



Review: [Untitled]

Reviewed Work(s):

My Brain is Open: The Mathematical Journeys of Paul Erdos. by Bruce Schechter

The Man Who Loved Only Numbers: The Story of Paul Erdos and the Search for Mathematical Truth. by Paul Hoffman

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REVIEWS

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My Brain Is Open: The Mathematical Journeys of Paul Erdős. By Bruce Schechter. Simon & Schuster, 1998, 224 pp., \$25.

The Man Who Loved Only Numbers: The Story of Paul Erdős and the Search for Mathematical Truth. By Paul Hoffman. Hyperion, 1998, 289 pp., \$22.95.

Reviewed by Albert A. Mullin

Trying to understand the late, great Paul Erdős (1913–1996) is like trying to write a beautiful palindromic sonnet! Erdős was a genius wrapped in a mathematician inside an eccentric. A great problem poser and problem solver, he could see analogies between analogies. Personally independent in spite of his gregarious nature, he had an almost fanatical love of justice, partly due to some bad experiences in his own life. He always had a high regard for every form of intellectual aspiration and spiritual effort.

Like Mersenne, Erdős greatly advanced mathematics by extensively publicizing and propagating results and conjectures. Like Euler, Erdős published prodigiously and maintained his full intellectual faculties until the very day of his death. Since posthumous articles are still appearing, his complete works may reach a total of 1500 items. Like his fellow countryman John von Neumann, Erdős had a vivid interest in people. On the other hand, few mathematicians delighted in gossip like Johnny—certainly not Erdős. Like Gödel, Erdős had no formal students, although he wrote joint papers with nearly 500 different collaborators. Erdős had neither the “genius’ ego” nor the “actor’s ego,” either of which can be disastrous for cooperation. Both Gödel and Erdős will likely have an endless number of students of their works.

Much has been made of Erdős’ eccentricity; his peripatetic lifestyle; and his bantering use of terms such as “epsilon,” “boss,” and “slave” (“child,” “wife,” and “husband”), abbreviations such as P.G.O.M. (Poor Great Old Man) and S.F. (God, the Supreme Fascist), and metaphors such as THE BOOK (the S.F.’s transfinite volume containing the most elegant proofs of all theorems). Earlier this century, James Joyce made this whimsical, elliptical way of communicating intellectually respectable in his last two novels, *Ulysses* and *Finnegans Wake*. Erdős’ eccentricity was often amusing and always harmless: sufficiently spectacular to provoke comment, but never serious enough to constitute disintegration. Edmund Landau summarized the situation well when he said, “Wir Mathematiker sind alle ein bißchen meschugge” (“We mathematicians are all a bit wacky”).

There are numerous tales about Erdős; remarkably, many are true. Erdős himself would tell jokes in which he figured, but on close inspection, the jokes tell as much about others as they do about Erdős. For example, there is the neat story about Erdős traveling around the world by airplane, as he did so often. An epsilon is sitting between Erdős and the boy’s mother. The boy is studying plane geometry, but he is puzzled by a certain result. Always looking for new talent, Erdős politely offers to help, but the boy refuses. The boy’s mother scolds, “Listen to the man!” But the boy cries out to his mother, “What could *he* know about geometry?” Then there is the story about an old mathematician who declared that he had been

fortunate to have a wonderful life: he had proved elegant theorems and he had met many famous people. But he regretted never meeting Einstein. Erdős muttered something like, “Fear not, soon you will!” Erdős could joke positively about many situations that really were quite negative when viewed deeply enough. He enjoyed his job at Notre Dame: “Who could dislike a place with plus signs everywhere?”

In his later years, Erdős was constantly on the move. In Erdősian verse: “Another roof, another proof.” His lifestyle after 1971 came straight from Keats: “What mad pursuit? What struggle to escape?” Erdős never married, perhaps because he preferred truth to beauty. He moved about freely and often, spreading the mathematical Word everywhere. He never sought “glory” because he realized it was a little like the elegant bed of Louis XIV: namely, magnificent, but full of bugs! Erdős lived slightly longer than Hilbert, but slightly shorter than Dedekind. His own wry comment on getting old was: “I am becoming stupider no more.”

