WHAT A (FIELD) TRIP!

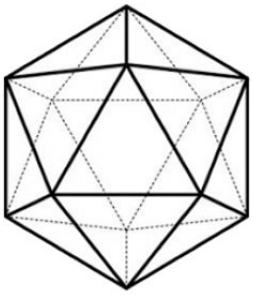
This year's Math Department Field Trip engaged students and faculty in embodied experiences in the mathematical arts at three spaces in NYC.

Mathematical Experiences await these undergraduate, graduate, and doctoral students outside Chelsea Market in Manhattan, NYC. Photo: Bogdan Nita

Everything I experienced during the trip conveyed how widespread mathematical art could be, and in different and unique mediums, even if it at first it might not seem inherently mathematical.

– VLAD NITA,
a senior pursuing B.S. and M.S. degrees in Mathematics, and a B.S. in Computer Science

What would you say is mathematical about the icosahedron on the right? Likely responses involve quantities, such as the *number* of faces, the *lengths* of the edges, or the *measures* of the angles at each of the vertices.



Now, if you were constrained from providing a response that relies on mathematical **quantities**, and instead you could only attend to mathematical **qualities**, what would you say is mathematical about the photograph on the right? This is the essence of the question we were asked to keep in mind throughout the trip and then respond to afterward:

> *Briefly describe a mathematical experience you had on this adventure that does not rely on quantification or computation. Then share what it enabled you to feel, appreciate, or think about.*

What kind of qualitative mathematical experience do you imagine the woman in this photograph might be having? What would that experience enable her to feel, appreciate, or think about?

Think of these as embodied (bottom) and dis-embodied (top) mathematical objects.

What kind of math field trip would be framed by such a question? The kind that hopes to move us outside of conventional ways of thinking about what mathematics is, and into a space where we'll only be able to come up with an answer by reflecting in new ways on just how it is we're experiencing some mathematical experience. In this news story, we share students' reflections on their mathematical experiences. These reflections will let us know if our hope was realized. □

The first stop on the trip was Artechouse in Chelsea Market for their MAGENTAVERSE exhibit. MAGENTAVERSE is an immersive experience that blends the physical and the virtual with the natural and the technological.

This otherworldly journey ignited in me a sense of being connected to the universe. At Artechouse, I felt like I was teleported to a beautiful space I have never been. It is wonderful how colors, shapes and music can affect our sense of space and time.

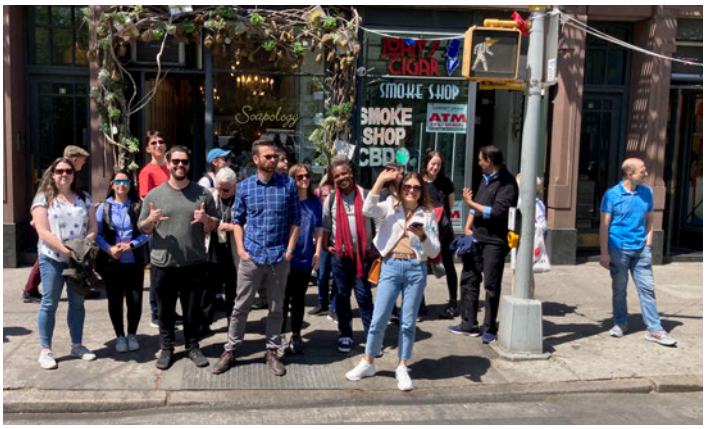
– PHOEBE ZIELONKA,
a graduate student pursuing
an M.S. in Mathematics

Photo: Phoebe Zielonka

It's hard to convey how *moving* the experience was without *moving* pictures, but these students sure look immersed. Check out the videos at Artechouse's instagram page to imagine what it must have *felt* like: **instagram.com/artechouse/**

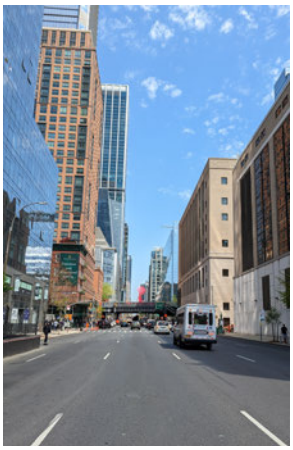
Photos: Bogdan Nita

After lunch in Chelsea Market, and on the way to stops 2 and 3 in the SoHo neighborhood of Manhattan, we walked attentively through Washington Square Park and were encouraged to be present, look around, and appreciate the mathematical moments.



The traffic moving and flowing was very interesting to think about… the use of street design combined with traffic lights, various road signs, and other means of communication… allowed for the traffic to be most constantly moving, and if one parameter were changed… the whole system would change.

– LORA LYNCH,
a senior pursuing a B.S. in Mathematics



Photos: Bogdan Nita, Steven Greenstein

The final two stops were installations by artist **Walter de Maria** (right), whose work involves spatial relations and bodily awareness. This is why these pieces were chosen for a field trip about embodied mathematical experience. De Maria emphasizes that whatever meaning his work takes on, that meaning is located in the viewer, not in the work.

