Alexander Grothendieck: 1928-2014
A stateless 20. century Mathematical Giant

Olav Arnfinn Laudal

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Introduction

Grothendieck is considered as one of the most influential mathematicians in the 20. century. Although he traveled (and sometimes with obvious problems) with a Nansen-passport issued by the United Nations, he was a pure French scientific product. Reacting to his death, November 13. President Hollande hailed him as "one of our greatest mathematicians and an out-of-the ordinary personality in the philosophy of life". He was a son of a russian jewish revolutionary, Alexander Shapiro, that finished his days in Auschwitz, and a German mother, Hanka Grothendieck, with an amazing history of her own. Alexander Grothendieck came to Paris in 1939, to join his father and mother. They had left him with a lutheran pastor in Germany in 1933 when Hitler came to power, and they had to flee. His mother died soon after the war, and Alexander had to take care of himself barely 16 years old. He studied at the Universities in Montpellier and Nancy, and came back to Paris in 1955, after having completed a Ph.D. thesis in Nancy that made his name well-known.

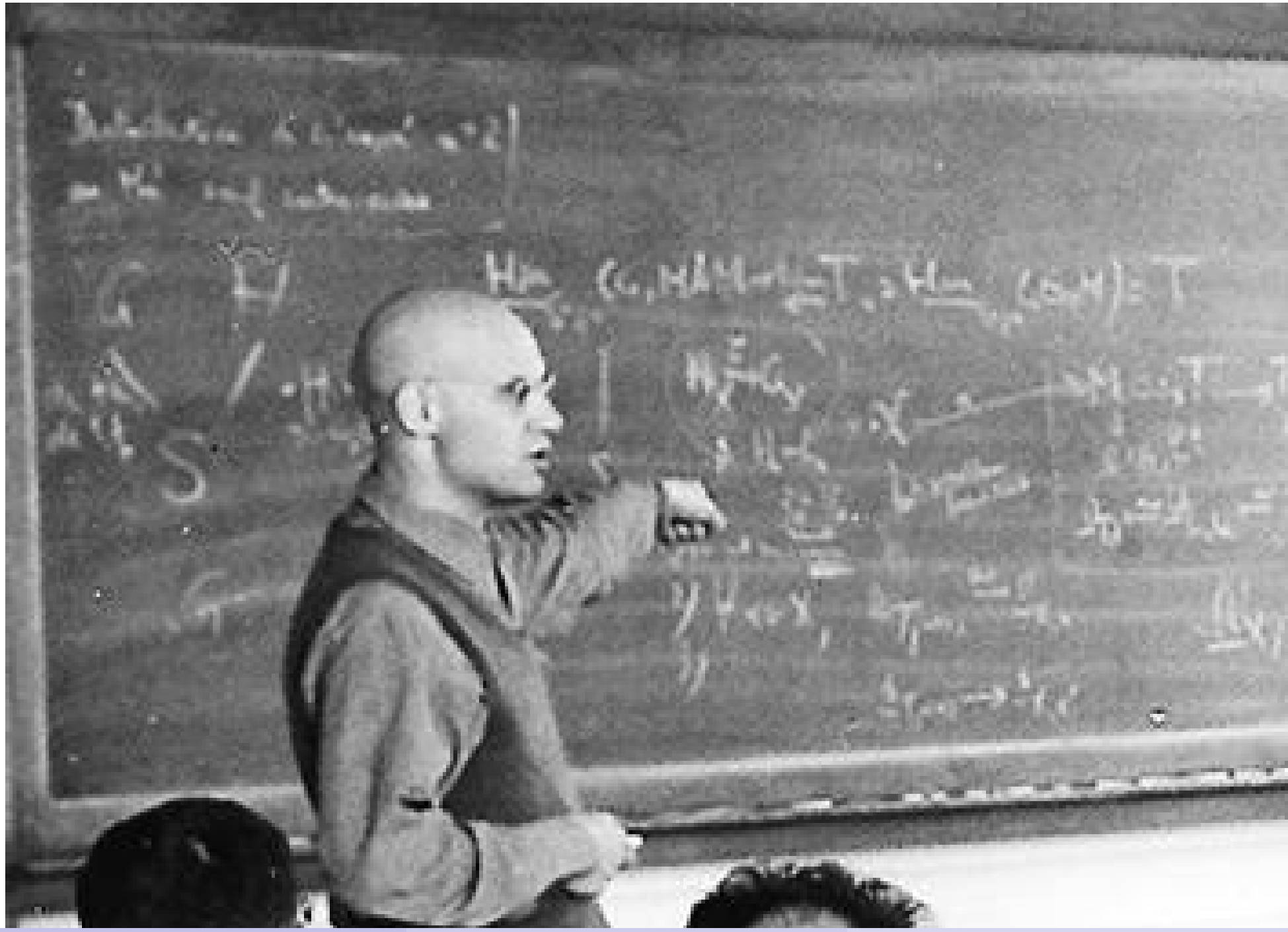
I met him in the Fall 1957, and again in 60-62. As member of a little group of unofficial assistants, I had the fascinating opportunity to see him at work, having the job of typing and putting together the notes we took of his lectures.
I shall give a short review of Grothendieck's mathematical legacy, including his reworking of algebraic geometry, follow him through his work for Peace and Justice, via a very complicated period in the early 1970's, until his non-standard mental break down, and subsequent isolation, in a little village in the Pyrenees, where he hid and died.

