

# *Mad Math*

**Jim Henle**

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# Mad Math

JIM HENLE 

*This is a column about the mathematical structures that give us pleasure. Usefulness is irrelevant. Significance, depth, even truth are optional. If something appears in this column, it's because it's intriguing, or lovely, or just fun. Moreover, it is so intended.*

*“Let me get this straight,” said the Scarecrow, “Are you telling me that if we can build a Klein bottle large enough for a person to climb into, be or she will fall down the bottle’s tube, drop out of the tube, into a four-dimensional space, then fall through that space and land on Earth?”*

— Martin Gardner, *Visitors from OZ*

Something happened at Smith College last fall. It was an event. It consumed much of the center of the campus. We called it “Mad Math.”

The inspiration for Mad Math was a magical day I experienced a dozen years ago. It was at my first *Gathering for Gardner*. This is a biannual conference honoring Martin Gardner and all the wonders his columns in *Scientific American* brought to the public—puzzles, games, tricks, paradoxes, toys, conundrums, wild ideas, and impossibilities.

Through his writings, Martin Gardner inspired generations of mathematicians, computer scientists, magicians, artists, artisans, philosophers, and philologists. Readers wrote to Gardner and shared ideas that he in turn shared. Reading his column, you felt that you were part of a community of minds. You were inspired. You were empowered.

The Gathering for Gardner I attended was packed with fascinating talks, but for that magical day the conference moved to a large estate where math was happening all over. It was a beautiful day, and everywhere groups were constructing colorful mathematical sculptures. There was a magician doing math tricks. There were teams working on a puzzle hunt toiling intensely and then running off for clues. I felt that I was in another world. It was entrancing and overwhelming. When I look back on that day, I am reminded of how I felt as a small boy when I visited Disneyland for the first time.

That special day is a regular feature of Gatherings for Gardner. A few years ago I wondered whether something like it could be produced on a college campus, with mathematical excitements all around—but not just for specialists, not just for the enlightened lovers of mathematics, and not just for the few hundred souls who are privileged to be at one of the Gatherings. It would be a mathematical fairyland for the many, for the young, for the old,<sup>1</sup>

➤ **Jim Henle**, Department of Mathematics and Statistics, Burton Hall, Smith College, Northampton, MA 01063, USA.  
e-mail: [pleasingmath@gmail.com](mailto:pleasingmath@gmail.com)

<sup>1</sup>The photographs here and in the rest of this column were contributed by Isabelle Hodge, Emmely Rogers, Dana Vera, Jennifer Warren, Quincy Webb, Charlene Morrow, and me. All but the last two are Smith students.



In the course of the day, at least five different teams succeeded in solving the puzzle.

for the innocent and for the unwary.<sup>2</sup>



This year, the stars were in place. I had the time, and I had the funds to put it together.

We also had a big sudoku puzzle.



I also had a theme: BIG

### Big Puzzles

The Soma cube is a puzzle invented by Piet Hein over 80 years ago. It's usually constructed from 27 small wooden cubes glued together into 7 puzzle pieces that have to be assembled into a  $3 \times 3 \times 3$  cube. At Mad Math, the puzzle was built from cardboard boxes 30 inches on a side.



<sup>2</sup>The Gathering for Gardner organization supports mathematical events called "Celebrations of Mind" all over the world. I don't know of any on the scale of Mad Math, except that I registered Mad Math as a Celebration of Mind.

## Big Balloons

It's a pleasant mathematical pastime to create polyhedra out of long balloons.



Cruising the internet, I located a source of balloons fifty feet long. We used some to make polyhedra.



In the morning, the sun was out, warming the air in the balloons. They rose.



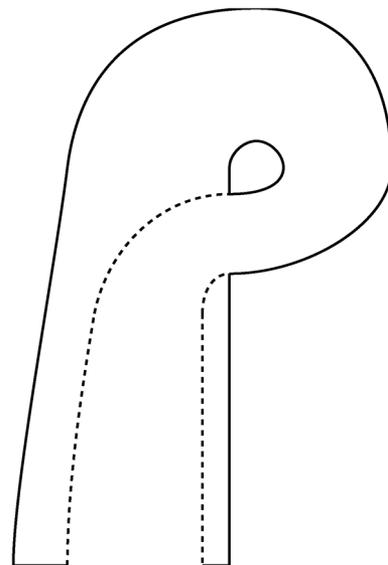
One escaped.



## A Big Walk-In Klein Bottle

Not a real one, of course. A real Klein bottle is four-dimensional. Even though the theme of Mad Math was BIG, three-dimensional was the best we could do.

