



Illustrating Mathematics

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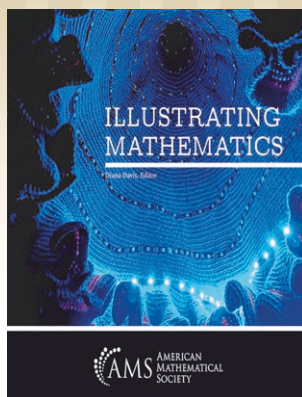
What comes to mind when you hear the phrase “illustrating mathematics”? Perhaps you think of a sketch you drew on the back of a napkin to try to understand a math problem,

an object 3D printed as part of an outreach project, computer graphics that allow a researcher to experiment, an elegant sculpture in a museum, or something entirely different. Mathematical illustration plays a wide variety of powerful roles, which often blur together and influence each other.

In the book *Illustrating Mathematics* (AMS 2020), editor Diana Davis has assembled an impressive collection of pictures and mathematical artists’ descriptions that show off the multifaceted roles of illustration in mathematics. The book is organized by medium, ranging from ancient approaches, like drawing, to newer ones, like 3D printing. In the book, we encounter wood, lasers bouncing off systems of mirrors, LEGO bricks, laser-cut puzzles, manifolds knit from yarn, and more, in representations of a wide array of topics.

While the pictures are beautiful on their own, the accompanying stories add depth and inspiration. Each chapter alternates between a full-page image of a piece and a page with the creator’s discussion of the piece. Several contributors reveal unexpected discoveries that they made while producing their visualizations. For example, mathematician Steve Trettel writes of features he discovered only as he printed wood cutouts of a family of tilings but had not noticed in the corresponding computer images. In a mix of old and new technologies, mathematician Katherine Stange describes how printing her computer-generated graphics and measuring them with a ruler and compass led to conjectures, which later became theorems that she proved in a paper published in *International Mathematics Research Notices*. Stange also writes that errors she made while coding often led to insights.

Many contributors share challenges that they encountered, a valuable feature for readers considering working with similar mediums. Sometimes, the creators merely warn of difficulties, while other times they also provide solutions. In a particularly satisfying example of collaboration between mathematicians and designers, Heidi Robb and Peter Benson explain how mathematician Dylan Thurston helped them overcome an issue in their initial approach to making a laser-cut wood tiling. On the other hand, sometimes one must work within



inflexible constraints. Glen Whitney, founder of the National Museum of Mathematics, writes that a coloring scheme he had hoped to use turned out to be mathematically impossible. On the page opposite her computer-generated graphic of a packing problem concerning Möbius strips, *Quanta Magazine*’s Art Director

Olena Shmahalo notes that “there might as well be some kind of pseudo-scientific ‘law’: ‘projects that seem simple are usually much more complicated than one might anticipate.’”

This collection arose from the special 2019 fall semester program on Illustrating Mathematics at the Institute for Computational and Experimental Research in Mathematics (ICERM), in which I participated. The book shares the excitement of that program in an easily distributable, longer-lasting format. Some of my most memorable experiences at ICERM include interacting with objects shown in the book, such as artist Oliver Labs’s glass cube that is laser-etched with rational points on a cubic surface and mathematician Rémi Coulon’s representation of the Cantor set as a 10,000-link necklace. The ease of portability of a book comes, of course, at the cost of not allowing tactile experiences. To compensate, many contributors provide URLs where one can learn more.

Davis has compiled an accessible and enjoyable collection that is likely to delight anyone interested in illustrating mathematics and inspire them to explore further. There are numerous other examples from the book that I would have loved to share, so I’d recommend this book for anyone, at any level, interested in math visualizations or the stories behind them. Regardless of whether you consider yourself more of a novice or an expert, what comes to mind when you think of “illustrating mathematics” is almost certain to expand while reading this book. ■

Ellen Eischen is an associate professor of mathematics at the University of Oregon. She co-organized the Illustrating Algebra and Number Theory workshop during ICERM’s semester on Illustrating Mathematics in 2019. She is the organizer of the Creativity Counts exhibit currently on display at the Jordan Schnitzer Museum of Art, which includes illustrations created by undergraduates in her Math and the Creative Process course. Her work is partly supported by National Science Foundation CAREER grant DMS-1751281.

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