Main points of the story

- What made him the "out-of-the ordinary personality of life" that President Hollande refers to?
- Grothendiec's family: Berlin, Paris, Auschwitz.
- Alexander's childhood, and education, Montpellier, Paris, Nancy, and back to Paris IHES.
- The Grothendieck Seminar at Fondation Thiers and at IHES, 1958-62-70
- His scientific legacy: Tohoku 1957 and The Grothendieck Epoch, 1958-1970, witnessed through the Proceedings of the International Congress of Mathematicians.
- Militarisme, Survie, Private Life, Nancy, Women, Children,
- The Savior: Deligne, Verdier, Giraud, and the other disciples.

The late works, and what is next?

- Pursuing Stacks, 1983
- The long march through Galois theory, 1981
- Rcolte et Semailles
- Esquisse d'un Programme, 1984. Lego tower, deformations of algebraic curves.
- Deformation theory, noncommutativity, the Russian school.
- Mathematical physics, "a domain which he loathed and of which he was totally ignorant": Cartier
- The Standard Model



Grothendiec's father: Berlin, Paris, Auschwitz

Alexander's father, Alexander Shapiro a Russian, from Belyje-Berega in Bryansk Oblast, not far from the border of Bielorussia and Ukraine, was of Hassidic Jewish family. He broke with the pious sect, and became revolutionary, took part in the aborted coup against Tzar Nicolai, in 1905, and spent more than 10 years in Prison. Otherwise little is known about his league of "Revolutionary Socialists" and his actions as a revolutionary in Russia. But he pops up in Budapest with Bela Kuhn, and in Berlin with Rosa Luxembourg in the 1920's., where he met Johanna, or "Hanka" , and Alexander was born 1928. As sympathizer of the S.A.P. he had to flee when Hitler came to power in 1933, but after a short stay in Paris, continued his class-struggle, with the P.O.U.M. in Spain, until Franco took over, and he returned to Paris where "Hanka" also had been living since 1933, and where Alexander had been sent, from Berlin, in 1939. He was, like many of the freedom fighters from Spain, interned in the infamous Camp du Vernet. As a Jew, he was later handed over to the Germans by the Vichy government, and ended his life in Auschwitz in1942.

