



A Decade of MoMath: TENacity, InTENSity, and PoTENTIAL

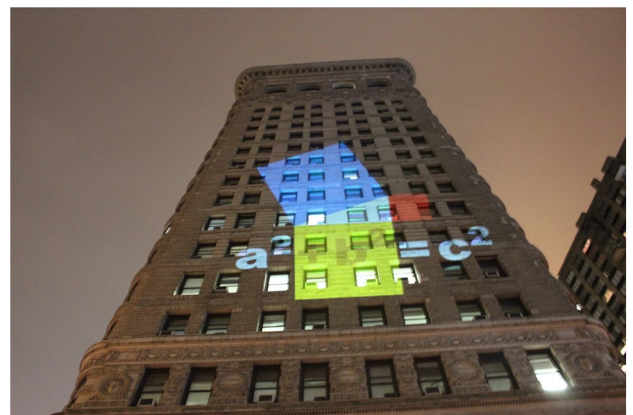
Cindy Lawrence

MoMath—the National Museum of Mathematics—celebrated its tenth birthday on December 12, 2022. In those ten years, including eight years during which I have served as its executive director and CEO, MoMath has blossomed from an idea for a small, 5,000-square-foot museum in suburban Long Island, New York, to a physical space of 19,000 square feet in the heart of Manhattan. Its staff has grown tenfold, from a small team of four people to a team of more than 40, and it has transformed itself from a new museum that few knew about into a recognized world leader and innovator in public mathematics engagement. How did this small, little-known museum take its place on a global stage, what have been its biggest accomplishments and challenges to date, and, as we reflect on the first ten years of operation, what hopes and aspirations do we have for its future?

The museum was the brainchild of Glen Whitney, a mathematician turned hedge-fund analyst. Inspired by a small museum of math on Long Island (the Goudreau Museum of Mathematics in Arts and Science) that had closed its doors, Whitney decided to turn his efforts toward reopening a museum devoted to mathematics. Right from the start, his aspirations were huge. With seed funding in his pocket from friends in the world of high finance, along with unbridled enthusiasm and the self-assurance and confidence that come from knowing you have a great idea, Whitney was ready to will the museum into being. Unfazed by those who called MoMath a “bad business idea” that “just doesn’t add up,” and bolstered by a team of eager volunteers, he rolled up his sleeves and got to work.

This column is a forum for discussion of mathematical communities throughout the world, and through all time. Our definition of “mathematical community” is the broadest: “schools” of mathematics, circles of correspondence, mathematical societies, student organizations, extracurricular educational activities (math camps, math museums, math clubs), and more. What we say about the communities is just as unrestricted. We welcome contributions from mathematicians of all kinds and in all places, and also from scientists, historians, anthropologists, and others.

Submissions should be uploaded to <https://submission.nature.com/new-submission/283/3> or sent directly to Marjorie Senechal, MathCommunities@gmail.com.



Pythagorize the Flatiron event (see pythagorizevideo.momath.org). MoMath’s largest-ever public event attracted thousands of people and proved that the Flatiron Building is a right triangle.

In short order, Whitney was joined by George Hart, a computer science professor who had long wanted to see a mathematics museum built in the United States. Describing himself as a “mathematical sculptor,” George brought a can-do attitude and an amazing level of creativity, ingenuity, and engineering know-how to the project. George was also *connected*—he knew anyone and everyone in the world of math engagement, and soon, with George’s help, the project was being nurtured and inspired by brilliant minds around the world.

As the third person in our initial trio, I had no formal experience to recommend me to the project. Yet as a lifelong math enthusiast, I had been running a program for students gifted in mathematics primarily to address the needs of my own children and others like them, who were not being challenged—nor experiencing the wonder and joy of mathematics—in their classrooms. I was immediately taken by the idea of sharing the cool bits of math—a subject I’d always loved—with others. And so I joined the “Working Group,” a dedicated group of volunteers who had been involved in the Goudreau Museum and who were now rolling up their sleeves to help bring the new museum to life.

Shortly after joining the group, I found myself stepping up to help organize the museum’s first major public initiative at the 2009 World Science Festival. Perhaps one of my greatest initial contributions in this effort was drafting the request for proposals that led to the hiring of Ralph Appelbaum Associates (RAA), a prominent museum design firm. Leading the RAA team was Tim Nissen, a brilliant designer with a history of creating science-oriented exhibitions. After helping us create the hugely popular *Math Midway* exhibition, which debuted to great acclaim at the June 2009 festival, Tim rounded out our team when he subsequently agreed to join MoMath full time.