Photo: bpk Bildagentur/Angelika Platen/Art Resource, New York

Photo: John Cliett

The Earth Room is 280,000 pounds of dirt spread 22 inches deep across 3,600 square feet of gallery space. It would be pretty straightforward to **quantify** the volume of dirt in The Earth Room. Do some unit conversions, find the product of the three dimensions. But listen to what you get when you ask students about the **qualities** of the mathematical experience they had in this space.

Photo: Steven Greenstein

Two things came to mind as I thought about the Earth Room. First, seeing the soil in the finite white room reminded me of harnessing infinity. Second (and perhaps more intriguing), the concept of equivalence came to mind as I looked at the evenly raked dirt across the room. Later, this thought of equivalence moved away from the horizontal aspect of the dirt in the room and transformed into the relationship between the Earth Room and the "man behind the desk" (I believe his name was Bill). I thought about how the soil looks "same" and "equal" throughout the room and how in mathematics, sameness and equivalence do not stand isolated and are not impactful by themselves. Rather, they are connected to a mathematical concept. Similarly, the soil in the Earth Room does not appear same and equal without the presence of Bill. The equivalent appearance of the soil is connected to his work as its caretaker, and the artwork's impact relies on the concept of Bill's existence. … Despite my preconceived assumption, I was mesmerized most by [The Earth Room] out of everything we saw that day…

– TARA PIZZI, a doctoral student pursuing a PhD in Mathematics Education

The Broken Kilometer, also by Walter de Maria, is composed of 500 polished brass rods, each 2 meters long, evenly distributed into 5 parallel rows. We can use these quantities to confirm that the sum of the lengths of these rods *really is* 1 kilometer: 500 rods × 2 m = 1,000 m = 1 km, so that checks out. We can also use them to determine the number of rods in each row: 500 rods ÷ 5 rows = 100 rods per row. Then again, hear what students have to share about the qualities of their experiences and what those qualities enabled them to feel, appreciate, or think about.

Photo: John Abbott

I found myself wondering about the use of cylinders in the Broken Kilometer. … They often exist as the shape of columns to support structures, as the shape of a wire in a complex analysis problem, and are one of the natural 3D extensions of a circle to emerge in nature. I am wondering what the relationships between curved surfaces and light/optics are, and what affordances emerged through the use of cylinders beyond any other shape one might choose.

– JOHN O'MEARA,
a doctoral student pursuing a
PhD in Mathematics Education

Rocco's down for the experience.
(Photo by Bogdan Nita)

I was surprised that the light in the room was not actual sunlight coming in through windows but rather LED lighting to simulate the effect. It was a sunny day outside, so there was no disequilibrium when entering the room which led to the assumption that it was the natural light. However, if it was a cloudier day, then I might have been more likely to question the presence of seemingly natural light.

– AMANDA PROVOST,
a doctoral student pursuing a
PhD in Mathematics Education

I lowered my face down to the floor at the Broken Kilometer… As I rose, with my eyes directed at the 100 brass rods in front of me, I watched the stripes of bright light reflected off each cylinder cascade out across the room. I lowered my head to recreate the effect. The stripes rolled in toward me like a wave at the seashore. I was struck with awe by the effect. … I played around with the effect, lowering and raising my head and moving my body sideways across the viewing area.

Photo: Bogdan Nita

The only light illuminating the space was a horizontal stripe of very bright artificial lights… Each cylinder was reflecting a horizontal stripe of light from those overhead lights to my eyes. As I lowered my head and the angle of my eye-line to each rod changed, the sector of the cylinder which reflected the light from above processed around each rod toward the ground. As I raised my head, the stripes recessed back upward. The rods further away had smaller angles of reflection, which resulted in the stripe of reflected light appearing lower on the cylinder. As I lowered my head, the stripes of light rotated around each rod until the next closest rod eclipsed my view of the reflection. This continued in rapid succession, leaving only the reflection in the closest rod. This successive eclipse of each rod caused what felt like waves of light moving inward and outward as I changed my head position. I was experiencing the perception of a complex mathematical representation of angles of incidence and reflection. My body, and particularly my eyes, allowed me to become aware of the effect and change my perception dynamically; something a diagram of the situation could never illuminate. … I left the space imagining cylindrical mirrors in other configurations and wondering about the geometry of reflections off cylinders.

– DENIS COOK
a doctoral student pursuing a PhD in Mathematics Education

What a trip, right?

As students and faculty in the Math Department, we're already sold on the joy and power of mathematical experiences. Focusing exclusively on its qualitative dimension in three spaces that might at first seem like odd choices for sites of mathematical exploration, we were provided with *new opportunities to feel, appreciate, and think about mathematics in new ways.* We hope that the expressions of students' experiences that we've provided here will leave you open to discovering your own new ways of experiencing mathematics. Let us know what you find! □

Ashwin Vaidya (Math Department Chair) and
Bogdan Nita (Math Faculty & Principal Photographer)