Newsletter

BELGIAN MATHEMATICAL SOCIETY

111, January 15, 2017

Comité National de Mathématique CNM

NCW Nationaal Comité voor Wiskunde

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

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Contents

What's happening in Belgian Maths?

I don't know. To be more precise: I know something but I would very much like to know more about what is happening in Mathematics. One of the missions of the Belgian Mathematical Society is to be a communication platform among mathematicians in Belgium. For this we set up a web page (which is being modernised by our new web master), a newsletter, a twitter account and a facebook page. So technology is available but we still have to feed it with information. While preparing this newsletter we received almost no announcements or information. I am sure this does not mean that mathematics is dying in Belgium. There are probably lots of channels to spread information and everyone has his favourite. Nevertheless I think it is worth the effort for all our members to communicate events, conferences, seminars and I would like to encourage YOU to do so.

Next Newsletter will appear on March 15. The deadline for contributions is March 8. Contact Françoise Bastin <F.Bastin@ulg.ac.be> with all information you want to share!

You can follow `BelgianMathS` on twitter and tweet announcements or other interesting information to @BelgianMathS.

We also have a facebook page: https://www.facebook.com/BelgianMathS. This page is your page! Please help us to keep it up to date and interesting by sending us nice links and information to Yvik Swan yvik.swan@ulg.ac.be

The end of 2016 brought some important good news for Belgian Mathematics: Jean Bourgain (Fields Medal 1994, since then at IAS Princeton) was awarded the 2017 *Breakthrough Prize in Mathematics*.

The Breakthrough prizes are funded by a grant from Mark Zuckerberg's fund at the Silicon Valley Community Foundation, and a grant from the Milner Foundation. Mark Zuckerberg is the founder of Facebook and Yuri Milner is a Russian entrepreneur involved with many IT companies like Twitter and Facebook. More information at https://breakthroughprize.org/News/34 and https://www.ias.edu/press-releases/2016/bourgain-breakthrough

I wish you all a very happy year 2017 and hope it will bring you lots of joy and great mathematical moments.

Philippe Cara,
BMS president

1 News from the BMS & NCM

1.1 Membership dues for 2017

With the new year also comes the time to renew your BMS membership.

The basic BMS membership fee remains unchanged: 20€ per year. See below for reciprocity membership.

You can either pay via bank transfer (**BIC: GEBABEBB / IBAN: BE70 0011 7447 8525**)
or via PayPal (see http://bms.ulb.ac.be/membership/paypal.php).

Our address is:

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Belgian Mathematical Society
Campus de la Plaine, C.P. 218/01
Boulevard du Triomphe
B-1050 Brussels, BELGIUM
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As a member,

- you will receive five times a year ***BMS-NCM NEWS***, the newsletter of the ***BMS*** and of the National Committee for Mathematics (***NCM***), containing information on what's going on in Mathematics in Belgium.

- you will receive the "**Bulletin of the *BMS* - Simon Stevin**", a periodical containing peer reviewed papers as well as book reviews. If you prefer not to receive the Bulletin of the BMS–Simon Stevin on paper, you can get it electronically. See section 4 for details.

- you will benefit from reciprocity agreements with the AMS, EMS, DMV, LMS, RSME, SMF, SBPMef, VVWL and KWG. This means you get a reduced membership fee for these societies. In case you are already member of one of these societies, your membership fee for the BMS is reduced to 18€. Details can be found on http://bms.ulb.ac.be/membership/reciproc.php

- you give our Society the possibility to develop actions: organizing meetings, promoting Mathematics and lobbying with the authorities.

  Some realizations of our Society: the ***BMS*** has conceived and promoted the online access to **Zentralblatt** in the Belgian universities; starting last year, the BMS also grants (financial) support for initiatives aimed at (future) mathematics students.

1.2 Reciprocity and combined membership

The BMS has reciprocity agreements with the AMS, EMS, DMV, LMS, RSME, SMF, SBPMef, VVWL and KWG. In case you are already member of one of these societies, your membership fee for the BMS is reduced to 18€. Details can be found on http://bms.ulb.ac.be/membership/reciproc.php

We summarize the most common combined memberships:

BMS	20,00€
BMS with reciprocity	18,00€
BMS + EMS	45,00€
BMS + EMS with reciprocity	43,00€

Note that the EMS (European Mathematical Society) membership fee of 25,00€ is allowed only to persons belonging to an EMS corporate member society, such as the BMS. The individual EMS membership fee is 50,00€ otherwise.

Note that it is now preferred that you pay your EMS membership fee directly to the EMS. See http://www.euro-math-soc.eu/ems_payment_new/ems_payment_new.html for details.

For your convenience however, it is still possible to pay for a combined EMS+BMS membership (i.e. 45,00€ or 43,00€) by bank transfer (BIC: GEBABEBB / IBAN: BE70 0011 7447 8525) or PayPal. We will then forward your EMS membership fee to the European Mathematical Society.

1.3 Checking your membership status

To check whether we have received your dues, go to our online database.

Try typing your family name in the search box. If you agreed to have your institution and e-mail in our public database at the time you became a member, you will see your institution and e-mail address. You will also see the year in which you last paid your dues.

If you forgot to pay for more than one year, you will get no response from our database as you are not a member anymore! In this case we suggest you to re-apply for membership by filling out the online form at http://bms.ulb.ac.be/membership/appliform.php and transfer your membership fee asap.

1.4 Address changes

If you would like to alter the information we use to communicate with you (e-mail and/or postal address) or anything else about your membership, you can either fill out the membership form at http://bms.ulb.ac.be/membership/appliform.php or simply contact the secretary of the Society at <bms@ulb.ac.be>.

