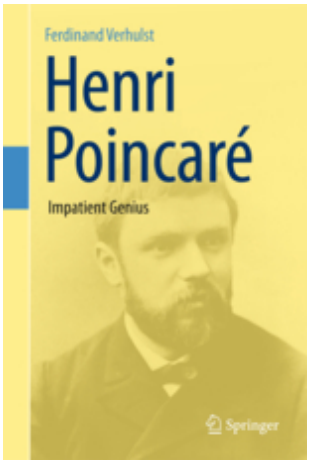
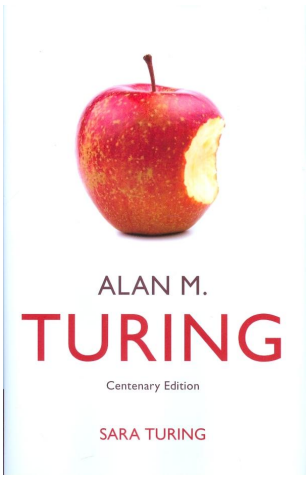
Henri Poincaré, Impatient genius *Ferdinand Verhulst* Springer Verlag, 2012 (x+260 p.), hard cover, ISBN 978-1-4614-2406-2, € 39.95
Alan M. Turing *Sara Turing* Cambridge University Press, 2012 (xxiv+169 p.), centenary edition, hard cover, ISBN 978-1-107-02058-0, £ 17.99





The year 2012 is celebrating two centenaries: the death of Henri Poincaré (1854-1912) and the birth of Alan Turing (1912-1954). On this occasion the two books mentioned above were published.

Henri Poincaré contributed to and was influential on many different areas: differential equations, dynamical systems, topology, mathematical physics, algebra, group theory, probability, etc., but he was also involved in the philosophy of mathematics and science. Verhulst's book has two parts. The first one is biographical, describing Poincaré's life and his contributions on a less technical level. The second part makes a selection of his work, mainly concerning differential equations and dynamical systems. The second part is about 2/3 of the book and is definitely much more technical including mathematical formulas, which are absent in the first part. A number of publications of Poincaré are summarized to which some background and additional remarks and comments are added by Verhulst. They cover automorphic functions, dynamical systems, topology (only briefly), and mathematical physics. Poincaré's work on automorphic functions was inspired by a paper of Fuchs and that is why he called them Fuchsian functions. In fact Fuchs considered only some special cases, but nevertheless Poincaré chose to stick to the name which has led to a controversy reflected in many letters back and forth between him and Klein who, pointing to the Riemann school and didn't approve on this naming.

The chapter on differential equations covers Poincaré's thesis that he presented at the *Université de Paris* in 1879 under the supervision of Hermite, a work started earlier at the *École des Mines* guided by Darboux, Laguerre and Bonnet. The larger part of this chapter discusses the 3 volumes of his *Mécanique Céleste*, the first modern book on dynamical systems.

The chapter on topology (his *Analysis Situs* paper) is short, but it introduces the Poincaré conjecture: Every simply connected, closed 3-manifold is homeomorphic to the 3-sphere, a proof of which was only given by G. Perelman in 2002-2003. The paper is bookmarked as the birth of algebraic topology. The chapter on mathematical physics covers different topics in this area to which Poincaré has also contributed significantly like fluid dynamics, relativity, and cosmology.

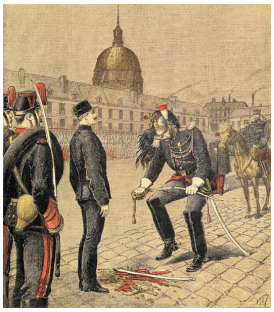


Henri Poincaré

Of a somewhat different nature is the chapter with a translation of Poincaré's address to the *Ligue française d'éducation morale* given three weeks before his death. Two years before WWI broke out, he pleads for respect among the many different individuals from which society is made up, a message of all times.