One must ask several questions about Erdős’ super-productive life. How could he settle the Prime Number Theorem so easily without recourse to complex function theory? What prepared him for the necessary insights? Why didn’t he settle the Riemann Hypothesis? Why didn’t he settle Fermat’s Last Theorem in an elementary way? I doubt that THE BOOK contains any 200-plus page proof of Fermat’s Last Theorem, nor do I expect a short proof to be in the margin. Surely his deep conviction of the important role of discreteness guided Erdős away from various problems. His use of probabilistic methods in graph theory and Ramsey theory will long be remembered, but why didn’t he find a *constructive* probabilistic method? Finally, one must be very puzzled that Erdős was rejected for work on the Manhattan Project at Los Alamos, while Klaus Fuchs was accepted. However, sometimes rejection is a great blessing in disguise.

Erdős’ motto was: conjectures and proofs! His main interest was with the most primitive and basic objects of mathematics: the positive integers. Of course, he was interested in other areas of mathematics too: number theory; combinatorics (finite and transfinite); combinatorial geometry; set theory, but not logic; analysis; and probability theory, with special emphasis on probabilistic methods for the existence of formal objects. His approach to the investigation of this broad range of topics was uniform: unleash a barrage of cogent challenges. Then he would politely cajole people into working on them, almost always successfully. Most mathematicians are good at either conjecture or proof, but Erdős was great at both!

Here we have a pair of well written and sympathetic books (each authored by a non-mathematician) on Erdős’ life and works. There is considerable overlap in topics between the books, and I could find no meaningful contradiction of views between them. Nevertheless, the two books do have different flavors and approaches. I found *My Brain Is Open* slightly more mathematical and more willing to go into details of technical results. On the other hand, I found *The Man Who Loved Only Numbers* more socially oriented; it even contains a detailed story about Erdős’ intuition and Marilyn vos Savant’s column on the Monty hall dilemma. It also has sub-biographies of several mathematicians who make more than cameo appearances. The different flavors of the two books are illustrated by the types of errors they contain. For instance, *The Man Who Loved Only Numbers* cites an erroneous value of π (pages 92 and 209), while *My Brain Is Open* confuses Ultra (a complex Allied operation involving intercepting and rendering intelligible enciphered enemy signals) with the codes used by Nazi Enigma machines. I suspect that life in Hungary between the World Wars was far worse than these books portray.

My Brain Is Open contains a broad spectrum of interesting topics: the many travels of the wandering mathematician; his early life and friendships in Hungary; mathematical proof (including THE BOOK where elegant proofs are found); squaring squares and Nazi Enigma machines; Ramsey theory; life at the Institute

for Advanced Study (including discussions with Einstein, Gödel, and von Neumann); number sieves; the great Prime Number Theorem controversy between Erdős and Selberg; and his many collaborations. *The Man Who Loved Only Numbers* also contains a rich vein of interesting subjects: straight from THE BOOK; problems with Sam and Joe; Einstein vs. Dostoevsky; marginal revenge; S.F. made the integers; and survivor's party. Each of the books has a splendid set of photographs of Erdős at various points in his life (only one photograph is common to the two books). Further, *The Man Who Loved Only Numbers* contains sample letters showing Erdős' noteworthy handwriting and terse style. Each of the bibliographies documents numerous technical results very well and points to useful sources for much additional information about Erdős.

In a world where the only modern mathematician that an average person can name is Theodore Kaczynski, it is wonderful to have these two accounts of the achievements and the humanity of the beloved Paul Erdős. I highly recommend *The Man Who Loved Only Numbers* to the intelligent general reader interested in the life and results of a mathematical genius, and I highly recommend *My Brain Is Open* to mathematicians, physicists, and computer scientists. For those saddened now that Erdős has, as he would have put it, "left," have heart, for now he knows whether the Riemann Hypothesis is true or not! And maybe the proof doesn't require any complex function theory.

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