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Book descriptions

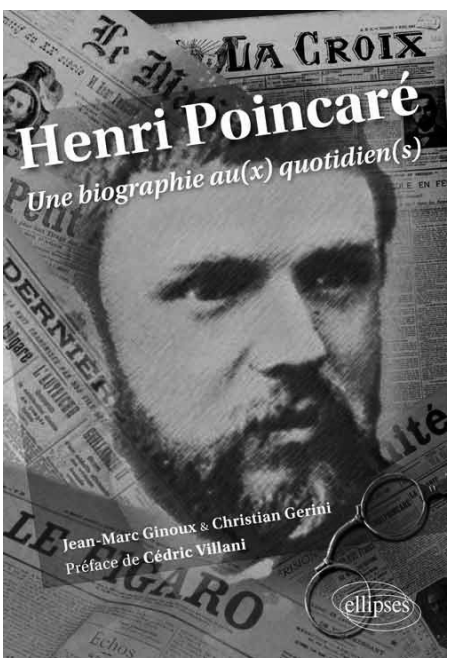
New books about Henri Poincaré

In the 'centennial year' 2012 there will appear three books on life and work of Henri Poincaré. Each of the respective authors Jean-Marc Ginoux, Ferdinand Verhulst and Jeremy Gray gives a short description of his own book.

Jean-Marc Ginoux and Christian Gerini
Henri Poincaré: a biography through the daily papers
World Scientific, December 2012
Original French edition:
Henri Poincaré: une biographie au(x) quotidien(s)
Ellipses Marketing, July 2012
ISBN 9782729874070, 304 p., € 24,-

This book presents an original portrait of the famous French mathematician Henri Poincaré through from what the newspapers of its time said about him. An abundant choice of press cuttings (*The Washington Post*, *The New York Times*, *The Sun*, *The Times*, *The Herald Tribune*,...) allows to discover the most significant events of his career but also his role in the public space, both for its many scientific and technical skills as for his philosophical insights.

Moreover, this approach enables on the one hand to rebuild his biography highlighting many unknown anecdotes of his life (his first name was not Henri but Henry, he received his *baccalauréat* in science with zero in mathematics) and of his career (he was involved in a controversy about the rotation of the Earth from 1900 to his death, his intervention in the Dreyfus affair has played an important role) and on the other hand to evaluate the reception of the scientific and philosophical works of Henri Poincaré in the daily papers, i.e. by ordinary people. As an example, it may be interesting to discover how the newspapers reveal the 'mysteries' of the stability of the solar system when Poincaré won the King Oscar II Prize in 1889, or how they comment his election at the French Academy or his philosophical writings...



The original French edition

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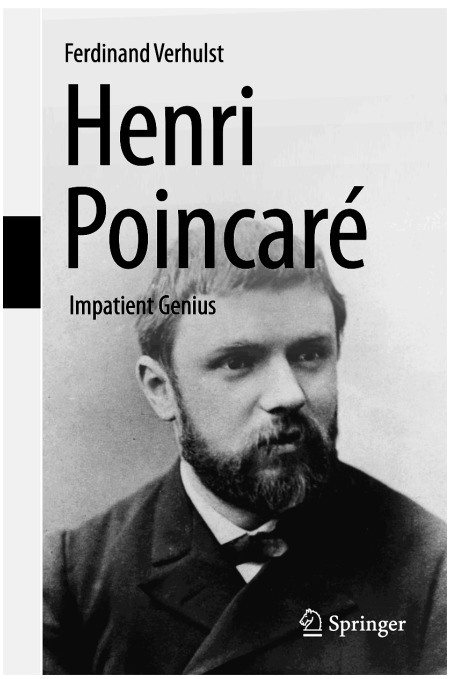
Ferdinand Verhulst
Henri Poincaré, impatient genius
Springer, August 2012
ISBN 9781461424062, 260 p., € 39.95



This biography consists of two parts; first it describes the life and career of Henri Poincaré, the second part deals with scientific documents and details.

Working myself in the field of dynamical systems and chaos and taking part in the discussions on possible dramatic changes of the climate and other models for reality involving chaos, I became quite soon confronted with the work of Henri Poincaré. He was the first to notice the possibility of chaotic motion in classical mechanical systems, his insights and results were deep and far-reaching, using techniques that were understood only in the sixties of last century. He did these explorations around 1880, nearly 35 years old. Working in this field of dynamical systems, I started to read his papers and books on the dynamics of the solar system and also his philosophical essays.

