

## Adding It All Up: Building the National Museum of Mathematics

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### Abstract

Strategies, setbacks, and stories from the four-year journey to create North America's only hands-on science center focused on math and its many connections, including its connection to the world of art and beauty. Officers from the National Museum of Mathematics (MoMath) share their experiences in building an innovative new museum from scratch, and describe what's been happening since opening day and what is planned for the future. This discussion places a special focus on the incorporation of artistry into the very fabric of the Museum, and on continued opportunities for art and artists at MoMath.

### Creating a New Museum

Five years ago, Glen Whitney had a novel idea: to open a museum like the nation's best hands-on science centers, only focused on math and its many connections. The idea was warmly received by the math, finance, education, and cultural communities, and soon there was an enthusiastic group of volunteers. A Board of Trustees was recruited, and the small group was on its way. From the very beginning, the Museum had a strong connection to the world of art. George Hart, a noted mathematical sculptor, was one of the first to sign on to the new project, and his vision and technical guidance helped form the foundation of the nascent museum's first project: a presence at the 2009 World Science Festival (Fig. 1; see also [1]).



**Figure 1:** *The Math Midway on LaGuardia Place, Manhattan, NY in 2009.*

**From concept to museum.** But Glen's vision for the new museum, originally dubbed Math Factory, far outstripped the notion of a one-day festival booth. He quickly realized that the Math Factory would be America's *only* museum of mathematics, and that the World Science Festival would be nothing more than a debut event—a proof of concept of sorts. Would people enjoy a math exhibition? Could the design of such an exhibit allow folks to enter a different world, to see and experience math in a whole new way?

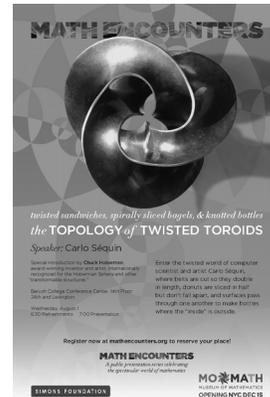
With the right designer, the answer was a resounding yes. Tim Nissen, an exhibit designer with a long track record of success, came on board with an excitement and an artistry that infused the exhibit

with a sense of playful exploration. Innovation and creativity abounded as the team designed over twenty unique mathematical experiences. And on June 14, 2009, the *Math Midway* (mathmidway.org) made its debut – the planned 1,200 sf booth having expanded, by sheer force of enthusiasm, to become a 4,500 sf traveling exhibition. As thousands of people poured into the exhibition space, they proved that math could be exciting, engaging, and fun – and gave the team the impetus to continue on full force. And even at this early stage, the connections to art were apparent – see the Amazing Acrobats, for example (Fig. 2).

While the *Midway* began to travel the country, the Math Factory team renamed itself and began its new journey, building a permanent museum: the Museum of Mathematics (momath.org). While the team searched for the perfect space and location, they also began running programs almost immediately, bringing hands-on math to teachers, students, and the general public. A free public lecture series, *Math Encounters* (mathencounters.org) became a flagship program of the incipient museum. Designed to communicate the richness and excitement of math, it showcased unusual and engaging areas of mathematics, often focusing on art in one form or another. Erik Demaine, Scott Kim, Angela Vierling-Claasen, Craig Kaplan, and Carlo Sequín—art played an important role in each of their presentations, and in the success of the exciting new series. What better way to bring math to the masses than through the connection with art and beauty—*Math Encounters* proved that theory neatly (Fig. 3).



**Figure 2:** *Amazing Acrobats* (George Hart)



**Figure 3:** *Math Encounters* poster.

A second program, the *MoMath Masters*, was not focused on art, yet it provided (and continues to provide) a showcase for mathematical artistry. Centerpieces at the first annual event were designed by George Hart (Fig. 4a), and at the second by Carlo Sequín (Fig. 4b). Attendees at MoMath events have come to expect a burst of mathematical color and beauty on every table, with centerpieces at the Opening Ceremony designed by Erik and Marty Demaine continuing that trend (Fig. 4c).

