Mathematik*: The Journal

Bieberbach and **Vahlen** are considered the main proprietors of the journal *Deutsche Mathematik*, which was intended to promote their nationalistic views. It lasted from 1936 to 1942, and is not really remembered for its content. Intended to be "truly Aryan," a history of topology notes that "after the first two volumes, however, it settled down to being just another mathematics journal." (James 854)[13] *Deutsche Mathematik* remains only a name for a movement and its meager journal, known for attempting to displace the success of Göttingen without offering any coherence in its stead.

[13] On the topic of topology, James also notes, the journal published exactly one paper, which ironically even appears to be written by someone without a college education. Topology ideas had been in no short supply, and can be rather *anschaulich*, so this serves to underscore any doubts that *Deutsche Mathematik* had any general impact.

3.6 Bieberbach's Fate

> *"Nur soviel wird gesagt: Bieberbach hat, wie durch verbürgte Äusserungen belegt ist, diese Irrtümer später erkannt und tief bereut." (Grunsky 190)*
>
> *("Only this much will be said: Bieberbach, as attested by various public declarations, later recognized and deeply regretted the error of his ways.")*

At the end of the war, **Bieberbach** lost all of his positions and was dismissed from teaching until he was offered a position in Basel in 1949, to strong criticism. (Wikipedia DE: Ludwig Bieberbach) He eventually continued his career in mathematics, and although the past never left him until his death at age 95, Grunsky suggests he had made amends with the community. Indeed many mathematicians excuse his radical views as an instrument of his obvious ambition to become the prominent leader of German mathematics. (Huckle Mathematicians)

3.7 Other Nazi Mathematics

In my treatment of pure mathematics up through Nazi times, I have had to neglect some of the more interesting aspects of applied mathematics during the regime. To give you a taste of what else went on, here is a selection:

- The 1936 Olympics in Berlin are known for being subject to the first live broadcasts; applied physics in the form radar and broadcast underwent strong development.
- Theoretical physics led by **Werner Heisenberg** led to moderately advanced research into atomic experimentation.
- The rocket program led by **Wernher vor Braun** involved some theoretical research. Some large-scale calculations were done at the *Institute for Practical Mathematics* in Darmstadt led by **Alwin Walther** (Remmert Review), and next to flight control and rocket ballistics the *Heeresversuchsanstalt Peenemünde* was also host to the development of calculating machines. (Kugele 2.2)

• Flight and aerodynamics were not only necessary for rockets; the Germans are well-known for their development of airplanes and Zeppelins like the famous *Hindenburg*.

• **Konrad Zuse** developed the first programmable computer (the Z1, in 1936-1938) and the first programming language (*Plankalkül*, 1941-1945). He founded a company in 1949 with moderate success, but because he was isolated from similar developments in the US, most modern computing development unfortunately doesn't stem directly from his work. In fact, while the ENIAC was developed in the US at the end of the war, modern theories of computation grow out of **Alan Turing's** effort in England to decipher the *Enigma*.

• The *Enigma* machine was Germany's attempt at unnecessarily clever cryptography for war communications; it involved a sort of typewriter with a mechanism to scramble a message. Ironically, the English were able to decode most messages because the Germans generally all signed their messages with the same ending: "Heil Hitler."

4 The Fate of the German Mathematical Tradition

4.1 Göttingen

In contrast with the *Deutsche Mathematik* attempting to grow in Berlin, the decline of German mathematics can be described in terms the practical dissolution of mathematical Göttingen within a few months after Hitler came to power in early 1933. Other strong centers, like universities at Heidelberg, Berlin, Frankfurt, Freiburg, Vienna, and Königsberg all suffered, but none of these had nearly the aforedescribed prominence of "**Hilbert's** Göttingen." Several mathematicians who were aware of the impending conditions had left earlier, but most of Göttingen was struck hard in 1933, with the new Berufsbeamtengesetz, which allowed the dismissal of civil servant (including professors) for reasons such as

§2: political unreliability

§3: being non-Aryan

§4: failure to guarantee to be ready to "go into service for the state at any time, without reservations." (Hanitzsch, Umbruch)