The style of his papers and books struck me as unusual. They are written in a kind of discourse between author and reader. The most-used sentence is "this is not all", after which the author starts once more to discuss his topic, elucidating new aspects. I was not accustomed to this style of writing. Mathematics books, especially research books, are usually written deductively and in a kind of secret language which makes them difficult to understand.

Poincaré's essays are special in a different way. He formulates simple but fundamental questions. For instance, how is it possible that after weeks of looking without success for the solution of a mathematical problem, after a night of restless sleep, one awakes in the morning with the solution of the problem? This question and his own experience induces him to explore the part played by the unconscious which in a kind of independent search of possibilities leads to the solution.

The philosophical essays have been collected in four books with many of such basic questions. Is science not a construction based on our fantasies, has it any relation with reality? Or, what is mathematics and what is physics; is mathematics (or astronomy) useful, why are people anyway engaged in science? All this in crystal-clear prose with understandable reasoning, so that in the beginning of the twentieth century in France and elsewhere, these books started to play a considerable part in public discourse. For instance his first philosophical book, *Science et Méthode* (1902), sold in the French edition until 1915 more than 20.000 copies.

I felt that Henri Poincaré was a very special scientist and man and this motivated me to collect material for a scientific biography. I found that there existed some French, but pretty old biographies, there was no biography in English. After some time I ran into difficulties. Poincaré was one of the most important scientists of all times and one of the greatest of the last 150 years. There is nobody alive who is competent in all the topics he worked on and who has a general view of all his work. I started to feel dejected and was prepared to stop the project. I talked to a German colleague and friend about this who said: "Poincaré is too great for all of us, so this is not a reason to end the project." It did not solve my problem, but this sobering statement helped me and I continued.

When writing a biography, more often than not, a certain sympathy or bond between autobiographer and subject arises. This happened in my case rather quickly. The wide interest of young Henri in language and arts, his curiosity directed at the explanation of natural phenomena, all this agreed very well with my own experiences in youth. For example, Poincaré noted that the word 'chaleur' (English 'heat') was not well-chosen in the context of thermodynamics; it suggests a quantity instead of a dynamical state. He also noted that well-chosen terminology helps progress; the word 'flux' from fluid mechanics started to play a part in other fields like the theory of electricity. This sensitivity for the use of language appeals strongly to me.

In studying his life, I was also struck by his open-mindedness and honesty. For instance, the famous German mathematician Felix Klein sent him a note with a theorem and proof which Klein valued highly. The proof needed correction, but Poincaré's answer was worse:

"Thank you very much for your last note, which you were so kind to send me. The results that you mention do interest me, and I will tell you why. I found them already some time ago, but without publishing them, because I wanted to clear up the proof somewhat. That is why I would like to know yours when you, from your side, have clarified this."

Another example is when the retrial of captain Dreyfus took place; he was convicted on false evidence. Poincaré was chairman of the committee that had to consider the scientific value of the proofs at the trial. He wrote:

"There is nothing scientific in this evidence and I cannot understand your uneasiness. I do not know whether the accused will be found guilty, but if he is, it will be on other proofs. It is impossible that such an argumentation would be seriously considered by scientifically educated people without prejudice."

Note that Poincaré belonged to the Establishment, he was president of the Academy of Sciences, his cousin Raymond Poincaré was prime minister and later President of the French republic. In general, the French Establishment was strongly against Dreyfus.

There are many other examples like this. Henri Poincaré was an outstanding man and an eminent scientist.

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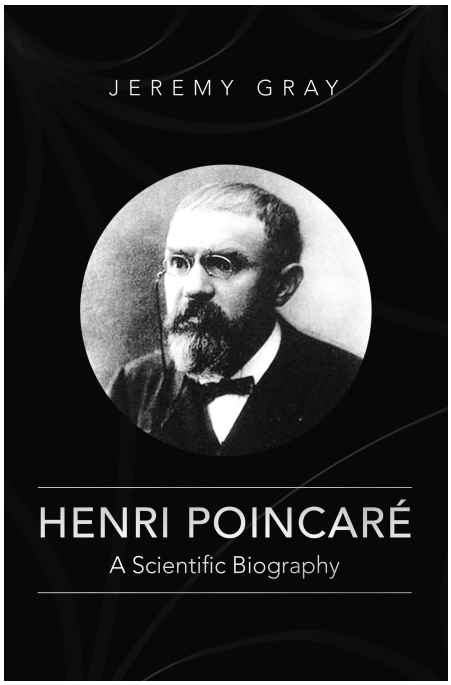
Jeremy Gray
Henri Poincaré: a scientific biography
Princeton University Press, November 2012
ISBN 9780691152714, 616 p., $ 35,-