The design process soon began. Glen and George, together with an advisory council of mathematicians and mathematics educators, brought mathematical ideas to the table; Tim brought them to life with his marvelous 3D renderings; and I brought the sense and sensibility of a nonmathematician to the process, serving as a translator of sorts between the mathematicians and those I hoped would someday be our audience. As someone whose formal mathematical training didn’t go beyond a few undergraduate mathematics courses, I found myself intrigued by the ideas being developed by the team, but at the same time, I was occasionally frustrated by my lack of understanding. Glen and George were the most patient of teachers, carefully explaining the mathematics behind each exhibit until I (and Tim) not only understood what was going on but could make important suggestions as to how we might better convey the ideas of the exhibit to a general audience. It seemed to me there was a fine line between awe and frustration, and I wanted to make sure we didn’t cross that line with our audience.

Despite the challenges posed by Hurricane Sandy, an extremely destructive hurricane that shut down the city (and our project) for weeks in October 2012 (and despite the mathematically interesting observation that it was the

largest-ever Atlantic hurricane on record as measured by diameter), the museum opened its doors in December, on 12-12-12. Several hundred visitors, decked out in black tie and gowns, attended its opening ceremony, with tens of thousands of visitors flocking to check out New York City’s newest museum in the year that followed. Winning accolades including “the most fascinating museum in New York State worth traveling for” and the “best museum for kids,” the National Museum of Mathematics, or MoMath as it was affectionately called, was on its way.

As the years went by, MoMath became more than just an exhibit-filled venue. It became a source of excellent programming, from its flagship *Math Encounters* public presentation series to its engaging-for-all-ages *Family Fridays* program featuring uniquely mathematical hands-on explorations. But more than that, it became a second “home” to many of the world’s mathematicians, mathematics educators, and math fans. It was a place where being a lover of mathematics was not just okay, it was celebrated; where fantastical worlds were built from shapes, symmetries, and patterns; and where like-minded individuals could come together for mathematical adventures—exploring, sharing, discovering, and relishing the joy of mathematics in a warm and welcoming environment.

Soon, MoMath began attracting visitors from around the world who were interested in seeing what we were doing, hoping to build a similar institution in their own countries. MoMath, which itself had been inspired by the vibrant and wonderful Mathematikum in Giessen, Germany, as well as the small Long Island predecessor museum, was delighted to have the opportunity to “pay it forward” by sharing its experiences and accumulated knowledge with groups around the world. Two conferences were also born that furthered the development of MoMath as a nexus in the mathematical community: the MOVES conference, an academic conference focusing on recreational mathematics that not only encouraged the participation of mathematicians and mathematics educators but welcomed their families too, and the MATRIX conference, an international meeting for those who run (or aspire to run) mathematics museums or who conduct mathematical outreach. Held in alternating years, these conferences attracted hundreds of participants and helped solidify MoMath’s presence in the world of mathematics engagement.

When the COVID-19 pandemic struck, the National Museum of Mathematics closed its doors to the public for the first time in eight years. Moving to a fully online platform without delay (our first online program ran on the exact same day as our last in-person program), we effectively opened a virtual door to the rest of the world. The ease with which we could bring interesting presenters to the MoMath stage via videoconference as well as the hunger for engagement and stimulation during an unprecedented global shutdown catapulted MoMath onto an even larger worldwide stage. Its audience grew from those in the local-to-NYC area to the entire world, with participants in its programs coming from more than 120 countries. And when the pandemic began to recede and the museum reopened to



Sierpiński tetrahedron with three of the museum’s founders—Tim Nissen, Cindy Lawrence, and Glen Whitney—using a construction system designed by founder George Hart (not pictured).

the public, it was with a new demand for continued online engagement.

As MoMath enters its eleventh year of operations, it looks to the future in a world still reeling from the pandemic and facing new issues with respect not just to public health, but to social justice and the economy. Some challenges of its first decade have been addressed: the incorporation of a program for a year-long visiting researcher injected a level of serious mathematics into the museum, while at the same time underscoring the importance of mathematics outreach even for top academic institutions; the MoMath Exponent Fellowship helped bring stability to the museum’s floor staff while also providing a unique opportunity for young mathematics graduates to have a year of mathematical experiences; and the ongoing commitment to hybrid events has allowed the museum to stay connected with participants around the world even as it has resumed full in-person operations.

But challenges remain. In a world where people can participate in events remotely, what is the role of in-person programming? How do we incentivize people to show up in person when it’s oh-so-easy—and perhaps safer from a health perspective—to watch a program from the comfort

of one’s home? And how do we to cover the significant labor costs of high-quality streaming when the revenues from online programming are near zero? MoMath is committed to continuing to serve those around the world, but it also wants to encourage and celebrate the very human need for in-person interaction. Especially in the world of mathematics, something that many people mistakenly think of as a solitary endeavor, we believe that coming together, in person, not only satisfies a basic human need but also helps combat this pernicious misperception.

