



MATHEMATICAL ASSOCIATION OF AMERICA

BECKENBACH BOOK PRIZE

THE BECKENBACH BOOK PRIZE, established in 1986, is the successor to the MAA Book Prize established in 1982. It is named for the late Edwin Beckenbach, a long-time leader in the publications program of the Association and a well-known professor of mathematics at the University of California at Los Angeles. The prize is intended to recognize the author(s) of a distinguished, innovative book published by the MAA and to encourage the writing of such books. The award is not given on a regularly scheduled basis. To be considered for the Beckenbach Prize a book must have been published during the five years preceding the award.

CITATION

Nathan Carter

Bentley University

Introduction to the Mathematics of Computer Graphics, Mathematical Association of America (2016)

The Oxford logician Charles Dodgson via his famed Alice character rhetorically asked, “Of what use is a book without pictures?” And most of us believe that a picture is worth a thousand words. In the same spirit, Nathan Carter in his *Introduction to the Mathematics of Computer Graphics* has given us a how-to book for creating stunning, informative, and insightful imagery.

In an inviting and readable style, Carter leads us through a cornucopia of mathematical tricks and structure, illustrating them step-by-step with the freeware POV-Ray—an acronym for Persistence of Vision Raytracer. Each section of his book starts with a natural question: Why is this fun? Of course, the answer is a striking image or two—to which a reader’s impulsive response is, How might I do that? Whereupon, Carter proceeds to demonstrate.

He leads us through vectors, geometrical transformations in two and three dimensions, lines of sight and perspective, the theory of color and lighting techniques; animation, applications of Bernstein polynomials and Bezier curves, and finishes with subdivision algorithms. Nathan Carter’s book is a modern-day version of the master wood-cutter Albrecht Dürer’s 1525 mathematical and artistic treatise *The Art of Measurement with Compass and Straightedge*.

Danger! Unless you are already an expert, reading this book may prompt you to produce graphics that indeed pop.

Biographical Note

Nathan Carter uses computer science to advance mathematics by writing open-source software for university mathematics education in areas including mathematical logic and abstract algebra visualization. He is a past winner of the Mathematical Association of America's Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member. His major projects have been books, beginning with *Visual Group Theory* (2009), which won the 2012 Beckenbach Book Prize from the MAA. His second text, *Introduction to the Mathematics of Computer Graphics* (2016), will receive that same award in 2020. His most recent book is an edited volume with many contributors, entitled *Data Science for Mathematicians* (2020), intended to help pure mathematicians make the transition into teaching and conducting research in the ever-growing field of data science.

Response from Nathan Carter

Nobody starts life able to write anything, much less write it well. So I must thank the two most significant influences on my life as a writer. I took several English and writing courses from Dan Fraustino as an undergraduate at the University of Scranton, because I knew that he was completely merciless in his requirement that I work and improve, and I hated that and loved it at the same time. Thank you so much, Dan. But long before I met Dan, I worked with an editor; my mother is a copy editor and has been for years, editing my school papers since before I knew that I wanted to study mathematics or write anything. From these two people more than anyone else, I've learned not to stop editing my writing until I can't find anything else to improve, no matter how long that takes.

Several academic friends deserve thanks as well. Andy Hansen of Indiana University first introduced me to computer graphics, Tony DeRose of Pixar and Rasmus Tamstorf of Disney both helped shape the topic list, and Ken Monks and Cornelia Van Cott helped me explain topology concepts correctly. And my friend Ken Crouse of E Ink was an extremely patient correspondent, teaching me what you can and can't say about human color perception. My friend and colleague Charlie Hadlock enthusiastically validated book-writing as a legitimate focus for a mathematical career; my dean Dan Everett supported my taking time to write; and my students patiently worked through many iterations of the text that were far less refined than the final product!

But my primary thanks go to the Mathematical Association of America; I have been very fortunate to work with them when writing books. MAA staff are dedicated and knowledgeable and care about publishing works that, first and foremost, benefit the mathematical community. My great thanks go to them first

for being willing to take up this book project and work with me on seeing it to fruition, then second for being kind enough to consider me for this award. Both have been a pleasure and I am blessed to have had the opportunity.