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GENIUS AND DARKNESS

TWO BIOGRAPHIES ILLUMINATE THE FRAGILITY OF MINDS KEEN AND POWERFUL ENOUGH FOR HIGHER MATH

Author: By Marcia Bartusiak

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Woodrow Wilson loathed mathematics. He once called it ``a mild form of torture that could only be learned by painful processes of drill.'' He was sadly misinformed. Much as an artist seeks to capture certain symmetries and groupings in visual form, a mathematician manipulates symbols into logical constructs, whose meaning can be as compelling and creative as any work of art. Einstein recognized this connection. The finely tempered nature of both scientist and artist, he said, ``longs to escape from the personal life into the world of objective perception and thought.''

Fine temperaments, though, can be precariously fragile. In the art world, the legendary example is Vincent van Gogh. Mathematics, too, has its share of strange and tragic figures, a fact born out in these two intriguing works.

In ``The Man Who Loved Only Numbers,'' Paul Hoffman introduces us to Paul Erdos, a lovable eccentric who would wander into his friends' bedrooms at four in the morning and gently ask whether their brains were open (for work, that is). Born in Budapest in 1913, Erdos started to display amazing arithmetical skills at age 4. By the time he died, in 1996, he had written some 1,500 papers on a variety of problems, from prime numbers to combinatorics (an area very useful in designing computer algorithms). While Hoffman skillfully explains how these pure-mathematical insights have applications in manufacturing and communications, it is Erdos's lifestyle that draws the reader in.

Erdos had no home and no wife: He relied upon the kindness of friends, if not strangers. Every few weeks or months, he journeyed from colleague to colleague around the world, all of his possessions packed in one shabby suitcase and an orange plastic bag. Frail and gaunt, he fueled himself on coffee and amphetamines. He had trouble tying his shoes and buttering his bread. He avoided sex (indeed, any

physical intimacy); what he solely desired was a mental communion with his fellow mathematicians.

``The Man Who Loved Only Numbers'' (which should be in stores within the week) is both humorous and informative, with the author providing short takes on the lives of other noted mathematicians as well, such as Fibonacci, G. H. Hardy, and Kurt Godel. Hoffman, the former editor in chief of Discover magazine and now publisher of Encyclopedia Britannica, presents Erdos mainly through the remembrances of his colleagues, freely jumping to and fro along the mathematician's lifeline. Yet, even amid the wealth of amusing anecdotes that Hoffman has uncovered about Erdos, the inner Erdos remains a mystery.

Artistically, ``The Man Who Loved Only Numbers'' might be labeled impressionistic, a charming sketch of an unusual man. ``A Beautiful Mind,'' on the other hand, is a far deeper look into the life of a mathematician. It might be compared to a Rembrandt portrait, filled with somber shadows and radiant light effects, for it is the story of a dark madness illuminated by a man's genius -- and by a triumphant recovery that leads to a Nobel prize.

The genius is John Forbes Nash Jr., who was born in West Virginia in 1928. He was tall, handsome, lithe, with a beguiling accent. But he was also haughty, socially inept, and very, very ambitious. ``Compulsively rational, he wished to turn life's decisions . . . into calculations of advantage and disadvantage, algorithms or mathematical rules divorced from emotion, convention, and tradition,'' writes Sylvia Nasar. He was a real-life Mr. Spock, devoid of any empathy whatsoever: A friendly hello in a hallway could elicit a wrathful response.

Recognized as a mathematical whiz while an undergraduate at Carnegie Institute of Technology, he went to Princeton for graduate work just as the university was achieving its stellar status within the world math community. Its math department had a style of schooling tailor-made to Nash's lone-wolf temperament: no required classes and a hotly competitive atmosphere. At the nearby Institute for Advanced Study, for example, the brilliant John von Neumann was making news for taking pure math techniques and applying them to a plethora of real-world problems, most notably the architecture of a newfangled machine called the computer. Nash was most intrigued by von Neumann's development of game theory, and while still a student, in 1950, wrote a follow-up paper on bargaining that was a tour de force in the application of mathematics to economics. The idea was hatched in the one economics course Nash had taken as an undergraduate. Soon after, he would extend von Neumann's work with a concept now known as the ``Nash equilibrium.''

Here Nasar keenly displays how the man can be reflected in his mathematics. Von Neumann, a social and politically savvy man, preferred cooperative game theory. Nash, the strident outcast, focused on noncooperative games. ``By broadening the theory to include games that involved a mix of cooperation and competition,'' writes Nasar,

``Nash succeeded in opening the door to applications of game theory to economics, political science, sociology, and ultimately, evolutionary biology." But that fact would not be appreciated for many more years.

Ever restless and eclectic, always searching for impossible problems, Nash moved into new arenas as an instructor at MIT and later at other academic posts. He made a stunning breakthrough in topology (used in such pursuits as cosmology) and then again in a completely different field, fluid dynamics. ``Some geniuses have been sprinters who have solved problems quickly," writes Nasar. (Erdos was like that.) But Nash ``was a long-distance runner." He hardly read the scientific literature but instead groped on his own and picked the brains of experts. He often gave off the impression that he was floundering, only to reveal -- after weeks and months of intense concentration -- a totally unexpected solution.

Meanwhile, his personal life bordered on soap opera. Sexually confused, he had a few homosexual relationships as well as a secret mistress who bore his child. In 1957, he married the beautiful Alicia Larde, who had majored in physics at MIT (a rarity for women at the time) and was a member of a noted Salvadoran family, which befitted Nash's pseudoaristocratic snobbery. But within a year his eccentricities grew worse; he was ultimately diagnosed with paranoid schizophrenia, perhaps hastened by the stress of his wife's pregnancy, his father's death, and a growing fear that his mathematical powers were in decline. Offered a prestigious position at the University of Chicago, he politely declined, writing that he was scheduled to become the Emperor of Antarctica.

For nearly three decades, Nash went in and out of hospitals, wandered off on sudden trips, and eventually returned to Princeton, where he roamed the halls writing gibberish on blackboards and worked on enigmatic projects on the school computer. With his sunken eyes and immobile face, which frightened the secretaries, he was known as ``the Phantom." Alicia had divorced him in 1963 (raising a son who also developed schizophrenia), but she never abandoned him. Seven years later, in fact, this extraordinary woman took him back in. It was his salvation. In the cloistered environment of Princeton, Nash's wild, alien notions ever so slowly turned back to more rational thoughts. His mind -- his beautiful mind, as one friend described it -- reemerged in the 1990s as if from a bad dream.

The triumphant climax arrives when Nash's work on game theory is honored with the 1994 Nobel Prize in Economics, a highly controversial decision (and one almost taken back), partly because of the fear that Nash's madness would reappear on the prize podium. Nasar, an economics correspondent for The New York Times, uses her expert investigative skills to reveal the tense negotiations that went on behind the award scenes (events traditionally kept under wraps for 50 years). Nash was very grateful for the prize. Jobless for so many years, he was hoping the Nobel would allow him to qualify for a credit card.

Nasar has delved deeply into Nash's year-by-year experiences. The detail does not weigh the story down, though. Rather, her exhaustive

research has been transformed into a novelistic narrative. While we never learn the deeper mathematics, it does not matter. She provides enough background for the reader to appreciate Nash's original thinking. Superbly written and eminently fascinating, ``A Beautiful Mind'' is simply a beautiful book.