The first part is about Poincaré's life and a less technical discussion of his work. His father was professor of medicine at the university of Nancy, Henri had a younger sister Aline that was very dear to him. As a child he was recognized by teachers and his family to be a bright lad, but he was not bred to specialize in one field or another, which explains his broad interests. At school he irritated his teachers because he almost took no notes, but could always recall the lesson, illustrating his formidable memory. In his own writings, he was very terse

taking nontrivial leaps in his reasoning, but was always happy to assist his peers with explanations. When taking the entrance exam for the *Grandes Écoles* he messed up the answer and was ranked fifth, while his lifetime friend Paul Appell was ranked third. Appell entered the *École Normale Supérieur* while Poincaré entered the *École Polytechnique* at the age of 19 where he got analysis from Hermite. After 2 years he moved to the *École des Mines*. In 1979 he worked briefly as a mining engineer in Vesoul, but was soon appointed lecturer at the *Université de Caen*. In 1881 he married and 2 years later he got a position at the Sorbonne. He taught many subjects, among which his lecture notes *Mécanique Céleste* in 3 volumes is well known.



Dreyfus' degradation.



Émile Zola's letter *j'accuse*.

By the end of the century he was involved with the *Dreyfus Affair*, a French officer who was falsely condemned on an anti-semitic basis for collaboration with the Germans. Émile Zola brought up the matter in a famous open letter *j'accuse* published the Paris newspaper *L'Aurore*. Poincaré, Hadamard and other intellectuals joined in as *Dreyfusards* in defense of Dreyfus who was finally pardoned in 1900 an eventually rehabilitated in 1906.



Solvay conference, Brussels, 1911. Henri Poincaré right bottom row next to Marie Curie. Einstein is the second from the right on the top row.

In 1889 Poincaré was awarded the prize installed for the 60th birthday of Oscar II, king of Sweden and Norway. Paul Appell got an honorable mention. As usual Poincaré's memoir was written with big leaps of intuitive assumptions. So Kronecker had some objections, but finally Poincaré got the prize for his solution of the three body problem. For the publication in the *Acta Mathematica*, some steps needed illucidating and gaps filled. In fact an erroneous version had been printed,

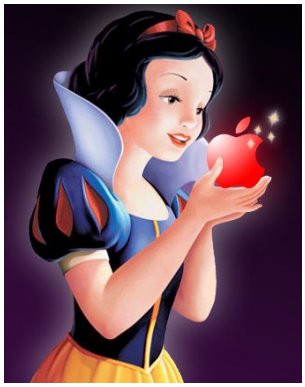


Poincaré's grave.

but was destroyed by Mittag-Leffer before its distribution to avoid a scandal. The additional comments by Poincaré eventually resulted in a version that anticipated the KAM (Kolmogorov-Arnold-Moser) theorem, proved in 1960 and more generally started the subject of chaos theory far ahead of time. Verhulst also devotes a chapter on Poincaré as a philosopher. Poincaré had indeed strong views on mathematics and science and has put this into writing. For example he was opposed to the strong axiomatic approach of e.g. Peano, Frege and Hilbert, but to him intuition was an essential tool for the development of mathematics. Peano's axiomatic definition of the natural numbers only makes sense when it is proved that such a thing as defined by the axioms really exists.

The book on Alan Turing is similar, yet of a complete different nature. It is written by his mother Sara Turing and first published in 1959. This centenary edition has been extended with a foreword by Martin Davis and an afterword by John Turing, Alan's brother. We have already reported on the contributions of Alan Turing in the previous issue of this Newsletter[1] and we shall not repeat them here. Martin Davis in his 11-page foreword summarizes briefly Turing's life, which is much more elaborated in Sara Turing's proper contribution.