2 Meetings, Conferences, Lectures

2.1 January 2017

Model theory and applications

Mons, January 16th - 19th, 2017

This workshop will be dedicated to model theory and its applications to algebra and other branches of mathematics. It will be the opportunity to review some lines of the subject as well as to focus on its recent developments. The panel of invited speakers reflects the large diversity of applications.

More details on the website of the workshop http://www.mathconf.org/mta2017

Speakers and lectures

- Luc Bélair (Montréal), The logic of decimals.
- Alexis Bès (Paris-Créteil), Logic, automata and numeration systems.
- Zoé Chatzidakis (ENS Paris), Model theory of difference fields and applications to problems in diophantine geometry.
- Raf Cluckers (CNRS, Lille, KU Leuven), A tameness notion for definable sets in valued fields.
- Paola D'Aquino (Caserta, Napoli2), TBA
- Arthur Forey (ENS Paris), TBA
- Andrew M.W. Glass (Cambridge), The model theory of?-permutation groups (joint work with John S. Wilson).
- Immanuel Halupczok (Düsseldorf), TBA
- Jonathan Kirby(East-Anglia), Exponential-algebraic closedness.
- Angus Macintyre (Queen Mary, University of London), Model Theory of Local Rings and Related Structures.
- Nathanaël Mariaule (Mons), Some remarks about the field of p-adics expanded by a multiplicative subgroup.
- Dugald Macpherson (Leeds), Definable simple groups in valued fields.
- Michel Rigo (Liège), Is Büchi's theorem useful for you?
- Katrin Tent (Münster), Profinite NIP groups.
- Frank Wagner (Lyon), Almost invariant families (joint work with Itaï Ben Yaacov).

See more information at the address https://www.uclouvain.be/684817.html

This conference is organized with the support of FRS-FNRS, CNRL, ASL & UMONS (Complexys)

2.2 May 2017

Joint congress of BMS with Belgian Mathematics Teachers' Associations VVWL and SBPMef

Brussels, May 25th - 27th, 2017

La Société Belge de Mathématique (SBM) organise, les 25, 26 et 27 mai prochains, un congrès à Bruxelles conjointement avec les associations d'enseignants de mathématiques des deux côtés de la frontière linguistique.

On May 25–27th, 2017, the Belgian Mathematical Society will organise a joint conference in Brussels with the mathematics teachers' associations of Flanders and Wallonia.

Van 25 tot 27 mei 2017 zal het Belgisch Wiskundig Genootschap in Brussel een gemeenschappelijk congres organiseren met de verenigingen voor wiskundeleraren van beide kanten van de taalgrens.

Location: Maria Boodschap Lyceum, Moutstraat 22, 1000 Brussel (TBC).

Program:

- **Plenary speakers:**
  - Rik Verhulst (former teacher and lecturer, author of many mathematics books)
  - Giovanni Samaey (KULeuven)
  - Davy Paindaveine (ULB, Godeaux Lecture)
  - Jeanine Daems (One of the "Wiskundemeisjes")
  - Jean Doyen (ULB)
  - Jean Mawhin (UCLouvain)
- **Afternoon:** Several workshops for teachers and academics: TBA
- **Late afternoon/evening:**
  - Round table discussion on why bright and talented pupils don't choose for mathematics studies.
  - MathsJam
  - Cinémath

Each day of the conference will be in a different language (Flemish, English, French).

Registration will soon open at http://bms.ulb.ac.be/mathconf2017/.

Organising committee: Michel Sebille, Christian Michaux, Isabel Goffa, Filip Moons, Yvik Swan, Philippe Cara.

2.3 June 2017

Meeting of the FNRS Functional Analysis group

Han-sur -Lesse, June 8th - 9th, 2017

On June 8-9, "Domaine des Masures", Han-sur -Lesse: Meeting of the FNRS Functional Analysis group. More informations will be available in the next Newsletter.

Groups, Rings and the Yang-Baxter equation

Spa, June 18th - 24th, 2017

A conference on "Groups, Rings and the Yang-Baxter equation" will be held at Domain Sol Cress in the beautiful town of Spa, Belgium. The international conference focusses on recent developments in the areas of ring theory, group theory and the new structure, called braces, that recently has attracted a lot of attention because of its role in a description of set-theoretic solutions of the Yang-Baxter equation. Special emphasis is given on the relations between these areas and in particular on topics where a mixture of methods (involving these theories) has been used. Some topics of particular interest are: group rings, unit groups, (graded) rings and also various algebraic structures used in the context of the Yang-Baxter Equation.

See poster at the end of this newletter and http://homepages.vub.ac.be/abachle/gryb/

3 PhD theses

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 March 15. The deadline for contributions is March 8. Contact Françoise Bastin <F.Bastin@ulg.ac.be> with title, abstract and defense date/place.

4 Electronic version of the Bulletin

We remind you that it is possible to convert your paper subscription to the Bulletin of the BMS into the electronic version of the Bulletin.

If you are interested, please contact Philippe Cara by e-mail (pcara@vub.ac.be with bms@ulb.ac.be in cc) for details.

You will receive a special "subscriber code" with which you can register for the Bulletin of the Belgian Mathematical Society at Project Euclid (http://projecteuclid.org).

5 Job announcements

5.1 From ULB

A full time academic position at ULB! See informations at the address

http://wwwdev.ulb.ac.be/greffe/files/5403.pdf

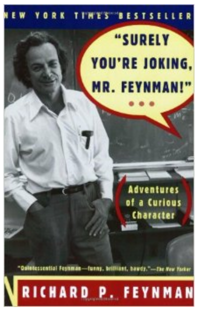
Deadline for application is February 20th, 2017.

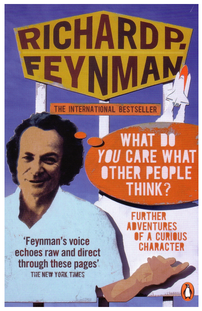
6 History, maths and art, fiction, jokes, quotations ...