Prominent mathematicians like **Noether**, **Weyl**, and **Courant** were out of work and soon left for America (Bryn Mawr, Princeton, New York). Some of the faculty, like **Hasse**[14] tried to remain and tried to continue at dear old Göttingen: the *Vorlesungstätigkeit* (*"lecturing activity"*) of pure math recovered in 1933-1936, and from then until 1941 applied math took over. However, things remained difficult: Encouraged by **Bieberbach**, student **Oswald Teichmüller** led a highly successful boycott of **Landau's** lecture to protect his fellow scholars from *unanschulichen* Jewish teachings, leading to the latter's departure. (Heibel 2.3)[15]

Hilbert stayed at Göttingen until his death in 1943; the Nazis seemed to be unusually formal about respecting pensions and retirements. (Huckle Jews, 14). Furthermore, the only pure math lecturers who remained in 1940 were **Herglotz** und **Kaluza**, who were both to old. Everyone else was either drafted or put to war tasks. (Schappacher 50)

Not only the faculty was deflated: the number of mathematics and physics students purportedly dropped 90% from 1932 to 1937. (Kugele 1.2) The mathematics library suffered, too: there was a book burning on May 10, 1933 (Hanitzsch, Umbruch), and Nazis didn't feel compelled to retain the "useless" remaining material; estimates for pure mathematics books and journals range as high as 88%, with about 20% for related, applied fields. (Schappacher 51) [16]

---

[14] **Helmut Hasse**, namesake of Hasse diagrams for posets, stayed in Germany to try to fight for the international dignity of German mathematics; he even tried to join the Nazi party, but was refused due to Jewish ancestry. (Wikipedia DE: Helmut Hasse)

[15] Oswald Teichmüller was a proud Nazi. After his habilitation 1938, he became a soldier starting July 1939. He held a role in cryptography for the Wehrmacht 1941, and disappeared on the Eastern front in Russia in 1943. In a 1948 letter, his mother writes that she was disappointed by her son's naïve willingness to put his career on the line. (Wikipedia DE: Oswald Teichmüller)

[16] Note that **Gauß**, who made Göttingen famous for mathematics, is said to have been attracted by its impressive library.

Göttingen stayed mostly intact during the war; some sources refer to a (possibly informal) agreement between Germany and England to spare the major academic centers of Oxford, Cambridge und Göttingen. (Hanitzsch, Situation)[17] Indeed, Göttingen was the first to recover teaching activity, an eventually re-attracted some prominent mathematicians; **Carl Siegel** returned briefly during the war. Göttingen is still a remembered and respected institution in mathematics, but it recovered none of its old mathematical prowess, which was dispersed around the world by the steamroller effects of the Nazi party. The German mathematical tradition can only be said to have continued and evolved in spirit.

4.2 The Fates of Mathematicians

I have tried to avoid referring to particular stories of mathematicians who were not a relevant part of the narrative of Hilbert's Göttingen or Nazi mathematics. Nevertheless, most of the tragedy lies in the individual stories of displaced talent. Thomas Huckle lists fates of 131 significant central European mathematicians in WWII (Huckle Mathematicians); if we count them, we have:

14 dead[18],
19 imprisoned[19],
4 hidden,
56 emigrants,
23 non-emigrants,
10 in German war research,
5 near-Nazi

It would be hard to tally who exactly was Jewish; often, the risk was ancestry or association with Jews; although ant-Semitism posed a greater those, by the end it didn't matter; everyone either had to get out or find a way to make due.

---

[17] Although the city actually suffered 8 decent air attacks, mostly intended for the rail station (Wikipedia DE: Göttingen)

[18] Including suicide by **Felix Hausdorff** and his family, to avoid internment.

[19] Including **Curt Herzstark**, whose last name literally is "heart-strong," and who is known for the remarkable mechanical Curta calculator that he designed while being kept alive to utilize his talents.

3.4 Emigration and Assistance

Many mathematicians emigrated from Germany. Most came to England or the USA, but several went to places like Russia or Palestine. Most of them also left by 1933 at the latest, but some like **Kurt Gödel** even in 1939 or **Carl Siegel** in 1940[20]. They were graciously welcomed at various institutions.