Hanka Grothendiec, hiding during the war, from Berlin to Cevenol

Hanka Grothendieck was a German, leftist militant in the 1920's, a would be writer, with an incredible history of her own. She was married to Johannes Raddatz, and had a daughter when she met Shapiro in Berlin, and Alexander Grothendieck was born. His legal name was therefore Alexander Raddatz. It seems that Alexander and his half-sister never got to know each other well, and she is reported to have lived in the USA, where she died. Hanka also had to leave Berlin when Hitler came to power, and she could not bring Alexander with her, so he was taken care of by a protestant pastor and teacher, and grew up on a farm, where one applied a rather popular German form of ecological agriculture. It seems that he lived there up to the winter of 1938-39, but then was sent to Paris, where he was taken care of by his mother. When the war came in 1939, Hanka and Alexander were interned in a place called Mende, in Allier, as "enemy citizens". This changed in 1940 after the fall of France, and mother and son ended up in a very nice village, Chambon-sur-Lignon, in Haute Loire, north-east of Mende, south-west of Lyon.

From Le Collège-Lycée Cévenol International, to Montpellier

Here, in Chambon-sur-Lignon, Alexander Grothendieck got a place at the "Foyer Suisse", while being a student at the Collège Cévenol, now Le Collège-Lycée Cévenol International, where the teachers were protestant and in the french Huguenot tradition. They took good care of jewish children. Probably very few knew he was a "half-Jew", and he was not bothered during the Vichy period, and had little problems during the rather harsh months of the Liberation. In 1945, Alexander got his high-school exam, the Baccalaureate, and could go to the University of Montpellier, a beautiful Mediterranean Town, where he wanted to prepare for a teacher position. Usually that meant to pass a "concours" and obtain l'Agrégation, qualifying for the highest positions in the French school system. But when he came to Paris in 1948, he had just a an undergraduate exam, a Licenciat, and had made his choice, he wanted to be a mathematician.

Via Paris to Nancy and Operator Algebra

He brought with him a long paper, where he had rediscovered a very general form of the Lebesgue integral! This must have helped him to get in touch with the operator group in Nancy, composed of Jean Diedonné, Jean Delsarte, Roger Godement and Laurent Schwartz, all very famous mathematicians, even then, and members of the Bourbaki Group. He got Schwartz, as his advisor and defended his thesis in 1953, on the theory of tensor products of Banach spaces. A reworked version was published in 1955, in the Memoirs of the American Mathematical Society, No 16, with the following dedication:

- Meiner Mutter
- Hanka Grothendieck
- in Verehrung und Dankbarkeit gewidmet.

Hanka Grothendieck died in 1957. She never recovered from her war-time sufferings. As many of Alexander's friends witness, he stayed very close to her all through his life, making her a kind of a Goddess-Mother, in his later theological fantasies.

End of the Beginning

In this paper, "Produits tensoriels topologiques et espaces nucleléaires" he does not refer to his thesis, but he thanks Dieudonné and Schwartz for help. He had to publish an "Erratum au Mémoire" in the Annales de L'Institut Fourier, the same year. Dieudonné had discovered an error in one of his proofs, and Grothendieck ads to this, by constructing a counterexample to his own theorem.
But now Grothendieck was on a completely new track. He had left operator theory. And later in his life he rarely looked back to this work of his. Cartier tells us that he ended up looking a little down on the people that continued his work in this direction. From his point of view, operator theory was part of the same physics that had created the atomic bomb, and the disaster of Hiroshima.
He left Nancy, and Functional Analysis, but also his first child, his son Serge, the result of a relationship with his landlady. The first of five children, born by three mothers.