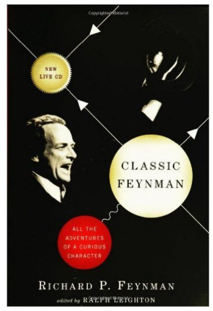
6.1 Book reviews

And as usual, but always to be read with great pleasure, here are some reviews from Adhemar Bultheel.

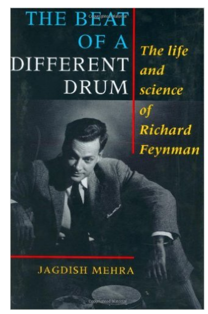
Classic Feynman: All the Adventures of a Curious Character *Richard P. Feynman, Ralph Leighton*
W. W. Norton & Company, 2005 ISBN 978-0393061321 (hbk), 528 pp.

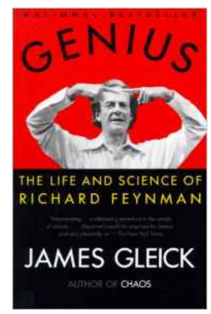






In 2005, two earlier books about the Nobel prize winning Richard Feynman (1918-1988) *Surely You're Joking, Mr. Feynman* (1985) and *What Do You Care What Other People Think?* (1988) were bundled into one volume: *Classic Feynman.* It is a collection of stories told by Feynman with a lot of humor. His friend Ralph Leighton taped the conversations and edited the books. This is indeed a collection of stories, involving only little mathematics or physics, and it should not be considered an (auto-)biography. Plain facts like that he contributed to the development of the atomic bomb in Los Alamos, that he shared the Nobel prize in 1965 for his work on quantum electrodynamics is background information here. Good to know but not essential. More 'scientific' biographies are written by James Gleick *Genius: The Life and Science of Richard Feynman* (Pantheon, 1992) or Jagdish Mehra *The Beat of a Different Drum: The Life and Science of Richard Feynman* (Oxford University Press, 1994) and many others followed in a slipstream of the megasuccess of the first SYJMF. The *Classic Feynman* comes with an extra audio CD with a one hour speech "Los Alamos from below" by Feynman. You can find this speech also on YouTube.





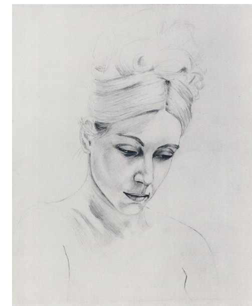
The stories are funny and you get some insight into Feynman's attitude towards science and society. Since the books have been around for a while, many extensive reviews can be found on the Web. His restless mind was always questioning, exploring, and inventing new things, he is an iconoclast not very keen on formal manners. As a youngster he learned himself to repair radios. As an undergraduate at MIT he pranked his fellow students at the Fraternity, and analysed his own dreams. When he got to Princeton, he arrived in an Oxford/Cambridge replica in full English tradition, including the accents, gowns at dinner, afternoon tea, etc. When the dean's wife asks him whether he likes lemon or milk in his tea, he answers absentmindedly "I'll have both", whereupon she answers "Heh-heh-heh-heh-heh... Surely you're joking, Mr. Feynman", which became the title of the first book. This was the first, but not the last time he heard this "Heh-heh-heh-heh-heh..." and learned that it meant he made a social error.

His first public seminar had the usual error of displaying too many formulas while Wigner, von Neumann, Einstein, Pauli and others attending. He was very relieved when they did not ask him questions, but the 'monster minds' discussed among themselves. Feynman's approach to problems is illustrated by his discussion with mathematicians. They claimed it was possible to cut up an orange in a finite number of pieces and put them back together to form a sphere bigger than the Sun. This is based on the Banach-Tarski theorem. However Feynman does not agree. They said 'an orange' and you cannot cut beyond the atomic scale. This shows his heuristic, no-nonsense approach he took in most problems he had to solve.

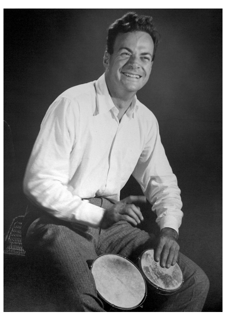
While he was working in Los Alamos on the ultra secret atomic bomb, he challenged his father and his wife to send him letters in code that he had to decipher. The censor demanded that they would include the key for him to read the message. So there was an arrangement that the censor would take the key out before handing the letters to Feynman.

He also tells how he got a fancy for picking locks and cracking safes which he uses in several pranks again. When after the war he wants to join the army, he is rejected for mental reasons, a consequence of his disliking of psychiatrists that he all classifies as fake. He can learn almost anything he sets his mind on. He shows off doing mental arithmetic and when he spends some time in Brazil, he learns to speak Portuguese, and for a conference in Japan, he impresses his colleagues with some Japanese sentences. At the conference, he insists in staying in a Japanese style hotel, unlike most of the other participants who resided in Western hotels. He liked Brazil very much and went several times, and made proposals to reform the teaching system for physics, and learns to play the *frigideiras* during Carnaval.

