

Newsletter

BELGIAN MATHEMATICAL
SOCIETY

109, September 15, 2016

Comité National de Mathématique CNM

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NCW Nationaal Comité voor Wiskunde

**Newsletter of the Belgian Mathematical
Society and the National Committee for
Mathematics**

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Welcome to the September edition of the BMS-NCM Newsletter!

Dear BMS member,

I hope you have had a nice and fruitful Summer time. In July some of you attended 7ECM, the 7th European congress of Mathematics. The weekend before there was a meeting of the Council of the European Mathematical Society. During that meeting it was decided that the **next European congress of Mathematics will be held in Slovenia from July 5th till 11th, 2020**. A preliminary website is already online at <http://www.8ecm.si>. We wish our Slovenian colleagues good luck with the organisation of the congress.

In case you visited Paris during Summer, you might have seen the following sign on the house at 16 rue des Bernardins, Paris 75005.

ÉVARISTE GALOIS
1811 -1832
MATHÉMATICIEN ET RÉPUBLICAIN
L'UN DES FONDATEURS DE L' ALGÈBRE MODERNE
A VÉCU DANS CET IMMEUBLE EN 1831

This commemorative plaque was inaugurated on May 31st in presence of Anne Hidalgo, the mayor of Paris, and Cédric Villani.

Sometimes we read that it was in the house of the rue des Bernardins that Galois wrote the 3 letters on the night before his death. This is not correct. Galois wrote these letters in a room of a pension more South of Paris, where he had been transferred from prison in March 1832 because of a cholera epidemic in the city. This place was very close to the *étang de la Glacière*, where Galois died in a duel on May 30th, 1832. You can read much more about Galois in <http://www.patrimoine.asso.fr/contenu/galois/EVARISTE.GALOIS.pdf> (in French).

On the sad side, we heard that Jean-Christophe Yoccoz passed away at the age of 59 years only. Yoccoz (May 29, 1957 – September 3, 2016) was an expert on dynamical systems and was professor at the Collège de France. He was awarded a Fields Medal in 1994. In that same year, our fellow Belgian mathematician Jean Bourgain (born 1954) was also awarded a Fields Medal. In our previous newsletters we announced the conference *Analysis and Beyond*, celebrating Jean Bourgain's work and impact, held at the IAS in Princeton in May. For those who could not attend the conference, the IAS has made available video recordings of all lectures online at <https://video.ias.edu/analysisbeyond/2016/0521-24>.

A few weeks ago the movie *The Man who Knew Infinity* appeared in the movie theatres in Belgium. If you have time you should certainly go and see it. The movie tells the story of the life and academic career of the pioneer Indian mathematician, Srinivasa Ramanujan, and his friendship with his mentor, Professor G.H. Hardy.

Philippe Cara,
president of the BMS

1 Meetings, Conferences, Lectures

1.1 September 2016

Save the Date !

21 September 2016

The Vrije Universiteit Brussel invites you to the conference

*The Beautiful Impact of Mathematics in Society (BIMS)
at the VUB-campus in Etterbeek on the 21st of September 2016.*

View in your browser

<http://us4.campaign-archive1.com/?u=3c9d3c0660d4be7659f505d77id=22c0f00997e=e2048cbaa0>

Mathematics is invaluable in science and technology, however it is seldom explicitly visible in our society. At this conference we put mathematics in the spotlight and work towards an integrated approach for mathematics in education, teacher training, research, society and innovation.

We have put together fascinating program featuring 6 inspiring speakers.

Day program (VUB-campus):

- 09:00 Welcome by our new rector Caroline Pauwels;
- 09:30 Wil Schilders (Director Platform Wiskunde Nederland), Deltaplan Wiskunde (NL);
- 10:30 Raymonda Verdyck (Head of Gemeenschapsonderwijs GO!), Mathematics in education (NL);
- 11:30 Etienne Ghys (Mathematics researcher renowned for his science communication), Mathematical research (EN);
- 14:00 Jan Bogaerts (Head of European Organisation for Research and Treatment of Cancer), Mathematics in Healthcare (EN);
- 15:00 Ton Kalker (VP of DRM Software Security at DTS), Mathematics in Industry Innovation (EN);
- 16:00 Simon Singh (Writer of the blockbusters "Fermat's Last Theorem" "The Code Book"), Stimulating mathematical talent (EN).