Proceedings of the IMC, 1954

The start of the Grothendieck era can be seen, in the history of the IMC in Amsterdam, Friday September 3. 1954, where at 4.40-5.10, in room 2, The Field Medalist, J.P. Serre talked about "Cohomologie et géométrie algébrique", invited by the Organizing Committee. By comparison, Thorvald Skolem got 45 minutes in room 8, to talk about: "A critical remark on foundational research." Serre had become the youngest member of Collège de France, that year I believe, less than 30 years old, and his influence in French and World mathematics grew, from year to year.
As a side remark, I should say that I was happy to seal off the first Abel Prize, putting the standard as high as possible, by pushing the most prominent members of the Abel Committee to choose Jean Pierre Serre.
One month after coming home from Amsterdam, Serre sent his famous manuscript, FAC, "Faisceaux Algébriques Cohrents", to Annals of Mathematics, where it appeard in Vol 61, No 2 in March 1955. This was a turning point in the history of algebraic and analytic geometry; this made algebraic geometry, just that, a Geometry, where the objects were Spaces.

Proceedings of the IMC, Edinburgh 1958

The next ICM in August 1958, took place in Edinburgh, and Grothendieck was now one of the main invited lecturers. Henri Cartan talk had the title; "Sur les fonctions de plusieurs variables complexes: les éspaces analytiques.", Chevalley's; "La théorie des groupes algébriques", and Grothendieck's talk was on the same subject Serre talked about in 1954, "The cohomology theory of abstract algebraic varieties". Hirzebruch also talked, on "Komplexe Mannigfaltigkeiten".
This was the start of a decades battle in analytic and algebraic geometry, with the search for a Weil cohomology of an algebraic variety, with coefficients "something as good as as a field of characteristic 0" proving the Weil conjectures. These conjectures had relations to one of Norway's strongest mathematical fields, Diophantine equations. One would like to know how many points with integer coordinates, modulo a prime p, N_p, one might find on a plane algebraic curve.

The Hasse-Weil conjectures

Hasse had proved, in 1936, that for a plane algebraic curve with equation $y^2 = x^3 - ax - b$, where a and b are integers we have the inequality, $|N_p - p| \leq 2p$. In 1940, when on the run, for desertion, in Finland and Sweden, André Weil had announced a startling generalization, where for any plane curve $f(x, y) = 0$, with integer coefficients there should be a corresponding formula,

$$|N_p - p| \leq 2gp$$

where g is the genus of the curve. Weil proved this in 1948, and it was generalized by Weil and Lang in 1954, to the case where we have m equations $f_i = 0, i = 1, ..., m$, in n variables and the inequality looks like,

$$|N_p - p^d| \leq 2Cp^{d-1/2}$$

where d is the dimension of the variety cut out by the equations $f_i = 0, i = 1, ..., m$, but where the constant C was difficult to determine.

The quest for the Weil Cohomology

In 1949 Weil proposed that one might get an exact formula, not only an inequality, and also determine C if one could find a cohomology theory, today just called a Weil cohomology, for all schemes, with certain good properties.
And now Grothendieck proposed that finding such a theory would be within his reach, in the next few years. I remember he said something like 3-5 years, but this is not in his printed lecture. It should, however take more than 10 years, and an awful mass of new mathematics, to sort out the basics of this project. Many people went to work on the problem, and as usual, Serre was a central player.
But, still today, the notion of a Weil cohomology haunts the mathematical community. It has now been baked into the theory of Motives, which I shall, maybe, come back to.

The Weil conjectures

Let X be a nonsingular projective variety of dimension n over $\mathbf{F}_p$, and put, $X(\mathbf{F}_{p^m})$ the set of $\mathbf{F}_{p^m}$-points in X, and $|X(\mathbf{F}_{p^m})|$ the number of such points. Define the Weil ζ function $Z(X,t)$ by,

$$logZ(X,t) = \sum_{m \geq 1} |X(\mathbf{F}_{p^m})t^m/m.$$

The Weil conjecture then says,

$$Z(X,t) = \frac{P_1(t)P_3(t)...P_{2n-1}(t)}{(1-t)P_2(t)...P_{2n-2}(t)(1-p^n t)}, P_i(t) \in \mathbf{Z}[t],$$

where,

$$P_i(t) = (1-a_{i,1}t)(1-a_{i,2}t)...(1-a_{i,b_i}t), \ |a_{i,j}| = p^{i/2}.$$

The P_i are the characteristic polynomials of the action of the Frobenius on the $H^i X$, the "Weil cohomology".