When challenged by a friend he learns to draw, and with success indeed since the gets commissions for portraits and an exhibition. He signs his artwork with the alias Ofey. He tells about tricks to survive gambling in Las Vegas, and what is the best way to pick up a girl in a bar (he's a notorious womanizer). Another hilarious story is when Feynman gives a lecture in a city college where it turns out to be impossible to pay him (but equally impossible not to pay him) a small amount of money for pure administrative reasons. Thirteen signatures were needed to finally cash a 50 dollar check. Equally funny is the story of conference about "the ethics of equality". The fluffy fuzzy formulations of the other participants from social sciences don't make any sense to Feynman as a physicist. He pledges never ever to go to a conference attended by a 'bunch of pompous fools' again. As member of a committee to evaluate the textbooks to be used in Californian public schools, he didn't want publishers to 'inform' him about their books, but did read them (growing into a grumbling volcano reading the out-of-this-world nonsensical math problems with totally unrealistic temperatures and colors of stars). Since one series of books was not ready in time, the publisher had sent in a dummy copy with blank pages. Hence Feynman did not give a score on that one. However other committee members did have scores even for those.... As a puzzle for himself he wanted to decipher a Mayan table of numbers he saw in a Mexican museum. He covered up the Spanish translation and found out that the repetition in the numbers corresponded to cycles of Venus. However, when he uncovered the Spanish text, it said something completely different. He so detected a fake codex that was used in the translation and so became and amateur 'expert' in Mayan arithmetic.



Ofey drawing



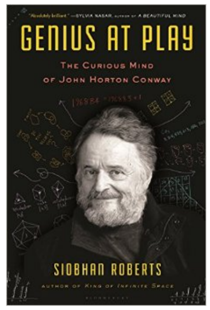
The second book was published shortly after Feynman died of cancer in 1988. Its main part is an account of Feynman's 'adventures' as part of the presidential Rogers Commission investigating the explosion of the Space Shuttle Challenger shortly after launch on January 28, 1986, leading to the deaths of its seven crew members. Feynman used his own direct methods, not following the schedule of the Commission. He so discovered the failure of O-Rings that caused a sealing breach due to resilience loss in low temperatures. He demonstrated this, immersing a sample of the rings in a glass of ice water during a televised hearing. He also discovered other flaws in the communication between engineers and executives. A typical Feynman pun is told at the beginning. When he arrived in Washington, he asked a taxi driver to bring him to 1415 8th street, which turned out to be an empty space way out of the center. The building was in front of his hotel across the street. Roger's offices were at 1415 H Street.

A short story is about his father and a longer one on a how he met his first wife Arline, who got tuberculosis during their dating period. He decides to marry her anyway and while he was in Los Alamos, working in the Manhattan Project, his wife resided near a hospital in Albuquerque a few hours driving away. She died in 1945 shortly before he finished his PhD. This story was used as the script for the movie *Infinity* by M. Boderick that was released in 1996. "What do you care what other people think?" was a sentence that Arline repeatedly said to him, and it became the title of the book.

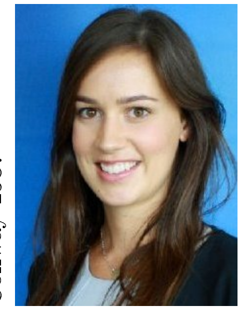
The rest of the book are letters and brief stories, probably left-overs from the first book. Worth mentioning here is a letter to his (3rd) wife Gweneth that he sent on 11 October 1961 from Hotel Amigo in Brussels, while he was attending the Solvay Meeting on quantum field theory. After his talk the participants were invited for a reception at the Royal Palace, not at all Feynman's usual biotope. He is introduced to the king ('the present king is called Baudoin or something...he had a young semi-dopey face and a strong handshake') and the queen ('she is very pretty. I think her name is Fabriola – A Spanish countess she was'). Since the king wanted to know what they were doing there were lectures: 'the old boys give a set of six dull lectures –all very solemn– no jokes'. Later he is introduced again to the king and makes more protocol errors by trying to shake hands again and making jokes, causing embarrassing silences. Later he is asked to meet the queen ('pretty girl but don't worry, she's married'). The queen is sitting at a table with another lady and 'one Priest in Full Regalia (who is also a physicist) named LeMaître'. He continues, giving a short summary of his conversation with the queen. Next day he is invited at the home of the secretary of the queen who has a home 'built in Belgian style': 'after an old farmhouse' with furniture old and new style next to each other ('It is much easier to find antiques in Belgium than in Los Angeles').

Many years after this was published for the first time, it is still recommended reading. A. Bultheel

Genius at Play: The Curious Mind of John Horton Conway *Siobhan Roberts* Bloomsbury 2015 ISBN 978-1620405932 (hbk), 480 pp.




Conway 1987


Siobhan Roberts

Here is a mathematician with an unconventional career who thinks (and lives) outside the box. He is born in 1937 in Liverpool in a family with two older sisters. He got a PhD from Cambridge in 1964 supervised by H. Davenport, was appointed the John von Neumann Chair of Mathematics at Princeton where he is now professor emeritus. He is Fellow of the Royal Society (he expanded FRS as Filthy Rotten Swine) and the American Academy of Arts and Sciences (he appeared at the ceremony wearing green running shorts) and has won several mathematical prizes. Like Feynman, an iconoclast with an overdue hippie attitude.

Conway is probably best known from his *Game of Life* developed in the late 1960s. Not really a game but a cellular automaton. There are living organisms distributed on a square grid and there are rules for birth, death and survival, which depend on the occupation of the nearby squares. Type "conway's game of life" in Google's search bar and you will see it evolve in the right top corner of your screen. He claims he never worked in his life. Just playing a lot of 'home-made' games. Nevertheless he has important contributions to geometry, group theory (the Conway groups, the Monster group), knot theory and number theory. He is most proud on his introduction of a new kind of numbers: the surreals (even though they do not crack Cantor's continuum hypothesis).