In the evening at 19:00 we share our pleasure in doing mathematics by delving together in some mathematical problems and enigmas while having drinks in the center of Brussels "A la Mort Subite": a real Maths Jam!

Registration is free but required.

Click the links for more information and to register:

<http://www.wtnschp.be/event/the-beautiful-impact-of-mathematics-in-society/>

1.2 May 2017

Save the date!

*Joint VVWL–SBPMef–BMS congress
Brussels, May 25–27, 2017*

In May next year we plan a joint conference with the two main teacher's associations in Belgium: the [Vlaamse Vereniging voor Wiskundeleraars](#) (VVWL) and the [Société Belge des Professeurs de Mathématique d'expression française](#) (SBPMef). The conference is aimed at highschool mathematics teachers and other professional mathematicians who care about mathematics education.

More information in our next Newsletters!

1.3 August 2017

11th International Conference on Clifford Algebras and Their Applications in Mathematical Physics

Date: 07.08.2017 – 11.08.2017 – **Venue:** Ghent University, Faculty of Engineering and Architecture, Jozef Plateaustraat 22, B-9000, Gent, Belgium

Main organizer: Hennie De Schepper – **Info:** <http://www.icca11.ugent.be> – **Contact:** <icca11@ugent.be>

2 PhD theses

No thesis announcements this time.

Will you defend your PhD soon? Do you have a student who is about to obtain his PhD? **Grab the opportunity to announce it in our Newsletter!**

Next Newsletter will appear on November 15. The deadline for contributions is November 10. Contact Françoise Bastin <F.Bastin@ulg.ac.be> with title, abstract and defence date/place.

3 History, maths and art, fiction, jokes, quotations ...

3.1 Movie

Have a look at informations and review about the film "The man who knew infinity" (in fact Ramanujan): <https://www.youtube.com/watch?v=NP0IUqNAw3k>
and <http://www.ams.org/journals/notices/201602/rnoti-p178.pdf>

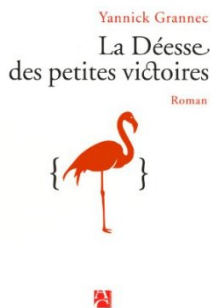
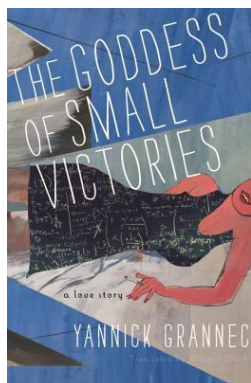
3.2 Adhemar's corner

To read during autumn evenings and ... anytime, please find here some reviews from Adhemar Bultheel.

The goddess of small victories Random House, 2014, ISBN 978-1-59051-636-2, 464 pp.

La déesse des petites victoires Éditions Anne Carrière, 2012, ISBN 978-2843376665, 468 pp.

De godin van de kleine overwinningen De Arbeiderspers, 2014, 978-9-029588409, 414 pp.
by *Yannick Granneec*.



Yannick Granneec

Kurt Gödel (April 28, 1906 – January 14, 1978) is considered to be one of the greatest logicians of all times and he has certainly shaken the foundations of mathematics in the 20th century.

Because of an illness in his youth he had a weak heart for the rest of his life. For his doctoral subject at the University of Vienna, he decided to work on the completeness problem formulated by Hilbert which resulted somewhat unexpectedly in his famous incompleteness theorems from 1930. These state that in the axiomatic system that is used in mathematics there are true statements that can never be proved. It stopped the formalism of Hilbert culminating in the *Principia Mathematica* by Whitehead and Russell abruptly.

He met his later wife Adèle during his PhD studies, but since she was a dancer in a nightclub, divorced and six years older than Kurt, his family resisted against a marriage.

He was teaching at the university when one of his students Moritz Schlick was murdered by a nazi sympathizer. This resulted in a nervous breakdown of Gödel. He developed a paranoid fear of being poisoned and he had to spend a long time in a sanatorium to recover.

He gave a lecture at the AMS annual meeting in 1933 where he met Einstein. They were good friends ever since. In 1934 he visited the *Institute of Advanced Studies* (IAS) to give a lecture series, but then he got another depression from which he had to recover.