The ICM 1958, Side Remarks

This was also the year when Nash, one of this years Abel Laureates published his "The imbedding problem for Riemannian manifolds", and the other Laureate, Nirenberg, gave his talk about "Inequalities for derivatives".
The Norwegian delegates, Selmer, Reiersøl, Piene , Erik Alfsen, and Viggo Brun, gave talks, Alfsen talked about: "Non linear integration" and Viggo Brun gave a talk on "An application of a "carpenter's curve" to Simpsons formula". I remember that I had some funny feelings with respect to the choice of theme of my old and respected teacher, and in solidarity with him, I decided to listen to his talk. From my place in the 3 bench-row I saw André Weil come in sitting down on the first row. My stupefaction was total, until I learned about the loan/gift of kr. 100, that Brun had sent Weil, when he was stuck in the north of Sweden in 1940! The story goes that no swede would give him money, as he was a deserter from the French Army, even his former friends refused. Viggo Brun, however was a steadfast humanist.

The Grothendieck Seminar

I came to Paris in 1957, for a one year stay at the Ecole Normale Superieure, and I saw Grothendieck some times, at the Thé des Mathématiciens, at the Institut Poincaré, and at seminars during that year. I was there when he entered the seminar hall with a bonnet, and everybody started shouting "chapeau", so that after some time he had to take his "hat" off, and thereby reveal that he had razed his head, creating the Grothendieck we know from pictures. In the Spring 1960 I was back in Paris, and joined a small group of friends from ENS writing notes of the seminars of, among other, Grothendieck. The first ones, in 59-62, were located at the Fondation Thiers, not too far from l'Arc de la Triumph, a place so anti-Grothendieckien as possible, Thiers was the butcher of the Communardes of 1871. But Grothendieck accepted this provisional housing of the IHES, but quit the beautiful place IHES, at Bures-sur-Yvette, created for Dieudonné and him, by Léon Motchane, with the help of Oppenheimer, when he at the end of the 1960's understood that the Army was part of the financial bases for the Institute.

Working with Grothendieck?

When I was asked to come here to talk about Grothendieck I looked through my old papers, stacked away in a summer house in Telemark, after my eviction from the Institute of Mathematics in Oslo. There I found my notes, duely typed by myself of two seminars, in the SGA II, published in 1962. Our group is mentioned in the Introduction of SGA II, but it would be a lie to say that we were considered as his assistants. I do not remember ever to have had a a conversation with him, on my premises. And I have a memory of a strange 1/2 hour buss-trip from the Fondation Thiers to Jardin de Luxembourg, sitting side by side without he uttering a word! He had gotten used to have helpers, or slaves if you wish. Even Dieudonné, writing the EGA, Borel and Serre writing Grothendiecks paper on the Grothendieck-Hirtzebruch Riemann Roch, were willing helpers, and seemingly accepted their situation as just that.

The ICM 1962, Stockholm

The conference in Stockholm in 1962, with King and Queen, opening and closing sessions in the Concert Hall, was impressive in itself, but for some of us young people, also much more. It was, in a sense, the consecration of Grothendieck's mathematical ideas (his new evangelium). As we have seen through the Proceedings of the ICM of 1958, Grothendieck had already 4 years before, gained an impressive position in mathematics. From his work on homological algebra, "Sur quelques points d'algèbre homologique, "the Tohoku paper, 1957, through his seminars i Paris, and in the United States, and some seminal papers, to his massive 3-volume EGA, written with the help of Dieudonné, had made his general philosophy in mathematics known far outside algebraic geometry. So even though Weil and some of the other big shots in contemporary mathematics had problems with the excessive generality, and strange language, he had become the one that made the rules. And the one that spelled that out, was Jean Pierre Serre, in his talk in Stockholm, entitled "Géométrie algebrique". Here the scheme theory, as basis for algebraic geometry was taken for granted.