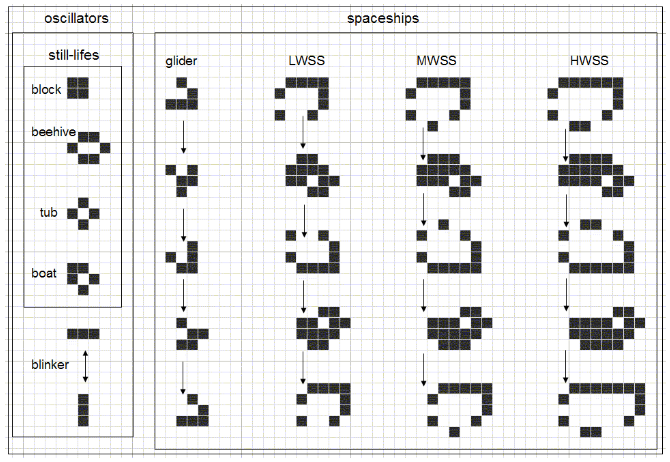
He is very talkative, thinking of many things simultaneously, and very chaotic. His office in Princeton became inhabitable, stuffed with paper polyhedra models hanging from the ceiling, books, papers, unopened letters, and lunch wrappers on the desk, chairs, and the floor. Nothing is organized and he keeps no files, letters or archive. This book reflects this format by jumping from topic to topic, informing the reader about many things in parallel, probably following Conway's thoughts during interview sessions. Quite often she includes long quotes by Conway to give an idea of his way of thinking and expressing himself. She finds letters by Conway in other people's files, but their answer to Conway are mostly lost. An autobiography would be out of the questions because Conway's ego and his problem in distinguishing fiction from facts would probably put the reliability of the account under too much strain.

Conway typically likes to play with sequences like for example his *Subprime Fibs*. Start with two arbitrary numbers. Then repeat the following. Add the last two numbers. If the sum is prime, keep this as the next element, if not, divide it by its smallest prime divisor and keep the result. He ensures that, whatever the starting couple, the sequence will always end in three possible cycles. The sequence is totally useless, and so far no proof has been found for his conjecture. Better known is his *Look and Say* sequence: Start with a number, for example 1. Read it 'one one' nd write it down: 11. Read this as 'two ones' and write that: 21. Then read 'one two (and) one one' so you write: 1211. Next is 111221, then 312211, etc. The sequence has several properties like for example *Conway's Cosmological Theorem* which says that the sequence has 92 different subsequences that do not interact with each other. He call them after the chemical elements. There are a few transuranic numbers and the ratio of the length of two successive elements is called Conway's constant 1.3035772690..., the only positive root of a polynomial of degree 71.

During his undergraduate years in Cambridge he invented with some friends WINNIE (Water Initiated Numerical Number Integrating Machine), a binary water computer with plastic cups, tubes, and strings. Filling the top cup with 1 unit of water represented 1. Adding another unit of water made the water flow to a lower cup, emptying the first one with a siphon system. So that presented 10 etc. It could count to 127 (that is 1111111 in binary). An overflow error caused a flooding disaster.

There is a story of finding the Conway group (1967), which is a simple group, the symmetry group of the Leech lattice, that is related to sphere packing in 24-space. This result brought him math fame.

The Game of Life (1970) was the next thing that spread like a virus worldwide. Although the rules are fully deterministic, it is very hard to predict what the configuration will be after a few steps. If this was a true model of life, then it would contradict his *Free Will Theorem* that he formulated much later (2006) with his colleague Kochen: It states that if humans have free will, then elementary particles possess free will too. He certainly believes humans have free will. Life seemed to have its free will too. The dancing dots on the board of Life evolved into certain "life forms" that get names like beehive, pulsar, blinker etc. One of which is called the glider, which is a configuration that, if left alone, will reproduce and fly off the screen like a space ship to populate the cosmos. Life was 'proved' universal. Later many more configurations were observed like glider guns producing an unending sequence of gliders or space ships, etc. The virus broke loose when Martin Gardner devoted his column to the game in 1970. It was so addictive that it is claimed that in the high days about 25% of all the computers world wide were running the Game of Life. Conway is now all fed up with it, and prefers not to talk about it anymore. Roberts has a long chapter on the impact of Life and all the references that were made to it, not in the least Wolfram's *A New Kind of Science*. There is a multitude of games that Conway invented, played or discussed. Together with E. Berlekamp and R. Guy, they have a 4-volume set of books *Winning Ways for Your Mathematical Plays*. The very last chapter deals with Life and proves the universality theorem.



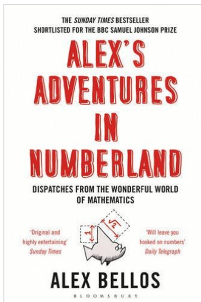
FRACTRAN is another of his inventions: a Turing complete programming language. It is just a list of fractions and some computation rules. Start with an input number. Find the result of the first fraction, multiplied by the input that gives an integer and repeat the operation using this integer result. At certain points in the calculation one finds the result like prime powers of 2 or the digits of pi. All that is needed is an appropriate set of fractions to start with and an input number. It seems magic, but the principle is quite simple because numerators and denominators can be considered as an encoding of registers based on Gödel numbering. So registers get prime numbers. Suppose registers 2,3,5, contain the values 1,0,2 then this is represented as an integer $50 = 2^1 \times 5^2$. If multiplied by a fraction, the numerator will add values to registers and the denominator will subtract values. The details can be looked up in Wikipedia.

