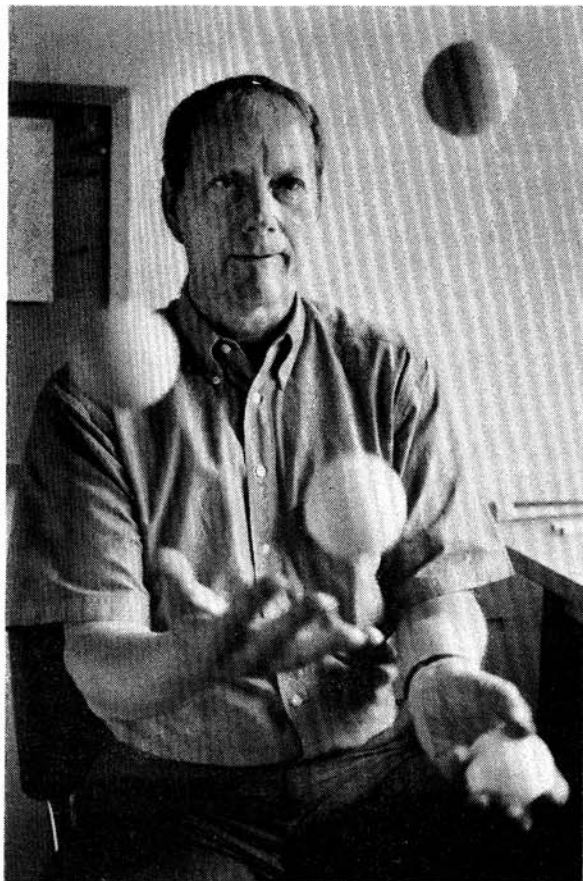


A "hands-on" approach to mathematics



Ron Graham shows off his juggling skills.

that there is a mathematical way of looking at all that goes on around you."

Like jugglers, mathematicians look at simple patterns and extend the concept to apply to unfamiliar areas. "In each case, you're breaking down complicated patterns to basic elements," Graham explains.

Graham has become so fascinated by the links among mathematics, juggling and magic that he's begun writing a book in collaboration with Persi Diaconis, a magician, statistician and professor of mathematics at Harvard University. The book, to be published by Princeton University Press, will be a "light-hearted, friendly, hands-on" explanation of the mathematics behind common (and

some uncommon) magic tricks. For example, readers will discover that the "perfect shuffle," in which a

card deck can be shuffled eight times and return to its original order, is actually based on an algebraic structure.

Graham began both his juggling and mathematics careers at age 15, when his exceptional math skills gained him early entry to the University of Chicago. He left after three years, finally receiving his bachelor's degree in physics in 1958 from the University of Alaska while working nights as an airman second class. He then went on to get master's and doctoral degrees in mathematics from the University of California at Berkeley, where he was a National Science Foundation fellow and a Woodrow Wilson fellow.

While in graduate school, he was a member of the Bouncing Baers, a professional trampoline act. He performed at circuses, school assemblies and supermarkets as part of a three-person troupe. He still has a trampoline in the backyard of his home.

He joined Bell Laboratories in 1962 and rose to become adjunct director of the information sciences division. Five years ago, he joined the Rutgers faculty.

A world-renowned mathematician, Graham has written several books on the Ramsey Theory, which holds that

Profile

Ronald Graham

Born: Oct. 31, 1935

Hometown: Berkeley, Calif.
Residence: Watchung, N.J.

Education: B.A., University of Alaska at Fairbanks; M.A., Ph.D., University of California-Berkeley

Family: Wife, Fan Chung; children, Marc and Cheryl

Interests: Juggling, trampoline, table tennis and parachute jumping

Linking mathematics, juggling and magic

By Pam Orel

With a little concentration, Ronald L. Graham, university professor of mathematics, president of the American Mathematical Society, member of the National Academy of Sciences and fellow of the American Academy of Arts and Sciences, can keep as many as six balls going in the air at once.

This has less to do with any administrative skills he might possess than with his art as a juggler, a talent more in keeping with a former role as president of the International Jugglers Association.

Graham, in fact, is rarely without the tools of his avocation, and balls and sticks can be found in the drawers of his desk at the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS).

He tries to practice at least a half hour each day and says juggling is not only a great way to relax, but also provides a different perspective on mathematical problems.

"I try to analyze where the balls are at what time," he says. "I can show


even apparently chaotic systems have a certain amount of guaranteed order, a concept useful in understanding large, complex systems.


Recently, Graham has also begun to devote some of his considerable energy, prestige and the weight of his position as president of the American Mathematical Society to the problem of mathematics instruction. His unconventional approach to mathematics may be a sign of the times — mathematicians, faced with reluctant and often poorly prepared students, are looking for new classroom approaches to the ancient science.

He envisions a new approach that would instill a love of the science and give students marketable skills. For example, he points out, the job market values workers who can solve problems creatively and work with a group toward a common goal. But those skills aren't emphasized in traditional math courses.


In response to these challenges, mathematicians at colleges and universities have turned to interdisciplinary approaches. At Rutgers, for example, students can explore the mathematics underlying physics and the practical applications of mathematics in areas like operations research.

"We need to re-examine the whole spectrum of teaching," Graham observes. And this, he admits, would be quite a juggling act.





Learning to juggle



Graham can teach the basics of juggling to those with no prior training in the art in less than an hour. He suggests:

- Most people learn to juggle from friends. Join a juggling club (most campuses have them) or group.
- Try initially just to control one or two balls. Work on mastering the basic patterns.
- ▲ Once you've mastered the basic patterns, move on to new patterns. Be open to new ideas or new combinations. Most jugglers are continually learning.

Recommended reading:
 "The Art of Juggling," by Ken Bengel, Brian Dube, Inc., N.Y., 1991.
 "Beyond the Cascade," by George Gillson, Cascade Books, Seattle, 1990.

For more information:
 The International Jugglers Association publishes a quarterly newsletter, "Juggler's World." Contact Bill Giduz, newsletter editor, at P.O. Box 443, Davidson, N.C., 28036; phone (704) 892-2244; fax (704) 892-2499; e-mail Bigiduz@davidsen.edu