

Martin Gardner's Mathematical Grapevine

Undiluted Hocus-Pocus: The Autobiography of Martin Gardner. By *Martin Gardner*, Princeton University Press, Princeton, New Jersey, 2013, 233 pages, \$24.95.

Martin Gardner in the Twenty-First Century. By *Michael Henle and Brian Hopkins*, editors, MAA Publications, Washington DC, 2012, 350 pages, \$40.00.

Martin Gardner is known to generations of mathematicians as the author—from 1957 through 1981—of the Mathematical Games column in *Scientific American*. Among other things, the columns introduced readers to fractals, Penrose tiling, public-key cryptography, John Horton Conway's Game of Life, the board game Hex (independently invented by Piet Hein and John Nash), mathematical aspects of the work of M.C. Escher, the Soma cube (also invented by Piet Hein), tangrams, polyominoes, and flexagons. Gardner also published at least 70 books (100 if you count pamphlets) on a variety of subjects, along with countless columns and magazine articles.

BOOK REVIEW

By *James Case*

Through the columns, and the articles he continued to contribute until late in life (he died in 2010) to various MAA publications (mainly the *College Mathematics Journal* and *Math Horizons*), Gardner is credited with the rebirth of recreational mathematics in the U.S. And because he defined recreational math as any mathematics undertaken “in a spirit of play,” it is hardly surprising that much of his mathematical writing concerns games.

One of the simplest is the Nim-like amusement known as Wythoff, named for Dutch mathematician Willem Abraham Wythoff, who invented it in 1907. To play, Bob and Alice are confronted with two piles of playing cards. Each in turn may either (1) remove one or more cards from one of the piles, or (2) remove equal numbers of cards from both piles. The first player unable to move—because both piles are empty—loses. Gardner's column on the subject revived interest in this and other “take-away games,” of which many have since been invented.

About twenty-five years ago, Steven Brams turned his interest in map coloring into a game—the map-coloring game. First Alice, then Bob, is allowed to color a single region of a given planar map M . The rules specify that each successive region must receive a color different from that previously assigned to any contiguous region. Alice wins if she is able to complete the coloring, and she loses if unable, at some intermediate stage, to color any as yet uncolored region. The “game chromatic number” $\chi_g(M)$ is the smallest number of colors affording Alice a winning strategy on M , and it was quickly established, after Gardner's 1981 column on the subject, that $\chi_g(M) > 5$. However, it took another 13 years to show that $\chi_g(M) < 3044$ for all M , and longer still to reduce that bound to 44, and later to 33.*

By far the most successful of Gardner's *Scientific American* columns, in terms of the response it generated, was the one he wrote in 1970 describing Conway's Game of Life. Played on a rectangular grid, akin to an infinite Go board, the rules of the (one-player) game cause an initial configuration of occupied cells to “evolve” deterministically over time, sometimes dying out, sometimes cycling among a fixed number of configurations, and, in rare instances, growing without bound. The Game of Life is now known to be a universal Turing machine; Andrew Adamatzky commemorated the 40th birthday of the game by editing an extensive collection of papers[†] from a number of prominent mathematicians and computer scientists who were inspired by the game.

Over time, Gardner developed what Doris Schattschneider later called “Martin Gardner's mathematical grapevine.” Late in life, he described the process to an interviewer as follows:

“When I first started the column, I was not in touch with any mathematicians, and gradually mathematicians who were creative in the field found out about the column and began corresponding with me. So my most interesting columns were columns based on the material I got from them, so I owe them a big debt of gratitude.”

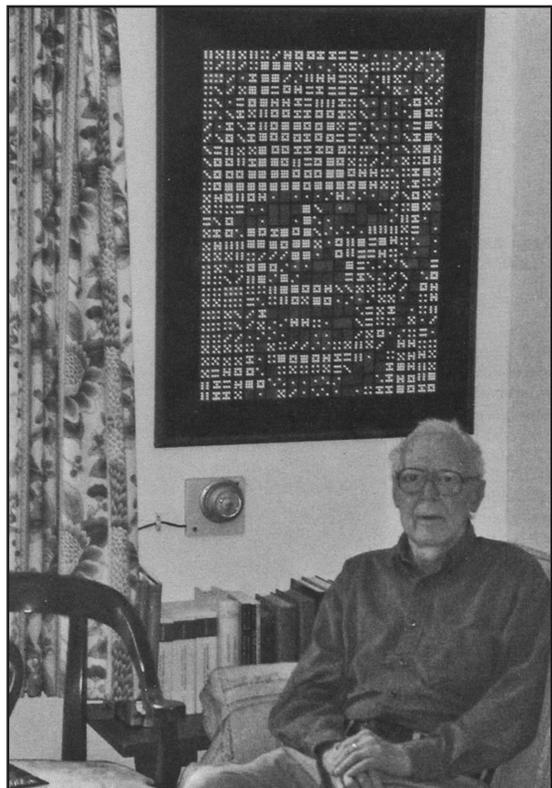
The MAA volume contains 41 articles, including eight by Gardner himself. Most concern subjects he introduced (or reintroduced) to the mathematical community, and attest to the vitality of his grapevine.

The title of Gardner's autobiography reflects his lifelong addictions to poetry and magic, as united in verse by Piet Hein:

We glibly talk of nature's laws
But do things have a natural cause?
Black earth turned into yellow crocus
Is undiluted hocus-pocus.

*H.A. Kierstead and W.T. Trotter, *Planar graph coloring with an uncooperative partner*, *J. Graph Theory*, 18 (2003), 569–584.