He finally married Adèle on 28 September 1938 and they left one year later for the US after the *Anschluss*. They traveled with the *Trans Siberian Express*, crossed the Pacific from Japan, and then took the train to Princeton where he had accepted a position at the IAS.

In 1947 Gödel applied for American citizenship for which he and his wife had to pass some kind of exam before an American judge, which is a kind of formality. However Gödel had studied the constitution thoroughly and claimed that there was an inconsistency that allowed the US to become a dictatorship. Einstein and Morgenstern accompanied him and fortunately Einstein knew the judge and the citizenship was awarded anyway.

He has contributed many other results to logic, philosophy, and he computed solutions of Einstein's general relativity field equations that would allow time traveling. He gave this to Einstein for his 70th birthday. Later in life he produced notes to prove the existence of God. In 1951 he and J. Schwinger were awarded the first Einstein prize.

He suffered however also periods of depressions and again afraid of food poisoning would only eat when his wife forced him to. When she fell sick and had to be hospitalized for a longer time, he literally starved himself to death.



Kurt & Adèle's marriage



A. Einstein



W. Pauli



R. Oppenheim



K. Gödel

These are some of the historical facts against which Yannick Granec has written a fiction novel. She is a French graphical industrial designer with a strong interest in mathematics. She was struck by the situation of Adèle, who was married to a man obsessed by mathematics, while she had a totally different background and without higher education. How was she living in Princeton where the IAS at that time attracted the top scientists of the whole world and where the foundations of mathematics and physics were rewritten. A time when the first computers were constructed, and all this against a background of WW II.



1951 Gödel and Schwinger get the 1st Einstein prize

explain things to Adèle at a level that she could understand. The best way to read this book as a mathematician is to read about Gödel's life and work first, perhaps also somewhat about the IAS and the collection of bright minds that were gathering there in the period 1930-1948.

Adèle Gödel died on 4 February 1981 in a retirement home surviving her husband for 3 years. The plot of the novel is that Anna Roth, a research librarian at the IAS, is assigned to befriend Adèle and try to acquire from her the *Nachlass*, Gödel's legacy, hoping to find there a proof or disprove of the continuum hypothesis. This allows Granec to let Adèle tell her story woman to woman. Anna Roth, divorced and herself the daughter of two mathematicians, has no problem to imagine Adèle's world. Technically, Granec alternates a chapter of Adèle's story of her life and a chapter in which we learn to know Anna. The former based on historical facts, the latter totally fictitious. All in all, it is a rather unfamiliar and very female look at a world of mathematicians from the outside looking in.



Einstein and Gödel

Granec, not being a mathematician, you should not read the book to learn about what exactly Gödel has done for mathematics. Nevertheless, since the mathematics, the philosophy and all these scientists chatting away are essential elements for the book, science does appear, but only at a level that any reader should be able to understand. The trick that Granec uses is that some of these scientists try to

Anna's story starts with her first visit to the retirement home where she meets the stubborn and far from cooperative grumpy Adèle for the first time. Adèle's story starts when she seduces Kurt Gödel when he visits the *Nachtfalter* where she was a dancer trying to get a living after her divorce. Gradually, as their stories advance, the old and the young women start to feel sympathy for each other. Anna's experiences in life have not been easy, but she gradually is pushed by Adèle to pick up her life again, and that includes the shards of her love life, and make the best of it. She comes to a conclusion at the end of the novel after Adèle has passed away.

The most interesting story line is of course Adèle's. Kurt Gödel is sketched as a man constantly in need of being taken care of. In the beginning Adèle tries to help him with a lot of love and care while he is recovering in a sanatorium. They both resist the disapproving family during an impending increase of nazi power. Adèle literally has to defend Kurt with her umbrella when he was harassed mistakenly taken to be Jewish. Crossing Russia by train on their way to Princeton is a terrible experience. In difficult circumstances such as this, all Kurt can think of is his work, while she has to worry about all the practical issues.