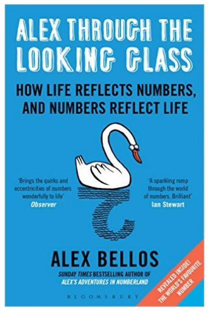
Conway (1978) by Simon J Fraser

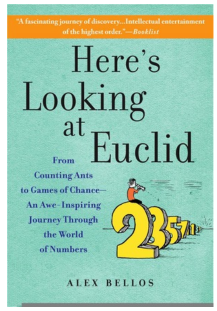
The Monster Group is a sporadic simple group of order about 8×10^{53} Conway (1985) and J. Tits (1985-6) gave simple constructions. Already in 1979 Conway and Norton conjectured the *Monstrous Moonshine*, a connection between the Monster and modular functions, only proved in 1992 by R. Borcherds who got the Fields medal for this. There is of course an extensive chapter on this and on the making of the *Atlas of Finite Groups* (1985) (now available online without Conway's name). The chapter is interrupted by his comments about the *Doomsday Rule*, an algorithm he invented to compute the day of the week for any date, plane tilings, etc. When he opened his computer, it spits out 10 random dates, and he has to answer with the day of the week before he can open a file. The target is to do this eventually in less than 10 seconds. The book rattles on illustrating Conway's attitude towards his wives, and to women in general (Two French women approach Conway and ask pointing to empty chairs: 'May we?' whereupon he promptly answers 'Mais oui!'), his way of teaching (he brought vegetables to the classroom, wrote on chairs, walls or the pavement outside), the Hofstadter-Conway \$10,000 Sequence (he accidentally awarded a \$10,000 prize instead of \$1,000 for who could find the limit behavior of the sequence), his depression after his first heart attack (he had two and two strokes), how he spends a couple of weeks every year at a Canada/USA Mathcamp (a five-week event for youngsters with a passion for mathematics), his ideas about the Free Will Theorem and quantum theory (particles have free will if their behavior is not determined by the past or by randomness), how he got his brain tested like Einstein's (growling and discussing all the time with the people performing the fMRI scan), ending with a long epilogue (illustrating how difficult it is to finish something when Conway is involved). The book ends with some appendices giving technical details of issues discussed, a selected bibliography of Conway, and a reference list.

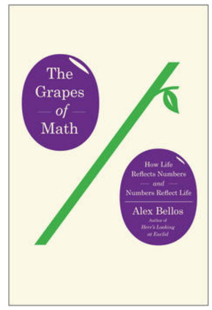
The book reads like a roller coaster ride: you never know where it's turning or what surprise is on the next page. I guess this is how it feels like, interviewing Conway. A. Bultheel

Two books by **Alex Bellos**. The UK editions are
Alex's Adventures in Numberland Bloomsbury, (2011) ISBN 978-1408809594 (pbk), 448 pp
Alex Through the Looking Glass Bloomsbury (2015) ISBN 978-1408845721 (pbk), 352 pp.
and their US counterparts are
Here's Looking at Euclid Free Press, (2011) ISBN 978-1408845721 (pbk), 336 pp.
The Grapes of Math Simon & Schuster (2014) ISBN 978-1451640113 (pbk), 352 pp.







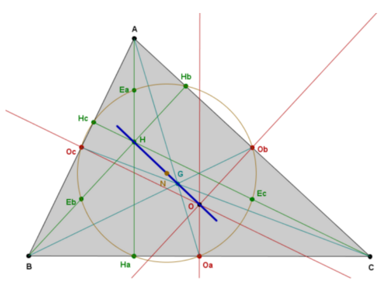



Alex Bellos

Alex Bellos wrote two successful books on popular mathematics. The first one is from 2010 and the most recent one from 2014. It just got a US paperback edition in 2015. The titles chosen may create some confusion because the UK and the US edition got different titles. Although the books are not that recent, they still deserve to be recommended for reading. Alex Bellos is a British mathematician who also got a degree in philosophy. At first he was South-American correspondent for the Guardian and wrote about Brazil. After his return to the homeland he produced these two marvelous books about mathematics.

I like the first one the most. Its subtitle is *From Counting Ants to Games of Chance - An Awe-Inspiring Journey Through the World of Numbers*. It was well received and it won several prizes. It brings an overview of many aspects of mathematics in a way that it is most entertaining for anyone, and you don't need to be a mathematician to appreciate it. It is clear that Bellos enjoys the subject and he doesn't get his information from dull books, but he actually interviewed several people and met them in person, which makes it a lively account. The historical facts and anecdotes do not diminish the liveliness of his story.


French decimal clock


Euler line

The book starts with the origin on how and why we human started counting. Bellos considers this a prequel to the actual story and hence calls it chapter zero. What is the origin of numbers, and how do humans perceive numbers (we catch small amounts without counting, but larger numbers need grouping or counting), and how much of the number concept can a chimp acquire?

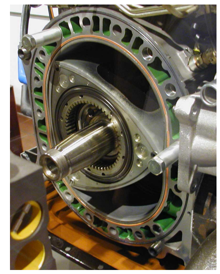
The real stuff starts in chapter 1 where we meet the different number systems, how to count on your hands or your whole body. Why we have a decimal system for almost everything but why attempts to introduce the decimal clock were not successful. We get a manual of how to compute with an abacus or its Japanese counterpart, the soroban.

In chapter two we meet numerology. Pythagoreans detected many patterns in number arrangements and geometric patterns: square numbers, triangular numbers, and we get many different geometrical proofs of the theorem of Pythagoras. We also meet the Platonic solids and the Euler line containing the four possible centers of an arbitrary triangle. Tessellations of the plane and Penrose tiles, the Menger sponge, and origami.

The most important number, the zero in only introduced in chapter three. There we also meet the different ways to compute with numbers. The mythical Vedic mathematics turn out not to be so much different from finger counting that was used by shepherds in France and Russia. The Swami Bharati Krishna Tirtha that Bellos interviewed was not really convincing. The Hindu gave us the zero, but for them the zero is certainly not a synonym of nothing. *Nothing is an existing entity; nothing is everything. Zero was invented by a culture that accepted the void as the essence of the universe.*

Chapter 4 is called 'Life of Pi'. Remarkably it starts with some stories about lightning calculators, the human computers on steroids. Probably a dying species since the introduction of the electronic computer. Japanese pupils are still drilled and there is a worldwide hype where mental calculators challenge one another in international competitions. Japanese sometimes use a mental abacus to do the computations since you see their hands shifting the beads like mad. Reciting digits of π as far as possible is one of the possible competitions and this is an incentive to explain several ways to compute π. Of course π is directly connected with the circle, but the chapter ends with a discussion of other curves of constant width like the Reuleaux triangle (used in the Wankel motor and a drill of this form can produce square holes) and the heptagonal circumference of a 50p coin.