G. H. Hardy arranged for 18 displaced mathematicians to take up places in Cambridge, England. (Huckle Jews, 20) Institutions in the United States relied on quite a bit of private funding for expelled German; at first The American Rockefeller Foundation helped support 300 scholars, including about a dozen mathematicians like **Courant**, **Siegel**, and **Noether** coming to the US. Thereafter, **Weyl** (at Princeton) and **Noether** (at Bryn Mawr), part of the displaced Göttingen faculty who then found themselves in the US, founded the *German Mathematicians' Relief Fund* in 1934 to help support others who shared their conditions. There was also an *Emergency Committee In Aid of Displaced Foreign Scholars* (Gapel).

Nevertheless, American mathematical immigration was not without its issues; the US was at the depth of its recession; money and job security, especially in a field like academics, were scarce. In fact, even more American mathematicians were out of a job than Germans were forced out. Therefore, the *Emergency Committee* tried to take care to distribute scholars. However, there were still some personal barriers; Americans were a little wary of these foreign mathematicians, and ant-Semitism was not completely absent.[21]

Nevertheless, many mathematicians, Jewish or not, found a place in the US. A great number of them settled in Princeton, New Jersey, which was home not only to a prestigious university with a mathematics department, but also the new *Institute for Advanced Study* founded by Louis Bamberger (who had German-Jewish parents). It is generally acknowledged that the mathematical attention on Göttingen re-coalesced on

---

[20] Both went to Princeton, but **Gödel** went over Russia, Japan, and the US, while **Siegel** snuck out through Norway.

[21] George Birkoff at Harvard tried to influence American hiring to be anti-Semitic; interestingly, the notable mathematicians mostly stayed out of Cambridge, MA. (Wikipedia: George David Birkhoff)
Also, Gapel, et al. note problems between "assimilated" and "orthodox" Jews.

Princeton after the war, contributing to the prominent rise of American mathematics in the second half of the century. Yet while many of the formalist ideas live on in modern mathematical theories, the German mathematical tradition, as it rose and fell under Hilbert, is now gone. No one can say where it would have headed without the calamitous impact of the Nazi regime.

4 Aftermath[22]

While it is well understood what German mathematics was before Nazis, and what occurred from 1933-1945, it is difficult to explain what value was lost in the dissolution. One cannot exactly say "Oh, **Hilbert's** program would have responded to **Gödel's** program in some interesting way X, and probably discovered a good way of thinking about Y that didn't evolve very well in the wake of WWII." These mathematicians were looking into the *nature* of what is knowable, provable, and deducible; they were defining their own tools. Who knows what they could have come up with?

What we *can* say is that their general approach has led to many useful results in mathematics (and metastructural topics like category theory); in particular, the most fundamental ideas about what is possible for systems to do in this electronic age stem from that era from *formalism*, and two of the most important ways of thinking about a computer as a system were suggested by **Turing** and **von Neumann** – both of whose academic careers were strongly influenced by Nazi actions. But as much as we can emphasize the interesting consequences of the Nazis in mathematics, we cannot say how the German mathematical tradition *should* or *could* have played out.

One cannot really say that the tradition was simply displaced, or evolved naturally, even if many of the mathematicians ended up in America and particularly

[22] Pun intended, in case you were wondering, even though the death of German mathematics is a grave subject.

Princeton[23]; the world simply had to deal with it and go on. So did Germany, which has palpably languished. The prestigious Fields medal given out at the ICM since 1936 has only been given to one German mathematician: Gerd Faltings... at Princeton University. (Wikipedia: Fields Medal)

It would be easy, say, to use **Bieberbach** as a scapegoat for the all the foolish conduct of German mathematics, and its hard-to-reestablish character, but one cannot say that German mathematics hasn't returned to a respectable level. There was still mathematics during WWII, and through the end of the war, such as the founding of a mathematical research institute by Süss in 1944. (Huckle Jews, 22) Despite the Cold war[24], mathematicians slowly returned, and Germany has held several respectable international roles; for example, the office of the International Mathematical Union is at the Konrad Zuse Zentrum in Dahlem.