1950 Kurt Gödel and Oscar Morgenstern



Adèle



Adèle 1957



Adèle and Kurt Gödel at Linden Lane

In Princeton she is feeling excluded from the conversations, partly because she did not speak English, but also without education, envying the spouses of Kurt's colleagues, and homesick for her family and Vienna. She seems to be the only one in these circles constantly in need of money living in a small flat while others live in fancy houses. Kurt is only working, always it is too cold or too hot for him, and he has an obsession to open the window whether it is cold or not. He is constantly ignoring and neglecting his wife. She draws strength from the visits and diner parties of Kurt's colleagues. Einstein is one of them. It is known that Gödel and Einstein loved to walk together on the campus discussing. Einstein is characterized as a jovial, food-loving, talkative, pipe smoking, sloppily dressed, but quite charming man. The total opposite of Gödel. The science in the novel we learn during the conversations for example between Einstein, Pauli, and Gödel when they have a diner at Gödel's apartment. Or Gödel, Einstein, and Morgenstern when they take a taxi to go to the court house for their "exam" to earn their US citizenship.

When later Adèle can buy a house in Linden Lane, she speaks English better and gets more comfortable with the wives of the scientists, having their girl chit-chat, while Oppenheimer, Hulbeck, Morgenstern, and Einstein, have their discussions about quantum physics, mathematics, art, philosophy, and the political situation under McCarthyism. Oppenheimer came under fire in this which-hunt for communists. Einstein was bugged by the FBI and probably Gödel like other members at the IAS were under surveillance. The Gödels had been in therapy with Hulbeck when

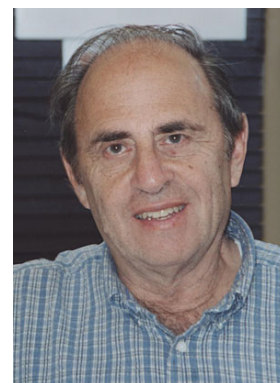
Adèle didn't know how to continue any further with a man like Kurt. His name was actually Richard Huelsenbeck, a German Dadaist poet who emigrated to the US in 1936, and started a psychiatric cabinet in New York under the name Charles Hulbeck. The Gödels befriended him after that.

Grannec describes the reason for the couple's therapy after she lets Adèle have some kind of breakdown, not being able to deal anymore with Kurt's constant yammering, his standard answer 'do as you please' when Adèle asks for his advise, neglecting her, thinking only of his work, never to see her point of view, always recalcitrating when she encourages him to eat something.

Also the visit of Gödel's family causes extreme stress that Kurt takes out on Adèle. While Kurt Gödel is sinking away in further paranoia, constantly complaining about his stomach ulcer, and locking himself away in his room to work, Paul Cohen is visiting. Cohen was slammed the door in his face at the IAS when he had tried to visit earlier, but his visit at the house of the Gödels cheers Kurt up a bit. Cohen proved later that the axiom of choice and the continuum hypothesis were both independent from the Zermelo-Fraenkel axioms of set theory. He won the Fields medal for it in 1966.



R. Huelsenbeck



Paul Cohen



Adèle and Kurt Gödel



Adèle, Kurt Gödel and his mother @ IAS

We read how the couple survives the death of Einstein and other colleagues. The death of Kurt Gödel comes rather abruptly in the novel but of course this dramatic event is rather well known. The death of Adèle comes shortly after that in the novel. At that time the interest has somewhat shifted to the problems of Anna Roth. Adèle has transferred the *Nachlass* to the library as she did in reality, but in this novel, Grannec, via a note of Adèle, gives Anna the credit for it.

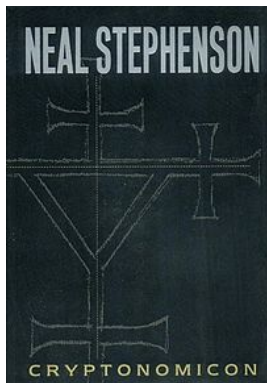
The story of a fictitious Anna has some historical interest, since also among her acquaintances some mathematical discussions take place and we are thus informed about Turing and cryptography, including the public key encryption principle and the RSA coding. Some parts of her story could be left out and seem to be only there for the sake of alteration. The novel won the *Prix des librairies* in 2013. The French pocket edition also appeared in 2014.

A. Bultheel



Adèle and Kurt Gödel's tomb

Cryptonomicon Avon, 1999, ISBN 0-380-97346-4, 918 pp; Luitingh-Sijthoff, 2001, ISBN 90-245-3718-5, 1085 pp; Livre de Poche, (3 volumes) 2001, ISBN 978-2253072362, 541 pp.; 2002, ISBN 978-2253072447, 540 pp.; 2003 ISBN 978-2253072553, 576 pp. by *Neal Stephenson*.