[†]*Game of Life Cellular Automata*, Springer, 2010.



Martin Gardner in person and in a domino portrait by Ken Knowlton. From Undiluted Hocus-Pocus, The Autobiography of Martin Gardner.

Gardner's interest in magic was, like most of his interests, primarily intellectual. Although he practiced magic tricks throughout his life, and invented more than a few, he performed in public only once. Shy by nature, he sought not audiences to surprise and delight, but rather understanding for its own sake.

Gardner's interest in magic led to enduring friendships with mathematician Persi Diaconis, who contributed a foreword to the autobiography, and with magician James Randi, who contributed an afterword. Gardner and Diaconis first met in 1958 at a magician's hangout in New York City, where actual and would-be performers were wont to gather on Saturday afternoons. While the 13-year-old Diaconis gravitated toward his contemporaries, Gardner hobnobbed with the professionals to whom he was known for the tricks he'd invented. Somehow the two became acquainted, and began to correspond. Diaconis estimates that he received about twenty letters a year from Gardner over a fifty-year period, many of them seeking assistance in discrediting the sloppy statistics and inadequately controlled experiments alleged to support the pseudoscientific claims Gardner never tired of discrediting. As Diaconis put it, "Martin interacted." The entire autobiography can be viewed as a record of his many interactions—with mathematicians, with debunkers of pseudoscience, with boyhood friends, college professors, navy colleagues, and more. Diaconis's foreword alone is worth the price of the book.

Less well known to the mathematical community is James "the amazing" Randi, who suspects that he and Gardner first met in the offices of *Scientific American* during the late 1950s. They were drawn to each other by their shared interest in pseudoscience, and the debunking thereof. Gardner's first venture into the field had been an article in the *Antioch Review* titled "The Hermit Scientist," about cranks who work in isolation from other scientists. A friend persuaded him to expand the article into a book, which, although the original sold poorly, became an instant classic when reissued by Dover under the title *Fads and Fallacies in the Name of Science*.

The dramatic resurgence of interest in astrology, faith healing, ESP, psychokinesis, and other supernatural beliefs that took hold around 1970 prompted Gardner and Randi to help found an organization called Resources for the Scientific Evaluation of the Paranormal. Its membership was later absorbed—along with TV personality Steve Allen, Carl Sagan, Isaac Asimov, B.F. Skinner, and other champions of evidence-based belief—into the similarly inclined Committee for the Scientific Investigation of Claims of the Paranormal. From 1983 to 2002, Gardner wrote a column called Notes of a Fringe Watcher for the organization's flagship publication *Skeptical Inquirer*. Randi was also a regular contributor.

The early and middle chapters of the book are a roughly chronological account of the author's life and times, from his God-fearing boyhood in Tulsa, Oklahoma, through his undergraduate years as a (sometimes religious) philosophy major at the University of Chicago, his entry into the Depression-era workforce on graduation in 1936, his four years in the Navy during World War II, his year of graduate school—funded by the GI bill—back at Chicago (which he left without an advanced degree after deciding that he wanted to become a writer, rather than a philosophy teacher), and his hungry years as a youthful freelance. Only in the 15th of his 21 chapters does he begin to describe his 44-year career as a columnist, first at *Scientific American* and later at *Skeptical Inquirer*.

He reports that he could still, at the age of 95, recite poems he learned in elementary school, including some not-so-great ones written by his favorite teacher. In childhood he devoured the works of Frank Baum, author of *The Wonderful Wizard of Oz*, along with those of Lewis Carroll and Arthur Conan Doyle. In high school—which he considered a complete waste of time—his hobbies were magic and chess. Examples of his early writing are interspersed throughout the book, with thoughts on religious matters. The writing samples include excerpts from both his high school newspaper and the college literary magazine he co-edited for a time.

Because he studied no mathematics in college, Gardner was obliged to learn what he needed for his *Scientific American* columns as he went along. As a result, they exhibit progressively greater mathematical sophistication. The series began with a single stand-alone article on hexahexaflexagons, large cloth structures that could be manipulated to reveal differently colored faces. Their creators were a group of Princeton graduate students that included John Tukey, Richard Feynman, Bryant Tuckerman—inventor of the Tuckerman traverse, a method for exposing all faces in sequence—and Arthur Stone. The hexahexaflexagons were, for a time, the Rubik's Cubes of their day. Gardner's article about the structures was a huge success, and he was promptly asked to consider a regular monthly column on "recreational mathematics." The results have been collected in 15 volumes by Cambridge University Press.

Along with Tukey, Diaconis, Conway, and Schattschneider, the mathematicians on Gardner's grapevine included Solomon Golomb, Raymond Smullyan, Roger Penrose, Benoît Mandelbrot, Donald Knuth, Frank Harary, Paul Erdős, Ronald Graham, and Fan Chung. Gardner regarded Diaconis as a top card magician, routinely performing "the cleanest second and bottom deals" in the business, and among the first to master the difficult Zarrow shuffle. The latter, which defied Gardner's own efforts, looks just like an ordinary shuffle but leaves the deck unaltered. At one point in their acquaintance, Diaconis was an undergraduate math major at Manhattan's City College, working as a shipboard poker hustler in the summer. Learning of his wish to acquire a Harvard PhD, Gardner recalled that Frederick Mosteller, founding chair of the Harvard statistics department, was an ardent magic buff. An interview was arranged and a notable career launched.

Martin Gardner was a valuable friend to the mathematical community. The MAA volume contains a number of acknowledgements from mathematicians whose careers and investigations he helped inspire, while his matter-of-fact autobiography reveals the sources of his own inspiration.

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