

Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century

By Masha Gessen

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A gripping and tragic tale that sheds rare light on the unique burden of genius

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Editorial Review

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Product Description

In 2006, an eccentric Russian mathematician named Grigori Perelman solved one of the world's greatest intellectual puzzles. The Poincare conjecture is an extremely complex topological problem that had eluded the best minds for over a century. In 1998, the Clay Institute in Boston named it one of seven great unsolved mathematical problems, and promised a million dollars to anyone who could find a solution. Perelman will likely be awarded the prize this fall, and he will likely decline it. Fascinated by his story, journalist Masha Gessen was determined to find out why. Drawing on interviews with Perelman's teachers, classmates, coaches, teammates, and colleagues in Russia and the US--and informed by her own background as a math whiz raised in Russia--she set out to uncover the nature of Perelman's genius. What she found was a mind of unrivalled computational power, one that enabled Perelman to pursue mathematical concepts to their logical (sometimes distant) end. But she also discovered that this very strength has turned out to be his undoing: such a mind is unable to cope with the messy reality of human affairs. When the jealousies, rivalries, and passions of life intruded on his Platonic ideal, Perelman began to withdraw--first from the world of mathematics and then, increasingly, from the world in general. In telling his story, Masha Gessen has constructed a gripping and tragic tale that sheds rare light on the unique burden of genius.

A Q&A with Masha Gessen, Author of *Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century*



Q: Grigory Perelman doesn't talk to journalists. How did you write this book? **A:** Actually, at this point he really talks to no one. When I first started researching the book, he was still speaking to his lifelong math tutor, his competition coach and, in many ways, the architect of his life, Sergei Rukshin. But sometime in the last couple of years, Perelman stopped talking to him. As far as I know, the only person with whom he is in permanent contact is his mother, with whom he shares an apartment on the outskirts of St. Petersburg. Fortunately, while I had no access to Perelman, I talked to virtually all the people who had been important in his life: Rukshin, his classmates, his math-club mates, his high school math teacher, his competition coaches and teammates, his university thesis adviser, his graduate school adviser, his coauthors, and those who surrounded him in his postdoc years in the United States. In some ways, I think, these people were more motivated to speak with me because Perelman himself wasn't doing it--and because they felt his story had been misinterpreted in so many ways in the media. **Q:** So not being able to talk to him was an advantage? **A:** Funny as that sounds, in some ways, yes. When you write a biography of a cooperating subject--even if it is just a magazine story, never mind a book--you are in constant negotiation with that person's view of himself. And people tend to be terrible judges of themselves. So you are always balancing your own perceptions against the subject's aspirations, and this can actually get painful for all involved. All I had was research material and my own perceptions. In this sense, this was more like writing a novel: I was constructing this character. **Q:** What made you think you could do this? **A:** Actually, I made two erroneous assumptions. I assumed that the journalists who initially wrote about Perelman, around the time when he turned down the

Fields Medal, mathematics' highest honor, were wrong. I assumed he was not as crazy, or as weird, as they made him sound. I figured he was a familiar type of Russian scientist--entirely devoted to his field, not at all attuned to social niceties and bureaucratic customs, and given to behaviors that can easily be misinterpreted, especially by foreign journalists. My second assumption, related to the first, was that my background as a Russian math school kid gave me the tools necessary to describe this type. My background certainly helped--I am Perelman's age, I come from the same kind of family, socially, economically, and educationally, as he does (Russian Jewish engineers with two children living on the outskirts of Leningrad in his case and Moscow in mine)--but it was barely a start. Because Perelman turned out to be much stranger than I assumed. **Q:** So he is as crazy as they say? **A:** I think *crazy* generally means that a person has an internally consistent view of the world that is entirely different from the view most people consider normal. I think this is true of Perelman. The interesting thing, of course, was to figure out what this internally consistent view of the world was. **Q:** And did you manage to figure it out? **A:** I think so. I concluded that this view, and the rigidity with which he holds to it, is actually directly related to the reason he was able to solve the hardest mathematical problem ever solved. He has a mind that is capable of taking in more information, and embracing more-complex systems, than any mind that has come before. His mind is like a universal math compactor. He grasps hugely complex problems and reduces them to their solvable essence. The problem is, he expects the world of humans to be similarly subject to reduction. He expects the world to function in accordance with a set of strictly laid out rules, and he absolutely cannot take in anything that does not conform to those rules. The world of humans is unruly, though, so Perelman has had to cut off successive chunks of it until all that was left was the apartment he shares with his mother. **Q:** Is that quality of his mind what the title of the book refers to? **A:** Yes, it's that "perfect rigor". But in fact that phrase comes from a quote by Henri Poincare, he of the Poincare Conjecture fame--from his ruminations on the nature of mathematical proof, which I quote in the middle of the book. **Q:** So what is the Poincare Conjecture? **A:** It is no more, actually. Now that Perelman has proved it, it is a theorem. And it is a classic theorem of topology, one of the most wonderfully weird mathematical disciplines. Topology, to my mind, is something like the perfect mathematical discipline. It leaves nothing to reality: though it deals with shape, you never measure objects in topology--not with a ruler, anyway. Rather, the concepts of topology are the products of their verbal definitions. And much of topology is concerned with things that are essentially the same as other things, even if at particular moments in time they happen to look different. For example, if you have a blob that can be reshaped into a sphere, then the sphere and the blob are essentially similar, or homeomorphic, as topologists say. So Poincare asked, in essence, whether all three-dimensional blobs that were not twisted and had no holes in them were homeomorphic to a three-dimensional sphere. And it took more than a hundred years to prove that yes, they were. **Q:** So? What's the use of something so abstract? **A:** Mathematicians hate that question. Mathematics is not here to be useful. It is beautiful, and that's enough. But the fact is, such discoveries generally have far-reaching--useful--consequences that are rarely evident at the moment of the breakthrough. The Poincare Theory will almost certainly have profound consequences for our understanding of space--the universe that we inhabit. **Q:** And Perelman will be awarded a million dollars for this proof? **A:** Probably. And he will probably turn it down. The commercialization of mathematics offends him. He was deeply hurt by the many generous offers he received from U.S. universities after he published his proof. He apparently felt he had made a contribution that was far greater than any amount of money--and rather than express their appreciation in appropriately mathematical ways, by studying his proof and working to understand it (he estimated correctly that it would take specialists about a year and a half to understand the proof), they were trying to take a shortcut and basically pay him off. By the same token, the million dollars will probably offend him. At the same time, if he chose to accept the money, he would find a way to make that consistent with his system of rules and values. But I really don't think this is likely.