Neal Stephenson

Those we read my reviews here will know that Neal Stephenson is one of my favorite authors. His *Cryptonomicon* is actually a classic from 1999. However, since the Turing year in 2012 and the film *The imitation game* from 2014, cryptography became again a hip topic. So this might be as good an occasion as any to pick up the book again. Although Stephenson is not a mathematician, cryptography seems to be one of his hobbies. It appears in this book and in at least two of his subsequent

books: In *Quicksilver*¹ and in *The diamond age*² where he describes a Turing machine. We still find some mathematics in *Anathem*³ but not cryptography as such.

You can imagine that he can put a lot of characters, adventures, plots, violence and sex in about 1000 pages, but also a lot of mathematics and the latter is somewhat unusual in a novel. Not for Neal Stephenson though. It is *the* techno-thriller *par excellence* that circulated as “the ultimate geek novel” a number of years ago.

I will not explain all fictional and historical characters as they are entangled in the complex plot. It is just too complicated and it might take the tension away when you want to read it. So only in general terms: Part of the events play during and shortly after World War II when the code breakers (among them Alan Turing) at Bletchley Park near London succeeded in decrypting the messages that were encoded by the German Enigma machines. This was extremely important to know the maneuvers of the German submarines, and other strategic plans of the Axis Alliance. However, it was equally important to prevent that the Germans would detect that the code had been cracked, because then they would immediately change their strategy and all the code breaking effort would be lost. So there was a special unit whose main task was to set up a smoke screen for the Germans, so that the successes of the Allied Forces could be explained by pure coincidence not pointing to an interception of coded messages.



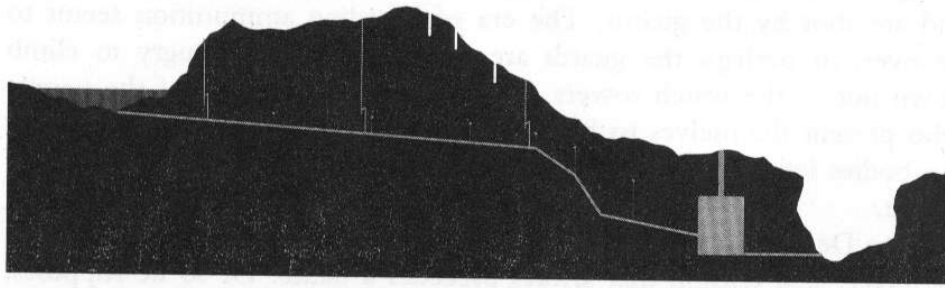
In the novel Lawrence Pritchard Waterhouse is an American code breaker who is involved in this operation. The fighting machine Bobby Shaftoe is an American marine who has to execute some of these jobs behind enemy lines. Shaftoe has an earlier Japanese friend Goto Dengo, who at the time of the war is the enemy. He is building some tunnels and a vault in the Philippines

¹This Newsletter, issue 54, September 2005.

²This Newsletter, issue 89, September 2012.

³This Newsletter, issue 86, January 2012.

where a massive stock of looted gold has to be buried. All workers are supposed to die when this underground system is detonated, but he escapes together with some Chinese slave Mr. Wing.