Reuleaux triangle

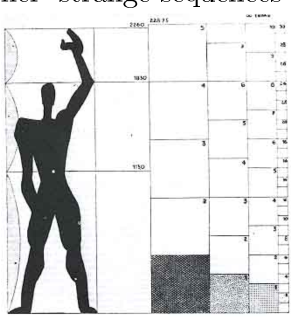

Wankel motor


supereggs

The history of algebraic equations is told in the next chapter. It also tells about the instruments that were used to help doing the arithmetic. The first ones were the slide rules based on the principle of logarithms. Then there were instruments like Fuller's calculator or the curta (a miniature pocket calculator), but then also the first electronic pocket calculators that were extremely expensive but on which you could produce words with the digits when the instrument was turned upside down. The chapter concludes with the introduction of quadratic equations, Descartes analytic geometry and the superellipse and his superegg with equations like $(x/a)^n + (y/b)^n = 1$ that Piet Hein commercialized in design objects.

What we know as a 9 digit magical square is known in China as lo shu, symbolizing harmony in the universe, but magic squares and other number patterns have been used in all religions. For example the improper 4×4 square on Gaudi's Sagrada Familia cathedral in Barcelona modified to add up to 33, the age of Christ when he died. And then there is the birth of another 'magic square', the Sudoku, as a worldwide phenomenon. Other puzzles include the Chinese tangrams, the 15 puzzle, the Rubik cube and the rearrangement geometric puzzles rearranging a cut-up triangle into a square, or the missing square puzzles and more recently the hinged dissections.

Next are the most exotic sequences in Sloan's On-Line Encyclopedia. The most exotic ones can be found there. Some have produced conjectures as yet unproved. Goldbach's conjecture for example, but also the powertrain by J.H. Conway: take any number e.g. 3462 and transform it into $3^4 6^2 = 2916$ and repeat to get $2^9 2^6 = 512 \to 5^1 2 = 10 \to 1^0 = 1$. Almost all numbers will end up in 1, but Conway found an exception 2592 that ends up in a cycle. Sloan found a second one 24547284284866560000000000. Are these the only ones? Probably not, but there is no proof. And there are, besides the prime numbers, many other 'strange sequences' with unanswered questions like the Récaman sequence etc.


le Corbusier Modular Man

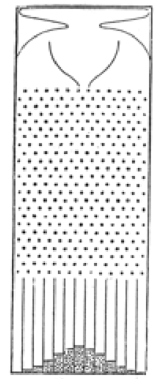
Chapter 8 deals with the golden ratio and the Fibonacci numbers and spirals that keep appearing so often in nature and in many man-made objects. The human legend created by Adolf Zeising in the late 19th century that the golden ratio is a spiritual ideal proportion and incarnates the key to beauty seems to hold only approximately, even though Le Corbusier's Modular Man is based on it.

Probability is the next subject. That is based on chance, and it was also the origin since the foundations were made by Blaise Pascal when Chevalier de Méré asked him to compute his gambling chances in the casino. Pascal used it in his famous wager which states that if there is a 50% chance that God exists, then it is better to bet on it that he does exist. Bellos elaborates on chances you have on the roulette, and the enormous appeal the slot machines have on humans. This brings him to discuss randomness and random walks and there is the incredible story of Ed Thorp, a mathematician who showed that card counting could overcome the casino's advantage with blackjack. He later applied his technique to hedge funding on the financial market which brought him great fortune.

The bell-shaped normal distribution is the subject of chapter 10. We learn that Poincaré so exposed his baker as a fraud selling underweight bread to him. Even after the shop was warned by the economic inspection, the distribution was skew showing that the fraud continued but that they always give him the heaviest one available. The Belgian Quételet was a professional collector of data, which illustrated the omnipresence of the normal distribution. This quote by Bellos is perhaps worth reproducing in this Newsletter: *Adolphe Quételet has good claim to being the world's most influential Belgian. (The fact that this is not a competitive field in no way diminishes his achievements.).* The connotation 'normal' to the bell shape was however promoted by the English Galton who also designed the machine which he called the quincunx to illustrate the bell shape.

The last chapter is about hyperbolic geometry, including Poincaré's circle model, so beautifully illustrated by Escher, but also Daina Taimina earned some fame with her hyperbolic crochet works. Her idea is simple: start with a line of stitches and add more stitched per line as you add new lines. The topology of our universe brings along the concept of infinity and Cantor's $\aleph_0$ and the classification of the infinite.

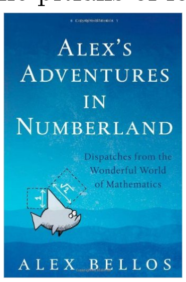
The book is well illustrated and there are some appendices with some more technical content, and also per chapter many interesting references for further reading.

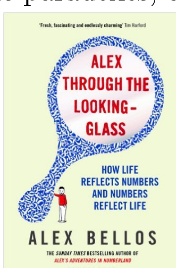


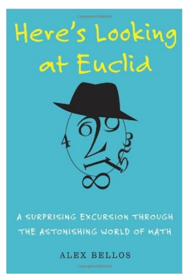
Galton board or quincunx

Adolphe Quételet
@ Royal Academy Brussels

The sequel **Alex Through the Looking Glass** has the subtitle *How life reflects numbers and numbers reflect life* is a continuation with more of the same kind of material. Again some spotlight is put on numbers and their history, but also on the psychological aspects, how analysis emerged from counting and computing, the intuitive resistance by some against new concepts such as negative and imaginary numbers, the pitfalls of logic paradoxes, cell automata as models of biological systems.