This is the record of a loving mother about her brilliant and famous son. It is a compilation of her own memories and citations from correspondence with Alan and with others who have known Alan during his life. Alan and his 4 year older brother, at a young age, were left in Scotland in the good care of "the Wards" when the parents sailed back to India where their father was involved with the colonial civil service. His parents rejoined the children on and off with long intervals. According to Sara, Alan impressed his teachers with his knowledge but not with his bad handwriting and his untidiness. Sara Turing does not mention Alan's homosexuality and neither does she allude to his possible suicide. Turing was found dead by his housekeeper the morning after he had been working on a non-poisonous weed-killer. An half-eaten apple was found[2] which made some authors suggest that he committed suicide by eating a poisonous apple as in the story of *Snow White*. A possible reason could be official harassment in a society where homosexuality was still illegal. It was only in 2009 that Prime Minister Gordon Brown officially apologized for the way in which Turing had been treated. What happened was that Arnold, Alan's partner had mentioned Turing's posh house to someone called Harry. The latter burgled the house and Alan went to the police to declare that some things had been stolen. The police however was more interested in the the fact that Arnold and Alan were living together in the same house than they were investigating the burglary and the result was that Alan was charged with gross indecency. Alan was spared prison but was forced to undergo estrogen injections which only resulted in Alan growing breasts. According to Sara's story however, Alan's death was just an accident. Sara Turing concludes her account with a discussion of some unpublished notes of her son on computing machines and on morphogenesis.


Here the reference to Apple is clear.

The afterword by John Turing is most interesting because he puts the sweet story by his mother into perspective and even contradicts her at several points. He at least recognized Alan's homosexuality at a very early age and he is convinced that his mother was very well aware of the fact. Alan did not disliked girls or women, but with his brother they had a classification of girls

[1] [1] Alan Turing, Google's doodle and the Diamond Age, Newsletter of the Belgian Mathematical Society, issue 89, September, 2012.

[2] Hence the apple on the cover, although Turing is at the origin of modern computers, I don't know if the reference to Apple is intended or not. Perhaps the resemblance to existing companies is purely coincidental.

that were "safe" or not. John also contradicts Sara when she claims to have recognized Alan's genius from the start. To the contrary, Alan's eccentricities where accepted with amused tolerance by his father, but turned into irritation when his school reports were not so favorable. Sara was constantly nagging Alan for his slovenliness and his teachers complained about Alan being only interested in mathematics, neglecting everything else.



Turing statue by Stephen Kettle at Bletchley Park



Turing 1946

If you want to learn about Turing machines, Turing test, cryptography, computability, morphogenesis, and all the scientific achievements of the visionary man Alan Turing, this is not the right book for you. It tells you a lot though about what kind of person he was.

Henri Poincaré and Alan Turing, two successive geniuses with quite different character. What they had in common was a broad interest in science, at least in their scientific career and they both had the impatience of gifted minds. Also they had strong ideas of their own that could be different from what was common convention, especially on the foundations of mathematics and science. Turing got an OBE (Order of the British Empire) for his work during the war, Poincaré got a *Légion d'Honneur* for winning the Oscar II prize. But they were quite different as well. Poincaré worked very systematically, doing research 4 hours a day, 2 hours in the morning and 2 in the afternoon. Turing was more chaotic and depending on his thoughts, he could thrust himself upon people any time of the day or the night much to the inconvenience of the ones being intruded. Poincaré was physically clumsy and near-sighted while Turing was more of a sportsman: a talented long-distance runner and he was keen on rowing and football and often took the bicycle for transportation, no matter what the weather conditions were.

The Turing book contains testimonies from primary sources about the person Alan Turing, but with a risk of being biased. Scientific achievements are left under the carpet. The Poincaré book is all compiled from secondary sources, but also gives a lively sketch of Henri Poincaré as a person. However here at least part of his scientific work is covered marvelously. Both books show that geniuses are only humans and that progress and even leaps in the progress of science come thanks to brilliant and independent minds being there at just the right time.

There were and are many festivities planned to celebrate the Turing year 2012. All the initiatives can be found on the website of the Turing Centenary Advisory Committee (TCAC) `http://www.mathcomp.leeds.ac.uk/turing2012/`. They range from scientific meetings to an opera on the Turing test. One may also find there several videos and publications about Alan Turing and his influence.

The Poincaré celebrations in 2012 are somewhat less widespread. In the September issue of the EMS Newsletter Cédric Villani from the *Institut Henri Poincaré* in Paris enumerates some initiatives. Worth seeing is the multimedia file about Poincaré from the CNRS *Dossiers multimedia Sagascience* which is available at the site `http://www.cnrs.fr/cw/dossiers/dospoincare/`. At `http://www.cnrs.fr/cw/dossiers/saga.htm` several other such files about other scientists are available.

Adhemar Bultheel