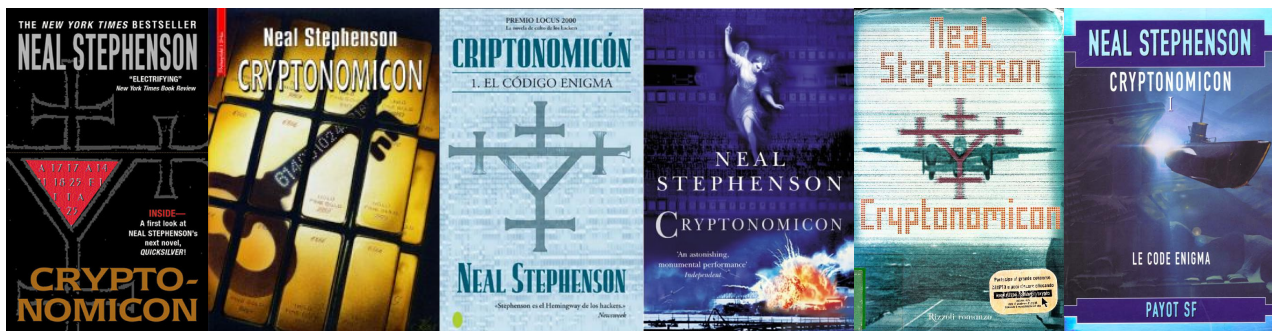


Construction of crypt by Goto Dengo to store the gold

Construction of crypt by Goto Dengo to store the gold

Another part of the story takes place late 1990's where several characters reappear at a later stage of their lives and others are descendants from the people in the first period. Here Randy Lawrence Waterhouse, grandson of Lawrence Pritchard, is a programmer trying to sell software in the Philippines for cheap instant communication. His friend Avi Halaby is CEO of an IT company called *Epiphyte* that is trying to set up a *data haven* nearby. So they become interested in the underwater fiber optic communication cables being installed by a company run by the son of Goto Dengo, and they get help from divers who happen to be the son and granddaughter of Bobby Shaftoe. Anyway, because of legal problems, the objective changes into treasure hunting for gold by several competitors, some who knew, and some who detected it by finally breaking a Japanese code *Arethusa*.

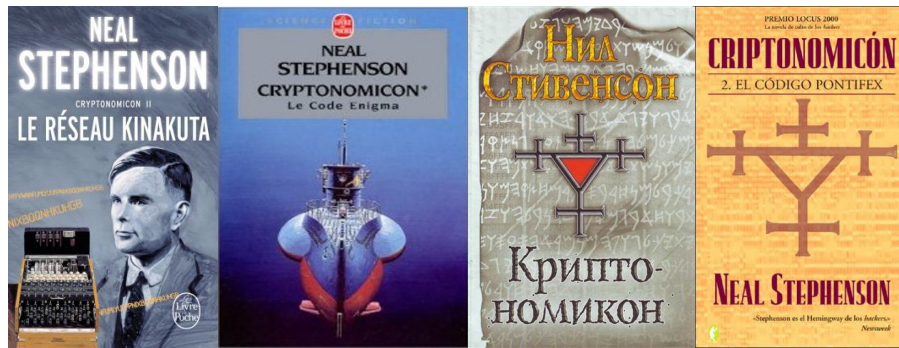
Another part of the story takes place late 1990's where several characters reappear at a later stage of their lives and others are descendants from the people in the first period. Here Randy Lawrence Waterhouse, grandson of Lawrence Pritchard, is a programmer trying to sell software in the Philippines for cheap instant communication. His friend Avi Halaby is CEO of an IT company called *Epiphyte* that is trying to set up a *data haven* nearby. So they become interested in the underwater fiber optic communication cables being installed by a company run by the son of Goto Dengo, and they get help from divers who happen to be the son and granddaughter of Bobby Shaftoe. Anyway, because of legal problems, the objective changes into treasure hunting for gold by several competitors, some who knew, and some who detected it by finally breaking a Japanese code *Arethusa*.



The title *Cryptonomicon* refers to some fictional *Kabbalah* of cryptography that was started by John Wilkins (1614-1672), one of the founders of the *Royal Society*, as one can read in *Quicksilver*. It is continuously updated by selected people and Lawrence Waterhouse is one of them. This Wilkins is an historical figure, and Stephenson mixes several of them in this novel. There are Turing, von Neumann, and Einstein, Douglas MacArthur, Ronald Reagan, and Isoroku Yamamoto and he embeds historical events as well. For example the Americans used Navajo talkers during the war because that was a language spoken by few and hence could not be understood by the enemy. Stephenson creates a fictional archipelago Qwghlm (pronounced Taghum) of two islands inspired by the Outer Hebrides where a language is spoken lacking vocals. It is a British equivalent of the American Navajo language. This is a rather funny episode. Mary cCmndhd (pronounced "Skuhmithid" and anglicized as "Smith") is a Qwghlmian character appearing later in the novel. Qwghlm is further elaborated in *Quicksilver*.