The first chapter is about the feelings that are assigned to numbers like being lucky or unlucky, why 7 is most often picked as a random number between 1 and 10, how a number associated with a commercial product can make it a bestselling top or a flop, the well known pricing methods like 2.99 € instead of 3.00 € to mislead the costumer, etc. It is remarkable that if you ask people to select the numbers they like or think of as good, or interesting, heavy, favorable, etc., then it turns out that prime numbers are recognized in the patterns that result. This might have something to do with our familiarity with times tables.

The second chapter is about the well known Bedford's law. In many large sets of numbers, the lower digits appear more frequently as the first digit. In fact the frequency of the numbers 1-9 follow some exponentially decaying distribution. A similar distribution can be obtained for words in a long text like a book. These examples are used to introduce logarithmic plots for power laws, and the more general Zipf's law that appears for many types of data like Kleiber's law in biology or popularity laws in big networks.

Triangles are the theme of the next chapter. From Thales's method to measure the height of the pyramids or Eratosthenes to measure the circumference of the Earth, to Pythagoras's theorem, to the triangulations of Gemma Frisius used in the 17th and 18th centuries to measure the meridian and find an answer to the dispute about the Earth being flattened at its poles or not.

Next focus is on conic sections and the finding of Galileo and Kepler about our solar system where the ellipses are featuring. In falling objects or in spotlights or in capturing systems, parabolas are the main object while hyperbolas appear in architecture. More general curves were used by the military in nomograms until mid 20th century. The circle is of course the one that is immediately connected to π. Bellos is obviously a strong promoter of the τ instead. Not the ratio of the circumference over the diameter, but the ratio of the circumference over the radius, which is $\tau = 2\pi$, is the proper constant that deserves all our attention. No more pi-day for him.

Other important curves are introduced from a physical point of view: cycloids, tautochrone, brachistochrone, different epicycloids, periodic waves and Fourier techniques. To illustrate what kind of anecdotes that can be found in the book, let me give this example. Bellos tells the story of Johan Bernoulli who challenged his peers to find the brachistochrone curve. Since after some time, he only got an answer from Leibniz, he challenged Newton by renewing the challenge and adding "those who boast that trough special methods ... they have not only penetrated the deepest secrets of geometry but also extended the boundaries in marvelous fashion" and sent a copy to Newton. Newton was at the time not in Cambridge anymore but was in charge of the Royal Mint. After receiving the letter he worked on the problem till 4 in the morning and submitted his answer anonymously whereupon Bernoulli said "ex ungue leonem" (I recognize the lion by its claws).

After π, the number e is the next one to be in the spotlight. It starts by a convincing attempt to illustrate to the reader how incredibly fast exponential growth is. The growth of cities, of bacteria, of the world's population. The exponentials can be combined to form the cosh, which is the form of the catenary curve, used by Gaudi in its upside-down version in the construction of the Sagrada Familia church but it appears in several other constructions as well. While Jakob Bernouilli introduced e as the limit of $(1 + 1/n)^n$, it was Euler who wrote it as the series summing the reverse factorials. It also shows up as $1/e \approx 36.8$ in the Marriage problem which should be solved according to the rule: skip the first 36.8% of the candidates and take then the first one that is better than all the previous ones.

cycloid on Bernoulli's collected work
supra invidiam - above envy - for the dog

Gaudi's chain models

The negative numbers and the imaginary numbers did not come overnight. A huge psychological resistance had to be overcome and it required a serious leap of the mind to accept them as 'numbers'. Once complex numbers are represented in the plane and connected with radius and argument, nice Mandelbrot sets come into reach.

Further development of mathematics came with Newton and Leibniz to introduce calculus. Differential equations govern most of the physical phenomena but curvature is also important for the design of road or railway curving and for the design of roller coasters on fairgrounds. The clothoid is the curve that solves the latter problem. Several of the fairground roller coasters had to be shut down because it caused neck injuries. Werner Stengel looked into the problem and designed the *Great American Revolution* for Six Flags Magic Mountain in 1976, the first loop-the-loop that worked properly because of the characteristic inverted teardrop of the clothoid. The flamboyant character of Cédric Villani also gets an extensive description here.

Six Flags loop-the-loop (1976)

Cloverleaf exits on highway

The crisis in logic and set theory in the early 20th century was related to continuity of the real numbers, and the axiom of choice, leading to the ZFC axiomatic system, the start of the Bourbaki group in France, and the acceptance of proofs by computer.

The last chapter is about cell automata, the game of life of John Conway with its many particular configurations like gliders, guns, beehives, traffic lights, etc. Gurus of the game were anxiously designing patterns to obtain special effects.

As this survey illustrates, as much as possible, the mathematics are related to our daily life. The mathematics are accessible for anyone. Some details are moved to an appendix. There you can also find a glossary of terms used, and more details for further reading, and if you want to look up some name or concept, you can use the excellent name and subject index. Both books are a pleasant read that is warmly recommended.

Adhemar Bultheel

Groups, Rings and the Yang-Baxter equation

Spa, Belgium | June 18-24, 2017

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Patrick Dehornoy
Gunter Malle
Don Passman
Louis Rowen
Wolfgang Rump
Sudarshan Sehgal
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Leandro Vendramin
Efim Zelmanov

Invited Speakers

Eli Aljadeff
Nigel Byott
Francesco Catino
Ferran Cedó
Fabienne Chouraqui
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