All this cannot make amends for what happened a third of the way into the 20th century. Without being unduly disappointed with modern German mathematics, it is important to remember what Göttingen meant; it was remains a tremendous symbol for the bridge between past and modern mathematics, and we should never forget what we have lost. As Hilbert express in 1934 when he was visited by NS-Reichsminister Rust at a banquet in Göttingen and was asked if its mathematics was suffering at all, now that it had been freed of the Jewish influence:

> *"Jelitten? Dat hat nich jelitten, Herr Minister. Dat jibt es doch janich mehr!" (Huckle Mathematicians)*
>
> *("Suffered? It hasn't suffered, Herr Minister. It does not exist anymore!")*

---

[23] English-born John Conway once told me how at Cambridge he had only a vague idea about the exact geographical location of American mathematicians until he moved to Princeton – at which point he realized that this was exactly where all the prominent names were! I consider John Conway the greatest mathematician alive, so he should know what he's talking about.

[24] Which again induced a split in the DMV, but this time within two German countries that could not coöperate.

Appendix: German Mathematicians in the Early 20th Century

It is rather hard to decide who was in "Germany" (or at Göttingen) long enough, who did not live too early or too late to relate to the times, and who studied enough pure mathematics. Nevertheless, here is my attempt to compile the most important and recognizable names I came across in my research. At least a dozen of these should look instantly familiar to any serious mathematician.

Associated with Göttingen

Carl Runge
David Hilbert
Edmund Landau
Emmy Noether
Erich Hecke
Felix Bernstein
Helmut Hasse
Hermann Weyl
Max Dehn
Otto Toeplitz
Paul Bernays
Richard Courant
Theodor Schneider

Associated with Nazism

Erhard Tornier
Gerhard Gentzen
Hellmuth Kneser
Ludwig Bieberbach
Oswald Teichmüller
Pascual Jordan
Theodor Vahlen

Other Mathematicians

Adolf Fraenkel
Alexander Grothendieck
Alfred Pringsheim
Arnold Sommerfeld
Emanuel Sperner
Emil Artin
Felix Hausdorff
Ferdinand von Lindemann
Issai Schur
Josef Ackermann
Karl Menger
Konrad Zuse
Kurt Gödel
Kurt Hensel
Kurt Reidemeister
Lothar Collatz
Max Born
Otto Blumenthal
Paul Epstein
Richard von Mises
Rudolf Carnap
Wilhelm Süss

Works Cited

Regarding Wikipedia

It is a modern academic concession: Wikipedia is now so encompassing that many historical and technical facts are quick find with a Wikipedia search, often with accompanying evidence and sources. During my research, I collected numberous facts from various sources that can best be checked in practice by going to Wikipedia (and clicking around a bit for more "reliable" sources if desired); in addition, previous content states can easily be verified, so the existence of evidence is actually more durable than most other sites. Rather than trying to document all these facts, and trying to justify "common knowledge" that a mathematician would accrue from doing math and reading around, I have opted to cite this in my paper as follows:

> Emmy's American students were the "Noether Boys." (Wikipedia: Emmy Noether)
> ...can be found at http://en.wikipedia.org/wiki/Emmy_Noether
>
> Gauß ist in Göttingen begraben. (Wikipedia DE: Gauss)
> ...can be found at http://de.wikipedia.org/wiki/Gauss

Certain simple facts like dates of birth, death, and institutional affiliations can be corroborated with Wikipedia, unless belonging to another cited context. I have tried not to rely on such informal citation too much.

All the relevant articles were accessed at least once around December 8, 2010.

Main Sources

"German": Sources written in German.

"Primary source": Primary source (generally from WWII or earlier).

"PDF": Scholarly works in PDF format.

"Huckle site": Sources from the site of Thomas Huckle's Summer 2003 seminar on mathematicians during Nazi times.

• Bieberbach, Ludwig. "Kunst Des Zitierens." Web. 9 Dec. 2010. <http://gdz.sub.uni-goettingen.de/no_cache/dms/load/img/?IDDOC=249630>. Primary source, German.

• Bieberbach, Ludwig. "Über Die Bewegungsgruppen Der Euklidischen Räume." Springer. Web. 8 Dec. 2010. <http://www.springerlink.com/content/p2p72002h5520410/>. Primary source, German.

• "Chronik Der Jahrestagungen." *Deutsche Mathematiker-Vereinigung*. 2010. Web. 08 Dec. 2010. <https://www.dmv.mathematik.de/die-dmv/geschichte/104-liste-der-tagungsorte.html>. German.

