

# book Review

## My brain is open: The mathematical journeys of Paul Erdős

By **Bruce Schechter**, *Simon & Schuster*, 1998, 224 pp.

## The Man who loved only numbers: The story of Paul Erdős and the search for mathematical truth

By **Paul Hoffman**, *Hyperion*, 1998, 302 pp.

## A Beautiful Mind

By **Sylvia Nasar**, *Simon & Schuster*, 1998, 619 pp.

The three books relate the life stories of two well-known contemporary mathematicians: Paul Erdős (pronounced "Air-dish") (1913 - 1996) and John Nash (b. 1926). Even if one believes in the image of the creative mathematician as an eccentric and absent-minded professor, one will still be shaken, almost shocked, by the conditions and circumstances in which these two extraordinary personalities have been moulded. In a less friendly environment or in a more conservative age, such extreme deviations from the norm could only lead to alienation from the scientific community.

The book by Schechter is more concise and more easily absorbed by the less mathematically inclined reader. The one by Davis is richer in anecdotes and mathematical details and draws heavily on personal interviews with many people who collaborated with Erdős in research. These two books contain much overlap in the biographical details and mathematical ideas of Erdős. However, reading Davis after reading Schechter gives more fascination and understanding of Erdős the man and Erdős the mathematician. You will also get to know something about the history of Hungary (Davis gives a more comprehensive account) and about the turmoil and upheaval of Europe during the two world wars. In particular, you will get a glimpse of what sort of incongruous things that human beings are capable of inflicting on fellow beings in the name of dogma, bigotry and even in the name of democracy and freedom. The moral ending of the long and arduous journey of Erdős is a happy one: recognition by his home country as a national treasure and given a unique

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citizenship status (even the steely rigidity of a communist system can melt in the face of the passion and fervour of learning).

Erdős the man is just a physical entity whose existential purpose is to conjecture and prove mathematical theorems. His emotional and human cravings are minimal - perhaps a little more than those of a holy Indian sadhu in search of the eternal truth. Erdős's search for truth is in the rarefied realm of mathematical points, curves and numbers. His passion for mathematics borders on the obsessive-compulsive side - so does the ascetic's pursuit for the spiritual truth. But it will probably be easier to accept the self-negation of the ascetic than to accept the idiosyncrasies and eccentricities of a person with a compulsive drive of the intellect that neglects all the mundane but necessary chores of life. The journeys of Erdős may be likened to those of a mendicant monk in his perpetual wandering of searching, offering and giving. Yet somehow, the fervent search for mathematical truth offers less excuse, if not justification, than the arduous search for spiritual perfection.

The later half of the life of Erdős is intertwined with the life of Ronald Graham, the American graph theorist paid by AT&T Bell Laboratories to indulge in his favourite intellectual activity of doing mathematics. Davis has much to tell about the selfless contribution of Graham in helping to sustain Erdős the man for the love of mathematics. Erdős has only two attachments: his mother (who, in the later part of her life, accompanied him on his mathematical journeys up to the last day of her life) and mathematics (in which he collaborated with perhaps the largest number of mathematicians ever). When his mother died, there was an emotional and psychological gap that had to be filled in with the aid of stimulant drugs that would let him work longer and harder with little time to think about his mother.

To Erdős, anything that is not related to mathematics is a triviality not worth fussing over. Like the consummate mathematician who is always inventing new words or re-defining old words to fit the world of his ideas, Erdős created a new vocabulary in his communication with his friends. For example, the mathematical term "epsilon" = "child", "preaching" = "lecturing", "boss" = "wife", "slave" = "husband", and so on. In his platonic world of mathematical ideas, the search is not just for new theorems but also for the simplest and most elegant proofs of known theorems, which he believed are all recorded in "The Book" somewhere in the highest realm (of heaven, for want of a better term). He was totally immersed in his mission and even up to the last minute of his life he was doing mathematics.