ICM,1966, Moscow, Field Medal.

At the ICM in Moscow in 1966, George de Rham, Chairman of the Fields Medals Committee, announced the prize vinners: Michal Francis Atiyah, Paul J. Cohen, Alexander Grothendieck, and Stephen Smale, and added. "Unfortunately, A. Grothendieck, was unable to come".
This was an uneasy time in Europe, with quite a lot of political stress, and even though the borders were more or less open, so that Dan Laksov could buy a car in Paris, and bring his new girlfriend to Moscow, and hear his exhaustpipe fall off in the middle of the Red Square, without being molested, things were not so simple.
I got a very nice looking girl, said to be the Norwegian Delegations Guide and interpreter, taking very well care of me, much better than of anybody else in the Delegation. She had cards so we could see, eat, and not be bothered by the queues, all over the Town. Why me? Well, I was an "army captain" and head of the Norwegian military research group on Codes and Ciphers!

Field Medal.

I assume that Grothendieck did not want to be honoured in the capital of the Soviet Union, that imprisoned and ex-pulsed his father, and foiled the struggle in Spain. His excuse was strictly political, and there should, soon be much more politics involved in his actions. Added to this was, of course, the fact that the final battle of Berlin, destroyed all birth certificates, and all other official papers, concerning his identity. He had no official statehood, and traveled with a Nansen Passport issued by the United Nations. Pierre Cartier tells us that Grothendieck delayed applying for French citizenship until, at the end of the 1980's, when he was convinced that he could no longer be called up to serve in the French Army.

Field Medal

Henri Cartan gave the laudatory talk for Atiyah, and Jean Dieudonné for Grothendieck. Dieudonné, among the young mathematicians in Paris, often called the Chicago Cop, was a tuff guy, with high regards for his own judgement, but his opening words: "Chacun sait que Grothendieck est le principal artisan de la rénovation de la Géométrie algébrique qui s'accomplit sous nos yeux", were received with obvious acceptance. Dieudonné went through the history of algebraic geometry of the century, and ended up with comparing Grothendieck to Hilbert, a heavy burden for a not yet 40 year old mathematician. In between he summed up the main points of the work of Grothendieck up to 1966.

The Legacy, as Dieudonné saw it

First, the idea that any commutative algebra should be considered as a space, the Affine Scheme of the algebra, a notion my teacher Chevalley, had coined in the middle of the 50's. He had taken the idea from operator theory, developed by Gelfand and Shilov, and already important in the development of quantum theory. But Grothendieck changed the definition. For Chevalley, the points were the maximal ideals, or the local rings associated to them, for Grothendieck the points were the prime ideals. This seemingly minor change of definition, made it possible for Grothendieck to focus on the "morphisms" as the main objects. Dieudonné stressed this point and for good reasons. For algebras, morphism are just the homomorphisms, for schemes it corresponded to mappings, intuitively of the same kind as topological or differential maps, and therefore gave a way of extending the notion of scheme, from the affine, to general, by gluing together affine schemes via partially defined isomorphisms. This was the new version of the "abstract varieties" of André Weil. And it all fits with the ideas of FAC, Serre's paper, the Bible of the time, for algebraic geometers.

The mid 60's

What had happened during the years between 62-66, is well documented. I left Paris for an Assistant Professorship in Oslo, in Summer 1962, so my first hand knowledge of the Paris mathematical battles stopped. My friends Giraud, Verdier and Douady tried to keep me updated, but I lost a little track until the ICM in Moscow. Reading the letters between Serre and Grothendieck, published as "Grothendieck-Serre Correspondence" in 2004 (2001) by The American Mathematical Society, and the Société Mathématique de France, the story comes alive. To me, the report that Jean Pierre Serre sent Grothendieck from the conference at Woods Hole, i 1964, was one of the most important inputs into Grothendieck work during these years. And his results are amazing. The seminars at IHES , at the Séminaire Bourbaki, the continuation of the EGA, with Dieudonné, contain a mass of new mathematics, today used in almost all of the Mathematical Sciences, and sometimes taken so for granted that the origin is subdued. Oddly enough these ideas are now also in the for-front of modern Physics.