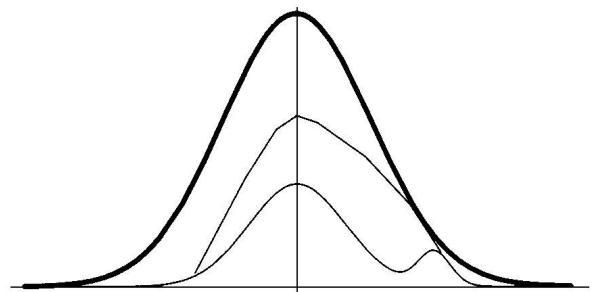
But let me move to the mathematics. Already in the first chapter we read about Turing and Lawrence Waterhouse discussing the evaluation of the zeta function in Princeton, later joined by Rudy Hacklheber, a (fictional) German cryptographer. They discuss Leibniz's symbols, Riemann, Euler, Russell and the *Principia Mathematica*, Gödel, a series expansion for π , and of course some elements of cryptography. Not exactly the start of an ordinary novel. The reader is introduced to elements of cryptography and how they could be decoded by detecting patterns in the code. It was very important to capture some of the Enigma machines from German U-boats, which has actually happened. Once the system is known, then it was important to find the key. In

Waterhouse's mind this cryptographic system the key is compared with a register to be chosen when playing an organ.



The unit that has to generate the smoke curtain for the Germans was originally called unit 2701, but Waterhouse objects because it is the product of two symmetric primes: 73 and 37. That would be too obviously suspicious for German cryptographers like Rudy, and hence the unit is renamed as 2702. When later in a grounded U-553, a safe has to be opened, the combination alternates left-right the numbers 23 - 37 - 7 - 31 - 13, all primes.

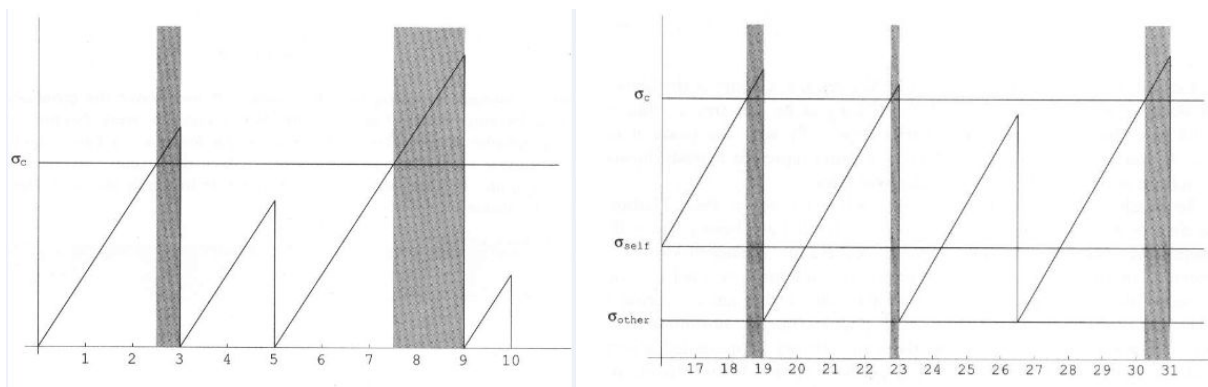
Waterhouse trying to decode the message from the safe consults Turing. Turing had returned from Princeton, now studying radio tubes, a new American technology. The code seems to be based on a one-time key generated by a very large (pseudo) random number that should be generated by some algorithm (could this involve the evaluation of the zeta function?) initiated by a relatively simple key (turns out later to be the date).



Cloaking the deviating Gauss shape

Some women working at Bletchley park should be larger than average because they had to reset highly placed switches at the *Bombe* machines that were computing the keys. This entails a discussion of Gaussian distribution of the length of female employees, which would show a side peak, and hence alert German intelligence agents. What would be a proper strategy to hide the side peak?

Modulo calculus is needed to avoid too frequent repetition in a generated sequence for the code. This is explained with a bicycle (Turing loved cycling) whose chain has a weak link that would break when coinciding with a tooth of the rear sprocket. When the number of links in the chain and the number of teeth in the sprocket have a small common multiple, the chain will break more frequently.



Waterhouse's performance graph

Another fun mathematical model, complete with graphs and formulas is worked out for how