When Erdős first posed and solved problems in an area of mathematics called "graph theory" and in the larger area of "combinatorics", it was more like taking on the mathematical challenges of an intellectual game. It seemed to be of no particular consequence then, but nowadays, problems of that type have turned up in more applied disciplines like operations research, computer science and molecular biology. What is not so well-known is that Erdős had also made important contributions to number theory (in particular, probabilistic number theory). The first "elementary" proof of the famous Prime Number Theorem, conjectured many years ago by the German mathematician Carl Friedrich Gauss (177 - 1855) and first rigorously proved by the Russian mathematician P.L. Chebyshev (1821 - 1894) using sophisticated methods in analysis, was provided independently by Erdős and the Norwegian mathematician Atle Selberg (1917 - ), himself the recipient of the Fields Medal (the equivalent of a mathematical Nobel Prize) in 1950, using what mathematicians call "elementary methods". What could have been considered to be a collaborative effort turned out to be a personal feud over priority (and perhaps intellectual ego). Accounts of this episode are given by Davis and Schechter.

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The story of John Nash brings out the incredible story of the rise and development of an intellectual ego and genius within a short span of time, only to be cruelly thwarted by what appears to be the inexorable forces of Mother Nature in the form of schizophrenic attacks. Just as dramatic is an equally incredible phoenix-like rise from the ashes: an almost thirty-year spate of zombie-like existence dissipates imperceptibly, if not spontaneously, in time for the award of one of the highest scientific honour that can be bestowed on any scholar: a Nobel Prize. For a long time, even many mathematicians themselves are only vaguely aware of the physical existence of Nash. Many presumed that he had been dead for some time - the casual and semi-official scientific biographies that are often attached to the discoverers of important theorems and creators of new theories in encyclopedias and scholarly handbooks seem to remain eerily silent on Nash's existence. This silence was broken, almost rudely, by the fanfare in the wake of the announcement of an award of a Nobel Prize in Economics to Nash in 1994 for work done more than forty years ago. What followed was inevitable: the resurrection of Nash the mathematician and the unearthing of Nash the man. It must be more than the journalistic streak in Sylvia Nasar (a former economics correspondent for the New York Times) that picked up and unraveled this strange story of genius and madness.

While Erdős is an extreme example of genius and eccentricity, Nash is a singular example of transition from genius to madness and the rare return back. In their respective eccentricity and madness, yet there is consistency of unreasonableness. Perhaps it is this persistent unreasonableness that reveals hidden insights and breaks new grounds. Both men vividly exemplify George Bernard Shaw's model of the unreasonable man as the cause of progress. Both represent the anti-thesis of a widely held view that great mathematics is done in splendid isolation. The fruition of their incipient ideas is often catalysed by long and intense discussions with others. This is the new paradigm for mathematical activity: there is too much knowledge to be ingested by one single mind.

These three books reveal the large gamut in style and modus operandi of the mathematical mind. Yet in spite of the legendary detachment of mathematical research from mundane physical existence, mathematicians do squabble over recognition and priority and are often driven by less than noble ideals of the human spirit in pursuit of truth. Abstract names immortalized in and attached to well-known theorems and concepts take on flesh and blood with mortal imperfections.

Nasar gives us some idea of the development of the leading mathematics departments in the United States, especially those at Princeton, Harvard and MIT, and of the origins of the well-known Institute for Advanced Study in Princeton. Many of the famous personalities in mathematics and modern science come to life on a panoramic stage that spans the old world of Europe and the new world of the "wild west". The mystique of the Nobel Prizes is partially unveiled by glimpses into the hidden deliberations of the prize to Nash. It is the culmination of the improbable support that the Princeton mathematics department tacitly and unofficially extended to Nash at a time when he must have felt totally isolated and helpless and during which even his past mathematical brilliance is hard to justify the present concession. Even if questions could be raised about his sexuality or homosexuality, his story gives hope to the stricken mind and suffering soul.

Reviewed by

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