PROFILE: HELAMAN FERGUSON

Carving His Own Unique Niche, In Symbols and Stone

By refusing to choose between mathematics and art, a self-described "misfit" has found the place where parallel careers meet

BALTIMORE, MARYLAND—Helaman Ferguson's sculpture studio is set back from the road, hidden behind a construction site. Inside, pieces of art line shelves and cover tabletops. Ferguson, clad in a yellow plastic apron and a black T-shirt, serenely makes his way through the room. The 66-year-old is tall and white-haired, his bare arms revealing a strength requisite for his avocation.

The most striking work in the studio is a more than 2-meter-tall, 5-ton chunk of granite. When it is finished, it will stand in the entry to the science building at Macalester College in St. Paul, Minnesota. Right now, it is a mass of curving surfaces sloping in different directions, its surface still jagged with the rough grains left by the diamond-toothed chainsaw Ferguson uses to carve through the stone.

"I'm in my negative-Gaussian-curvature phase," Ferguson says. "Say we're going to shake hands, but we don't quite touch. OK, see the space between the two hands?" That saddle-shaped void, he explains, is a perfect example of negative Gaussian curvature. Our bodies contain many others, he adds: the line between the first finger's knuckle and the wrist, for instance, and where the neck meets the shoulders.

The topological jargon is no surprise: Ferguson spent 17 years as a mathematics professor at Brigham Young University (BYU) in Provo, Utah. What is unusual is how successfully he has pursued a dual career as mathematician and artist and the ease with which he blurs the categories. Math inspires and figures in almost all of Ferguson's artistic works. Through them, he has helped some mathematicians appreciate the artist's craft and aesthetic. And he's persuaded perhaps even more artists that math may not be as frighteningly elusive as they believe, or even if it is out of their reach, it's as beautiful as any work of art they might imagine. "The way he has brought together the worlds of science and the arts—this is an admirable thing," says Harvey Bricker, Ferguson's former college roommate.

Twin callings

Ferguson himself finds it hard to say which calling came first. As a teenager in upstate New York, he learned stone carving as an informal apprentice to his adopted father, a stonemason. Artistically, however, he was more drawn to painting. After finishing high school in 1958, he wanted to study art as well as math. He chose Hamilton College, a liberal arts school in upstate New York near where he had spent most of his childhood, where he could do both.

After getting his math degree, he enrolled in a doctoral program in math at the University of Wisconsin, Madison. He paid for some of his living expenses by selling paintings. He also met and began dating an undergraduate art student, Claire. The couple married in 1963 and had their first child (of an eventual seven) in 1964. Ferguson dropped out of school for a couple of years to work as a computer programmer, then resumed his math studies. He obtained his master's degree in mathematics at BYU and a doctorate in group representations—a broad area of math that involves algebra, geometry, topology, and analysis—at the University of Washington, Seattle. In 1971, he accepted an appointment as assistant professor at BYU.

As a mathematician, Ferguson is perhaps best known for the algorithm he developed with BYU colleague Rodney Forcade. The algorithm, called PSLQ, finds mathematical relations among seemingly unrelated real numbers. Among many other applications, PSLQ provided an efficient way of computing isolated digits within pi and blazed a path for modeling hard-to-calculate particle interactions in quantum physics.

In 2000, the journal *Computing in Science and Engineering* named it one of the top 10 algorithms of the 20th century.

Function-al form. The Fibonacci Fountain at the Maryland Science and Technology Center was inspired by the "golden ratio."

Meanwhile, Ferguson's artistic career also developed apace. When he married Claire, a painter, the two struck a deal: "I get the floors, she gets the walls," he says. He began focusing more on sculpture. The art department at BYU allotted him some studio space, and he turned out a regular stream of work. He's done commissions for the Maryland Science and Technology Center, the University of California, Berkeley, the University of

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St. Thomas in St. Paul, and many other institutions. He has also designed small sculptures for awards presented by the Clay Mathematics Institute in Cambridge, Massachusetts, the Canadian Mathematical Society in Ontario, and the Association for Computing Machinery in New York City.

He has worked to keep a foot in each of the "two cultures." While at BYU, he taught a course each year for honors students called Qualitative Mathematics and Its Aesthetics. Both art students and math students enrolled: the artists looking for a palatable way to take in a math requirement, and the math students lured by the promise of higher level mathematics. Ferguson delivered on both ends. He taught concepts mathematicians don't normally encounter until graduate school, such as braid theory. Artists could relate to braids as physical objects, rope or hair that can be woven into a specific form. But students were also asked to write down an algebra to go along with how the braid was formed—a noncommutative algebra.

"Some of these folks were in there because they were either afraid of or hated math," says Ferguson. At the end of the semester, however, "quite a few art students wanted a follow-on semester—more math, more art."