And what of the economic environment in which the museum now operates? Rampant inflation has driven up operating costs while concurrently creating a greater need for free and reduced-cost programming. Thanks to the generous support of its board and donors, the museum has been able to focus on accessibility and renew its commitment to ensuring that nobody with a need and an interest is turned away, but this remains an ever-present and ongoing challenge.

Additionally, mathematics has historically not been equally welcoming to all groups, and the math community as a whole is focused on improving diversity—how can MoMath continue to participate in this effort in its second decade? Programs specifically aimed at this goal, such as *The Limit Does Not Exist* and *Bending the Arc*, were a good start, but MoMath needs to continue its efforts in this regard to ensure that all students have the opportunity to succeed. Bringing presenters from underrepresented groups to the stage and improving internal diversity (from staff to board and from presenters to audience) are important, but focusing our efforts on the youngest members of our audience may be a critical key to initiating systemic change. Reaching early-career mathematicians who can serve as role models and providing them with the training, support, and encouragement to do so is another initiative underway at MoMath. This program is simply awaiting sufficient funding to begin; we think we can move the needle with this effort. Given its unique role in engaging the public with mathematics along with its broad geographic reach, MoMath has both an opportunity and a responsibility to help dismantle long-held stereotypes about who can be successful in the world of mathematics, and it will continue to focus its efforts on this goal.

The expansion into online programming has reduced entry barriers and has helped MoMath reach audiences who may not be traditional museumgoers and who may not see themselves as belonging in the world of mathematics, but there is more to be done in this arena as well. A new digital initiative is underway that we hope will ignite curiosity and interest in an even broader group around the world. The conception is not to make digital copies of museum exhibits, but rather to include new interactive experiences that focus on the same goal: to engage, to delight, and to inspire.

In summary, having reached our tenth birthday, we are filled with pride in our past accomplishments—in building something meaningful and impactful—while also being cognizant of the tremendous responsibility success confers on us. Ten years ago, a museum of mathematics may have

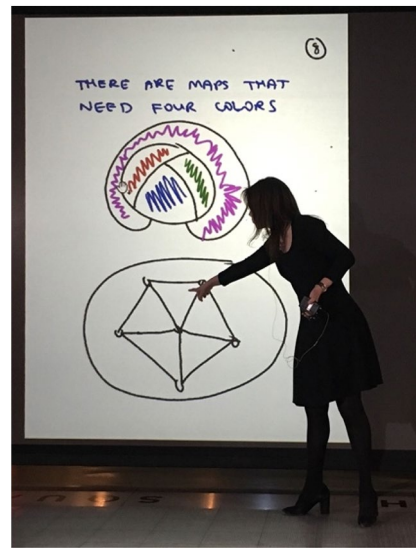


Twist 'n' Roll exhibit. The Museum's exhibits encourage exploration and discovery.

MoMath partners with the Flatiron Business Improvement district to celebrate the summer solstice.



Family Fridays (familyfridays.momath.org) brings all ages together for hands-on math exploration.



The *Math Encounters* (mathencounters.org) public presentation series celebrates the wonder of mathematics, bringing serious math researchers to the stage to share what they do with a general audience.



Monkey Around exhibit. Almost 50% of the Museum's visitors are adults unaccompanied by children.



Composite (composite.momath.org), MoMath's changing exhibition gallery, offers a rotating series of shows.



Hands up for fun at *Family Fridays* (familyfridays.momath.org).



Ring of Fire exhibit from the *Math Midway 2 Go* traveling exhibition (mm2go.momath.org). The relationship between three-dimensional objects and their two-dimensional cross sections is engaging and, at times, surprising.



Shapes of Space exhibit. The Museum focuses on engaging young women with mathematics.



Largest-ever bagel juggling event at the NYC Math Festival. MoMath takes to the streets each summer with the NYC Math Festival.



Miles of Tiles exhibit from the *Math Midway 2 Go* traveling exhibition (mm2go.momath.org). Even the youngest visitors can find something to explore at MoMath.



Family Fridays (familyfridays.momath.org). MoMath targets groups who are underrepresented in mathematics.

seemed like it didn't add up, but in fact, the proof is incontrovertible: MoMath makes sense, attracts an audience, brings joy, changes perceptions, and has an ongoing role to play in sharing the wonder and joy of mathematics with all.

Acknowledgments

All photos are courtesy of the National Museum of Mathematics, momath.org.

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