Creation of the new museum was not without challenges. An aesthetically delightful transforming staircase designed by John Edmark of Stanford University was cast aside for lack of a mere few inches of space. The arcane rules of NYC’s building department created challenges until literally hours before the Museum first opened its doors. The sheer difficulty of creating in life what the artist can easily render on paper confounded even the nation’s top exhibit fabrication firms...and yet...the Museum triumphed. The built space is engaging, inviting, and beautiful—words that are seldom associated with mathematics.

### Now and in the Future at MoMath

Art and math are interwoven within the very fabric of the Museum. A parquet deformation designed by Craig Kaplan surrounds the front façade (Fig. 5). Colorful and unique logos, designed by Museum staff and friends, grace the perfectly cubical entryway (Fig. 6). An unusual tessellation of dancing squares fills the lobby, and the grand Mathenaum beckons as one enters the Museum. To one’s left—a stunning artistic display etched in metal plates captivates both mind and spirit (Fig. 7). To the right, a logo generator encourages Museum visitors to create their own mathematical artwork. And deeper within, a grand spiral staircase is transformed into a sculpture of light and beauty (Fig. 8).



**Figure 4:** Centerpieces by (a) George Hart, (b) Carlo Séquin, and (c) Erik and Marty Demaine.



**Figure 5:** Parquet deformation (C. Kaplan)



**Figure 6:** Entry vestibule.



**Figure 7:** Light Grooves (Matthew Brand, 2012)



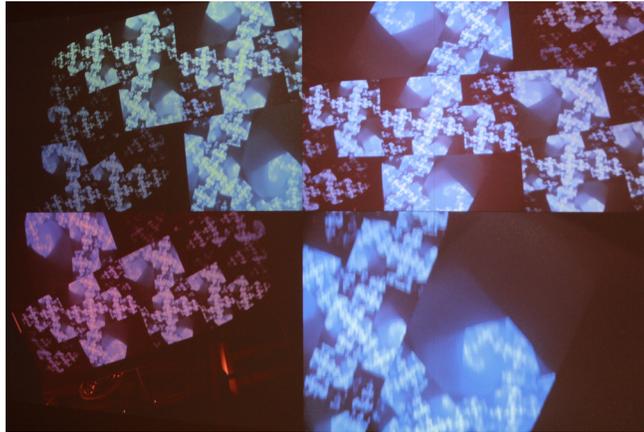
**Figure 8:** String Product exhibit.

Visitors continue to create mathematical art as they work their way through the eclectic Museum space. They design symmetrical patterns with a simple stroke of a paintbrush, adding color and changing symmetries with ease (Fig. 9, overleaf).



**Figure 9:** *The PolyPaint exhibit at the National Museum of Mathematics.*

The Mathenaem geometric sculpture studio encourages visitors to play with shape, structure, color, and pattern. Tessellations designed by visitors are laser cut before their very eyes. Intricate fractal patterns emerge from a simple video feedback loop, controlled by three visitors working in tandem (Fig. 10).



**Figure 10:** *The Feedback Fractals exhibit at the National Museum of Mathematics.*

Art and math will mesh more overtly this fall, when *Composite, the Gallery at MoMath*, hosts its opening show. The *Gallery* will be a place where mathematical artists can share their creativity and ingenuity, and where visitors can learn more about the often-surprising connections between math and art. *Composite* will host shows that include mainstream art, mathematically interpreted, as well as shows centered in the subgenre of mathematical art. It will be yet another place within MoMath's walls where the connections between art and math are called out and celebrated. If you would like to submit artwork or a proposal for a gallery show, please email [composite@momath.org](mailto:composite@momath.org).

MoMath has become a place where people are surprised, and entranced, by the incredible beauty inherent in mathematics. Surpassing all expectations, the Museum's goal of 60,000 visitors the first year will surely be exceeded, given that over forty thousand people have come to the Museum in its first three months. Math lovers and math phobics alike come in to play, and to learn through play, and kids and adults alike leave with a new appreciation for the wonders of mathematics.

## References

- [1] G. Hart et al, "Forming a Museum of Mathematics," in *Science Exhibitions: Communication and Evaluation*, (A. Filippopoliti, ed.), ISBN 978-0-9561943-8-1, 2010.