This was the floor plan:



It looked like this from the right side:



It looked like this from the left:



Our construction was perhaps more Klein than bottle. Still, everyone who walked in walked out.

The largest *glass* Klein bottle is the creation of Chris Stoll, the genius behind Acme Klein Bottles. Stoll insists that his bottle is “walk-in” too, for ferrets at least.

### Magic

Mathematical magician Colm Mulcahy, of Spelman College, *Mathematical Card Magic*,<sup>3</sup> and [cardcolm.org](http://cardcolm.org) held group after group in thrall.



As a performer, he engaged. As a professional, he mystified. As a teacher, he explained.

### Big Paper

Origamist Charlene Morrow directed multiple folding operations. For paper, she had sheets that were nine feet square,



creating one-of-a-kind masterpieces.



<sup>3</sup>CRC Press, 2013.



### Big Bells

Smith College has one of the few bell towers for change-ringing in the country.<sup>4</sup> The bells are big; the largest weighs half a ton.



I don't have bell-ringing pictures from Mad Math, but a week earlier, a group of ringers met to celebrate the tower's fiftieth anniversary. Here they are, all Smith alumnae.



The Mad Math ringers were led by Sarah Moriarty, third from the left.

### It Takes a College

I was most fortunate to have Sarah, Colm, and Charlene at Mad Math, but many of the events were run by students. They did an incredible job. Only a couple of them were math majors.

I also had the support of Smith College at every level. In particular, I had funding from the Department of Mathematics and Statistics, the Science Center, the Lecture Committee, and the very new Design Thinking Initiative.

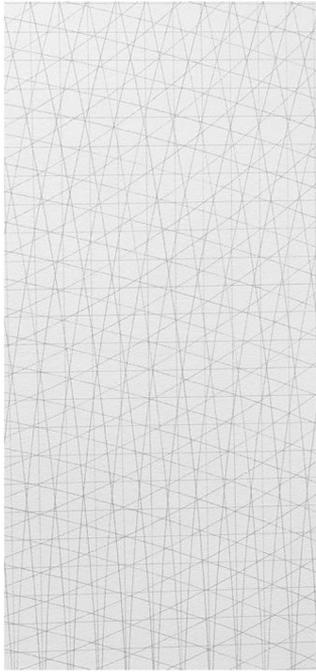
### Big Art

Mad Math featured tours of (mathematical) art on campus, featuring some large items, including works by Helaman Ferguson and Sol LeWitt.



Helamon Ferguson, "Aperiodic Penrose Alpha."

<sup>4</sup>Change-ringing is an ancient English pastime. With one person per bell, a group of ringers rings the bells in a planned succession of permutations. Just learning how to ring a bell at a particular moment takes months of practice. Change-ringing requires skill, mathematics, and teamwork.



Sol LeWitt, “Wall Drawing #139” (detail).

In addition, we were fortunate to have a kit from MoMath—the Museum of Mathematics—that allowed participants to build George Hart’s *Amazing Acrobats*.



### Small Puzzles

My student Ray Ren, whose puzzles were featured in an earlier column, “Puzzle Ninja Ninja,”<sup>5</sup> conducted a paper-and-pencil puzzle-design workshop.

### Puzzling Puzzles

There was a puzzle hunt as well. The puzzles used the campus and turned buildings into graphs to be diagrammed, colored, and numbered.

### Unadvertised Specials

We had two. There was going to be a third unadvertised special, but it got away.

One special was the game SET. While participants ate lunch, SET cards in the usual  $3 \times 4$  array flashed periodically on the wall.

Another special featured singers.



Four undergraduates cruised Mad Math singing canons and cajoling participants into joining them.

The special that got away was to have been a group of dancers that similarly would have cruised Mad Math, forming knots and luring participants into joining them to form fantastic tangles.

### The Very Idea

In my mind I imagined Mad Math as something like a mathematical flash mob. One day the campus is here. The next day, the campus is gone and in its place is a crazy universe, a scintillating, numerical, combinatorial, and geometrical playground. Walking across the campus, you would feel as though you were in another world, a playful world, a world of imagination, a world of endless possibilities and impossibilities.

I wanted students who were, say, headed for the library to be pulled in, lured by scene after scene of activity: a serious group positioning huge boxes, a laughing group assembling a colorful sculpture, an energetic team taping buildings to trees, a clutch of smiling kids crawling through vinyl corridors. And seemingly at every location, someone beckoning—

“Help us put these balloons together!”

“Join us! We’re on a puzzle hunt!”

“Hey! Do you know where Seelye Hall is? We need it!”

“Help us build this ...this ...*thing!*”

<sup>5</sup>Mathematical Intelligencer 40:3 (2018).