The end of the 60's

What happened next, during the years between 66 and 70, is part of European history. The student revolts, in Paris in 1968, in Berkeley, the same school year, had deep effects on the French Educational and Research System.

The Nordic Summerschool in Mathematics, Oslo August 1970

In 1969, Karl Egil Aubert, most Norwegian mathematicians know his name, had the glorious idea to apply for a grant in the series of Nordic Summer Schools, funded by the Nordic Cultural Commision, with the purpose of stimulating mathematical research within the Nordic Countries. Algebraic geometry was not an obvious choice, it was in the Nordic countries represented, on a serious level, by very few, and among those by just a handful that had really understood the revolution that had taken place since the War. I just came home from almost three years in the US, at Syracuse, Urbana Illinois, and a year at Berkeley during the student uprising, and Karl Egil and I had many good contacts in France. Together with Audun Holme we got together an impressive list of top mathematicians, and the resulting Proceedings, edited by my good friend, with contacts at Wolters-Noordhoff, Frans Oort, has become a source book for many of the subjects developed by Grothendieck.

The Nordic Summerschool

Kleiman told us about Motives, Martens and Mumford about Moduli Spaces, Swinnerton-Dyer gave "An outline of Hodge Theory", and Hironaka gave two long seminars on Schemes ETC. and a proof of his Resolution of Singularities Theorem. But Grothendieck did not answer the invitation, as far as I remember.

Grothendieck, Weil and Lubkin

One incident, in Oslo of interest for the Grothendieck story, was the presence of Saul Lubkin, a good friend of mine from the US. He had with the help of André Weil, published in Annals of Mathematics, two thick papers on the Weil conjectures. I had reproved part of the basic theorem, using very few pages, and Lubkin was impressed. Now I had a sneaking idea that part of what he would talk about in Oslo, would not be fit to print, so I proposed that I should take notes, and prepare a manuscript for him. He agreed, and I followed his 2 or 3 talks, and found that he had flipped out, again. Like Nash and Grothendieck, Saul Lubkin had been a wander boy, at Columbia, and Berkeley, but with regular psychological break-downs. He had, as long as I had known him, alternated between being a very fundamentalistic orthodox Jew, and a nice all-american mathematical wander-boy with very few inhibitions. It turned out that Grothendieck had written a very obnoxious letter, stripping Saul of all glory, also of his earlier work, and telling him to go jump in the lake. Immediately after the conference some of us climbed into my car and drove down to Nice for the ICM.

The ICM 1970, Nice

September 1. 1970, M. Olivier Guichard, Ministre de l'Education National, declared the congress opened, and Henri Cartan, President of IMU had Jean Leray elected President of the Conference, before he announced the winners of the Fields Medal, Alan Baker, Heisuke Hironaka, Sergei Novikov and John G. Thomson.
I knew Cartan well enough to see how proud he was. His work, making French mathematics top rank had produced wanders. Dieudonné, now the Dean of Sciences in the newly created University of Nice, was the organiser of the ICM, and Grothendieck had now the task of giving the laudatory talk for Hironaka Hironaka, for a work exemplifying the success of his own scheme theory.