• Gapel, Andreas, Ahmed Kotb, and Andreas Hirschvogel. Emigration in Die USA. Summer 2003. Web. 9 Dec. 2010. <http://www5.in.tum.de/lehre/seminare/math_nszeit/SS03/vortraege/emusa/Imegeration%20in%20die%20USA/index.htm>. Huckle site, German.

• Grunsky, H. "Ludwig Bieberbach Zum Gedächtnis." Jahresbericht Der Deutschen Mathematiker-Vereinigung. Vol. 88. Stuttgart: B. G. Teubner, 1986. 19-200. Print. Ser. 4. Primary source, German.

• Hanitzsch, Matthias. "Mathematiker in Göttingen Während Der NS-Zeit." Web. 8 Dec. 2010. <http://www5.in.tum.de/lehre/seminare/math_nszeit/SS03/vortraege/goett/>. Huckle site, German.

• Heibel, Hauke, Thomas Pfennig, and Stefan Rosenegger. "Deutsche Mathematik." 2003. Web. 8 Dec. 2010. <http://www5.in.tum.de/lehre/seminare/math_nszeit/SS03/vortraege/de-math/>. Huckle site, German.

• ma, Adolf. Mein Kampf. München: Zentralverlag Der NSDAP., 1943. Primary source, German.

• Huckle, Thomas. "Jüdische Mathematiker Im „Dritten Reich“." Web. 8 Dec. 2010. <http://www5.in.tum.de/persons/huckle/evenari.pdf>. German.

• Huckle, Thomas. "Mathematicians during the Third Reich and World War II" 4 Aug. 2010. Web. 9 Dec. 2010. <http://www5.in.tum.de/~huckle/mathwar.html>. Huckle site.

• James, Ioan Mackenzie. History of Topology. Amsterdam: Elsevier B. V., 2006. Print.

• Kugele, Stefan, Florian Wittemann, and Hannes Karger. "Mathematik in Der Kriegsforschung in Deutschland." 2003. Web. 9 Dec. 2010. <http://www5.in.tum.de/lehre/seminare/math_nszeit/SS03/vortraege/kriegd/>. Huckle site, German.

• Neuenschwander, Erwin, and Hans-Wilhelm Burmann. "Mathematik an Der Universität Göttingen." *Mathematik an Der Universität Göttingen*. Web. 07 Dec. 2010. <http://www.math.uni-goettingen.de/historisches/entwicklung.html>. German.

• Peckhaus, Volker. "Der Nationalsozialistische „neue Begriff“ Von Wissenschaft Am Beispiel Der „Deutschen Mathematik“ – Programm, Konzeption Und Politische Realisierung." Philosophische Fakultät Der Rheinisch-Westfälischen Technischen Hochschule Aachen, 2001. Web. 6 Dec. 2010. <http://darwin.bth.rwth-aachen.de/opus3/volltexte/2009/2696/pdf/2696.pdf>. German.

• Remmert, Volker. "Die Deutsche Mathematiker-Vereinigung Im ”Dritten Reich“ II." 2004. Web. 9 Dec. 2010. <https://www.dmv.mathematik.de/component/docman/doc_download/6-v-remmert-die-dmv-im-dritten-reich-ii.html>. German.

• Remmert, Volker. "Mathematicians under the Nazis (Review)." Sept. 2003. Web. 9 Dec. 2010. <http://www.h-net.org/reviews/showrev.php?id=8094>.

• Schappacher, Norbert. *Das Mathematische Instetitut der Universität Göttingen 1929 – 1950*. Publication. Apr. 2000. Web. 8 Dec. 2010. <http://www-irma.u-strasbg.fr/~schappa/NSch/Publications_files/GoeNS.pdf>.Revision of an essay by Schappacher while at Göttingen, 1983. German.

• Siegmund-Schultze, Reinhard. "Read This: Mathematicians under the Nazis." *Mathematical Association of America*. "Mathematicians under the Nazis" by Sanford L. Segal – Reviewed by Reinhard Siegmund-Schultze, 10 Feb. 2004. Web. 08 Dec. 2010. <http://www.maa.org/reviews/mathnazis.html>.

• Stauff, Heiner. "Deutsche Mathematik." Web. 08 Dec. 2010. <http://www.stauff.de/matgesch/dateien/deutsche_mathematik.htm>. German.