## The Idea Behind the Very Idea

Many adults and many college students have had a difficult relationship with mathematics. They have put it away and moved on. For them, math wasn't fun, it was a threat. They associate it with failure. Math class was where problem sets and quizzes told them they were not smart. Most kids can find excuses for low grades in other subjects. But a low grade in math seems inescapable. It seems like a final judgment.

In teaching, I have helped some students escape their mathematical purgatory. But the vast population of math-phobes don't choose to be in my classroom. And for those who do, the fact that it is a classroom works against the possibility of liberating their minds.

My goal with Mad Math was to mix the public with mathematics in a setting free of everything that blocks people from finding pleasure in mathematics. Specifically, at Mad Math—

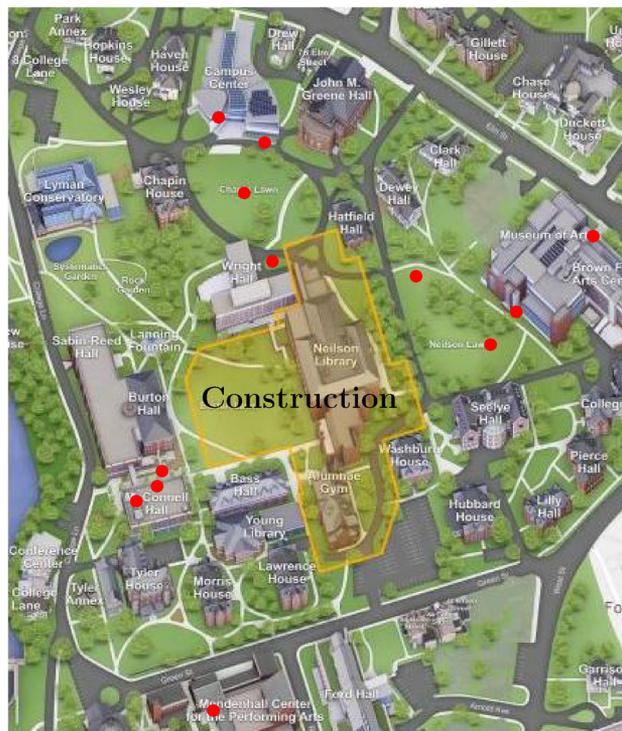
1. Nothing was presented as important, or useful, or necessary. No one was told that one thing was a prerequisite for another.
2. Everything was meant for pleasure and obviously so. Everyone could find their own pleasure and ignore what didn't please them.
3. There were challenges, but the challenges were tackled by groups. No one was alone. And the groups were formed ad hoc from strangers just met.

One *could* argue that Mad Math doesn't present real math, that is, what you need to know, what makes sense to know, what you get in courses. And I *could* respond that this is a way to get people in the door—at which point I can hit them with decimals and square roots. But I *don't* respond in that way.

My response is that Mad Math presents both the essence of mathematics and one of the most essential values of mathematics. This column, "For Our Mathematical Pleasure," is all about the delight of mathematics. I consider that delight its essence. And in my earlier column "Cucina Matematica," I made the argument that the greatest value in the study of mathematics is the cultivation of mind and that the honing of problem-solving skills is achievable by wrestling with any mathematical challenge, even delightful challenges.<sup>6</sup>

## Epilogue

Mad Math was good, especially for a first try. Not everything went smoothly, but much did. Our greatest obstacle was a huge building project in the middle of the campus.



● = Mad Math event

This meant that the events were scattered; they didn't form a critical mass. Also, it rained briefly but violently in the afternoon. That quieted things down.

I handed out a short survey after lunch, but only a fraction of visitors (36) filled it out. Of these,

Twenty-eight checked "I worked with people I hadn't met before."

Twelve checked "I didn't think math was like this." Of those twelve, seven checked "Some of this stuff is just crazy." All but one of the seven checked "I want to stay in this crazy place."

Three checked "I'm glad I did it, but I don't want to do it again."

Three checked "I don't really like math." All of those later checked "But if you ever do anything like this again, I WANT TO KNOW."

No one checked "I didn't check any boxes."

There were students, but there were also many families. I saw a lot of happy faces.

All this encourages me to believe that the sort of pleasure that I and other attendees at the Gatherings for Gardner get from mathematics can be enjoyed by almost everyone.

I learned much from the experience of producing Mad Math. I hope that similar events will follow. If you have questions, please write me at [pleasingmath@gmail.com](mailto:pleasingmath@gmail.com).

<sup>6</sup>"The Payoff." *Mathematical Intelligencer* 39:4 (2017): 62–65.