(Photo © Vladimir Shirokov)

Review

Gessen, Masha

PERFECT RIGOR: A Genius and the Mathematical Breakthrough of the Century

The story of Russian mathematical prodigy Grigory Perelman, who solved a problem that had stumped everyone for a century—then walked away from his chosen field.

Gessen (Blood Matters: From Inherited Illness to Designer Babies, How the World and I Found Ourselves in the Future of the Gene, 2008, etc.) tells Perelman's story from the viewpoint of a former student in the educational system of which he was a product. Soviet mathematicians worked in isolation from their Western counterparts during the Stalinist era, but were encouraged because of their value to the state. Perelman, an unusually gifted student, was identified early and his talent nurtured, even though, as a Jew, he faced crippling handicaps under the Soviets. He won the attention of an innovative math coach, Sergei Rukshin. The coach and student bonded early, and Perelman was accepted at a prestigious university and then at a top graduate school. As a star, he was allowed an unusual degree of eccentricity, which in his case included an almost total disregard of other people. Numerous contemporaries attest to his fanatical adherence to a set of ideals that essentially ignored the realities of the Soviet state. Politics, prejudice, making friends and getting ahead in the world—these meant nothing to Perelman. During postdoctoral work in the United States, he refused to cut his hair and nails and turned down job offers because he felt it beneath his dignity to apply for them. Meanwhile, he was homing in on a solution to the Poincaré Conjecture, a topological riddle so puzzling that the Clay Institute in Boston offered a $1 million prize to anyone who could solve it. When, in 2002, Perelman posted a solution on the Internet, he seemed to expect instant recognition. Instead, the world's mathematicians meticulously checked his proof, which Perelman took it as an insult and turned down a Fields medal, the math equivalent of a Nobel. To this day, there is significant doubt about whether he will accept the Clay prize. Though Gessen was unable to interview her subject, she paints a fascinating picture of the Soviet math establishment and of the mind of one of its most singular products.

An engrossing examination of an enigmatic genius.

(Agent: Elyse Cheney/Elyse Cheney Literary Associates)

(*Kirkus Reviews* 2009-10-01)

Gessen, Masha. **Perfect Rigor: [A Genius] + [The Mathematical Breakthrough of the Century]**. Houghton Harcourt. Nov. 2009. c.256p. index. ISBN 978-0-15-101406-4. $26. MATH

The "genius" here is Russian mathematician Grigory Perelman, who announced in 2002 a proof of the PoincarÃƒÂ© Conjecture, a complex problem that had resisted the best efforts of the world's mathematicians for almost a full century. Strangely, since that moment of apparent triumph, Perelman has progressively withdrawn from contact with the mathematics community and with most other humans as well. Russian American journalist and author Gessen (*Slate, New Republic; Blood Matters*) now tells of Perelman's very

unconventional life and career. Denied access to Perelman himself, she interviewed many people who knew him as a student and (later) as a researcher. Gessen details the special Russian schools for young mathematical prospects that Perelman attended and describes apparently incorrigible Russian anti-Semitism. Most important, the gist of her excellent discussion of the PoincarÃƒÂ© Conjecture and its proof should be intelligible even to readers lacking a background in higher mathematics. **VERDICT** General science buffs curious about how researchers go about creating *new* mathematics or about the eccentric personalities in this field will be fascinated by Gessen's book. More advanced readers can also turn to Donal O'Shea's *The PoincarÃƒÂ© Conjecture: In Search of the Shape of the Universe.***Ã¢Â‚¬Â?Jack W. Weigel, Ann Arbor, MI**

(*Library Journal* 2009-11-01)

About the Author

MASHA GESSEN is a journalist who has written for Slate, Seed, the New Republic, the New York Times, and other publications, and is the author of two previous books. She lives in Moscow.

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