Henri Poincaré is chiefly remembered as one of the great mathematicians of all time, but he was also a leading physicist of his generation, nominated heavily if unsuccessfully for the Nobel Prize, and a prominent philosopher whose many essays are still in print a century later. The book is an attempt to survey entire output, and to bring out both its inventiveness and its surprising degree of coherence. It is also an attempt to situate him in his time and place, as an increasingly prominent member of French society, capable of intervening in numerous controversies both popular and technical, and actively involved in national and international scientific committees.

Poincaré was often drawn into the scientific controversies of his day. He advanced a philosophy of science that could cope with major changes in scientific claims, and defended them against opposition from Duhem and other Catholic apologists. He defended mathematics against what he saw as the self-contradictory attacks of logicians such as Russell and set theorists like Zermelo. His lectures on every branch of physics revitalised French higher-level education in the subject. Not only was he the leading French expert on the fast-moving theories of electricity, magnetism and optics, capable of original insights and penetrating criticisms of the ideas of Hertz and Lorentz, he was enthusiastically involved in the technological issues of his day, notably on the nature of radio waves. He served for many years on the Bureau des longitudes and was involved in their unsuccessful campaign to decimalise time as well as their geodetic survey of Peru. His position as the leading expert on probability made him an expert witness in the Dreyfus case that polarised the French society.

Numerous fields created or rewritten by Poincaré continue to be active fields of research. His novel interpretation of non-Euclidean geometry not only helped him create the flourishing topic of interactions between complex function theory (Fuchsian functions) and geometry, but also to formulate, and finally prove, the uniformization theorem for Riemann surfaces. It challenged contemporary ideas about the nature of space and drew him into controversies about the nature of knowledge. His presentation of topology began the modern study of the subject, recently highlighted by the successful resolution of the Poincaré conjecture. The modern theory of dynamical systems begins with his reformulation of celestial mechanics that led him to the discovery of chaotic motion even in simple physical systems. In his later work on the foundations of physics he came to propose the Lorentz group before Einstein, and in the last year of his life took up Planck's theory of quanta and was the first to propose that space and time are fundamentally atomic.

His popular essays often distilled his experience into analyses of how to think productively that are still fresh and surprising, and this is because they drew on one of his deepest concerns: What is it to understand something? Poincaré aimed not merely to advance knowledge and to obtain new results, but to organise his own thoughts so as to make his contributions most effectively. He advocated several methods for doing this, chief among them analogy and generalisation, and his test of his own understanding was to see how far it led him in the discovery of good new ideas. This emphasis on understanding, and not merely new results, partly accounts for his own successes and also helps to explain the lasting appeal of many of his essays. Mathematics and physics will always have new challenges, its latest discoveries will shed their lustre with age, and good new ideas can even turn out to be wrong, but what it is to understand mathematics and physics — what is involved in doing those subjects and doing them well — that will always be fresh. Moreover, it is clear that Poincaré took his own advice, and so these essays shed light on his own attitudes to science.

Topics for which Poincaré's work is perhaps less well-known today also bear out the unity of his thought. His earliest interest in number theory was the subject of his last paper, on the arithmetic significance of Fuchsian functions. His work on the partial differential equations of mathematical physics, and his enthusiastic acceptance of Fredholm's work, was immediately applied to his study of tides and ocean waves. His doctoral thesis, unpublished in his lifetime, connects to his work on the complex function theory of several variables and algebraic geometry, his early affinity for the work of Sophus Lie led him to contribute to major developments in the theory of Lie algebras.

Among his last popular lectures was his defence of the geometrical conventionalism that he had deployed in discussions of the possible non-Euclidean nature of space in the early 1890s against what he saw as a premature rush to embrace the ideas of Minkowski about space-time.

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