A strange Laudatory Talk

In the published paper, he cites some of the most important results of the resolution of singularities theorem . Point b) is interesting. It concerns the possibility of computing the complex cohomology of an affine algebraic variety defined on the complex numbers, with the aid of the algebraic de Rham complex. To a perfectly ordinary sentence, he ads the following parenthesis (Grothendieck: divers raffinements inspiré par une question soulevé par Atiyah et Hørmander, ont été developpés par P. Deligne). Later on he laudes the effort of Hironaka, the difficulties of the proof are, "les plus monumentales qu'on connaisse en mathématique." And then he claims that the this proof introduces new algebraic geometric ideas, the role of which, in the future development of algebraic geometry, is too early to evaluate. Then an (*) "Cela est d'autant plus vrai que le développement de la géometrie algébrique s'arrtera court, comme tout le reste, si notre espèce devait disparatre dans les prochaines décades,-évantualité qui apparat aujourd'hui de plus en plus probable."

The End-Game I

Unluckily, this also turned out to be a turning point of the Mathematical Life in France. Dieudonné who had worked with Grothendieck since the 1950's, and had put all his energies into creating the IHES for his protege, was now dismissed by Grothendieck.
Grothendick had, in the aftermath of his Field Medal, begun to occupy himself more and more with politics, "aux sens large". In 1968 he formed a little group that published a newsletter called Survivre, an later Survivre et Vivre. The message was gloomy, Cartier calls it an "ecolo-catastrophe-oriented sect". The war in Algeria was, of course, the back-drop., and one may speculate in the relation between his memories and maybe his constructed heroic tale of his father, and his newfound activism. Anyway these years saw a completely different Alexander Grothendieck take form. He refused the very prestigious Crafoord-Prize in Sweden, he resigned his possition at the IHES, got a Professorat Associé at the College de France, held it for 2 years, and then took off.

The End-Game II

The rest of the tale is sad, even though there are also interesting and funny stories to be told about his life and actions. He could no longer hold a usual position in the French Research System, and went back to an ordinary University Professorship at his Alma Mater, the University in Montpellier, from where he resigned at the age of 60 in 1988. I know some of his last student there. They despised him, and left Montpellier as fast as they could.

He started making fun of his old students. Most of them, 19 in total, had not understood a thing of what he had given them. The only truly faithful was Deligne, until he proved the Weil conjectures using a different method, than the one Grothendieck had proposed. Then, in 1974, he also was out.

End Game III

Some years later, Grothendieck was ordered by God to announce that the World would end, totally End, at a certain date. He wrote 3-400 letters to his former students and scientific contacts, telling them to repent. The salvation would be for only a very few! The date came and he sent a new letter, retracting everything, God had told him that he, Grothendieck, was the Sinner. The Devil became more and more real for him, and he was frightened by the approaching death.
He also saw the Devil behind the change of speed of light, from the obvious harmonic one, 300.000km/sec, to 298.779 km/sec.

Sad Stories

His sons, and his only wife, and Verdier's rescue-operation. His court case for getting child care over his son and his half-brothers and sister in Nancy. His condemnation for hosting a Buddhist Monk.

Cartier's: In place of a conclusion.

For a conference at Cerisy-la-Salle, Cartier wrote: "Mathematics sees itself as the most *objective* of all the sciences. At the very least, its *intersubjectivity* requires that the mathematical experience be as detached as possible from the affect of the mathematician, in order to be communicated without distortion, respecting its collective nature. The mathematical subject, conceived to be the mathematician subject present behind the creation, is required to disappear, and in practice, this disappearance is quite effective.

Cartier's: In place of a conclusion.

In this situation, Grothendieck represents an extreme special case. He, whose father was at the heart of every social combat for half a century, lived outside the world, even much more so than the traditionally absent-minded professor. Even in his mathematical milieu, he wasn't quite a member of the family, and essentially pursued a kind of monolog, or rather, a dialog with mathematics... and God, as he did not separate the two things. His work is unique in that his fantasies and obsessions are not erased from it, but live within it, and takes its life from them: at the same time as he gave us a strictly mathematical work, he also delivered to us, in a Freudian sense, what he believed to be meaning". .....
"The name-is that of the father."