Bridging

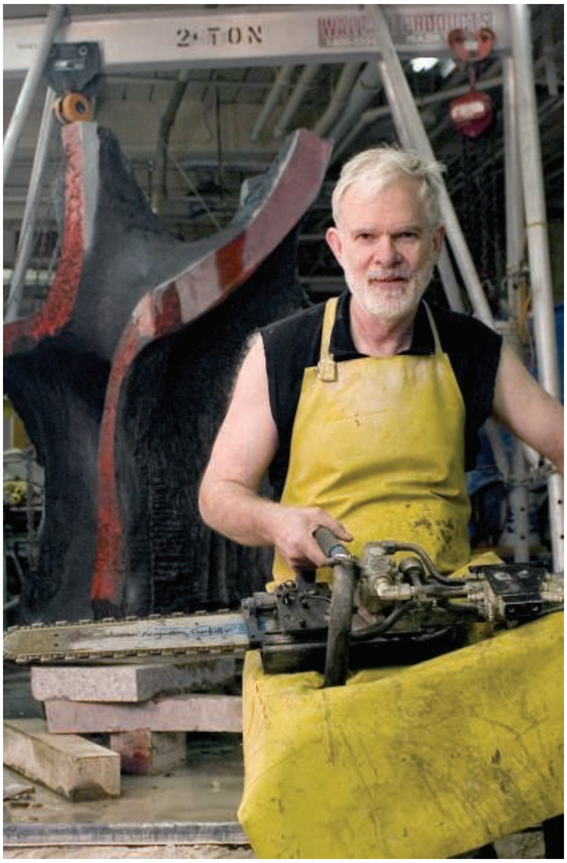
Ferguson, who left BYU in 1988, now devotes most of his time to his art. For his large-scale or complicated pieces, he uses computer programs such as Mathematica to form and refine the shape he wants the finished piece to take. "With sculpture, you want a piece to be a unit so it has direct impact as a form," he says. "Sculptures are complicated enough already." With computer programs, he says, before even putting hand to stone "you can walk around [the piece] and see a different view; you can touch it and reshape it to make it simpler and more direct."

Once the design is in place, Ferguson turns to the task of carving the stone. He works alone, without assistants, using both chisels and assorted power tools. Finally comes a lengthy smoothing process, going from 20-grit sandpaper to as fine as 8500-grit. Ferguson has to work "wet" much of the time, using water to wash down the fine particles of stone that could otherwise become deposited in his lungs. For some of the work, he dons gloves made of woven stainless steel and a positive-pressure facemask. A large sculpture can take several months to complete, working flat-out.

Twisted. Braids and knots turn up in many of Ferguson's works, including these small metal sculptures

Granite is Ferguson's favorite medium. "Mathematics is kind of timeless," he says, "so incorporating mathematical themes and ideas into geologically old stone—that's something that has great aesthetic appeal to me." He also likes the idea that his sculptures will be around for millions or even billions of years.

The finished sculptures vary widely in appearance. Some are delicate, with looped projections or intricate imprints, and are small enough to hold in one's hand. Others are massive, meant to be touched, even climbed on (as many children have discovered). As a rule, they also contain much more detail than meets the eye. "My work generally involves a circle of ideas," says Ferguson. People he interacts with, new information he obtains, mathematics he has had on his mind—all of these become "part of the design consideration."



Tough medium. A diamond-toothed chainsaw helps Ferguson carve through granite rocks that are up to a billion years old.

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As an example, he cites an architectural-scale sculpture recently installed outside his alma mater Hamilton College's new science building. The work, made of 10-centimeter-thick granite, centers on a pair of massive disks representing the planets Mars and Venus. "Venus" is exactly 161 centimeters in diameter—the height of the average female Hamilton student, taken from the records of one of the college's psychology professors. "Mars" is 174 centimeters in diameter—the average male student's height. The disks are inlaid with tiles in a pattern defined by the Poincaré and Beltrami-Klein models of plane hyperbolic geometry.

Ferguson's admirers say his artwork goes far beyond academic exercises. David Broadhurst, a physicist at the Open University in Milton Keynes, U.K., learned about Ferguson's sculpture after using the PSLQ algorithm in his research in quantum mechanics. He compares Ferguson's artistic renderings of math to Fournier playing the Bach cello suites, "giving expression to abstract forms, whose beauty is preexistent to the interpretation, yet recreated in a widely accessible medium."

For his part, Ferguson says his lifelong project to embody mathematics in mass and form is very much in the spirit of the times—and he credits technology with making it all possible. "We're living in the golden age of art, we really are. But it's also the golden age of science," he says. "Today, young people have seen more art and science in, say, their first 25 years of life than anyone in the years before that." With the collaborations between computer scientists and artists, and tools for art being used as tools for scientific exploration and invention, Ferguson suggests we may be in the midst of a second Renaissance. "It's a great time to be alive," says Ferguson, "because there are more places for misfits like myself to survive."

–KATHERINE UNGER

Katherine Unger is a writer in Washington, D.C.