Mathematicians: An Outer View of the Inner World

Reviewed by Todd Eisworth

Other than not having enough time to do mathematics, I think the most common complaint mathematicians have is that we wish more people understood what we do and why we do it. This book implements a new approach to addressing this common lament—take ninety-two large black-and-white photographs of mathematicians and pair them with accompanying personal reflections by those pictured. The end result of this is a very rare commodity indeed: a coffee-table book about mathematicians.

The origins of this book lie in a chance meeting between Brandon Fradd, a one-time mathematics major at Princeton who went on to run a biotech hedge fund, and Mariana Cook, a well-known photographer who had already published a collection of photographs of scientists. Fradd suggested that Cook do a similar project with mathematicians, and this book is the result. We get a chance to meet both of these people briefly in the text, for Cook wrote a short preface and Fradd a short afterword.[1]

Anyone casually thumbing through the book will be struck first by the photographs. They are

beautifully done, and their main effect is to demonstrate that mathematicians are people, too. Leafing through the pages, the reader is greeted by a variety of faces: avuncular, dour, serious, smiling, young, wrinkled, and, yes, even a few that look like stereotypical "math professors". The most interesting photos raise questions: Why is Mikhael Gromov sitting in the middle of abundant plant life? Why is there a tortoise crawling across the table in front of Ken Ribet?[2] Where are Marie-France Vigneras's shoes? Overall, the pictures do a nice job of demonstrating that mathematicians are human beings with personalities, quirks, and interests just like everyone else.

For most readers, though, the main attraction of the book will be the essays accompanying each photograph. These are all written in the first person, and as we read, it is as if the person pictured on the facing page is speaking to us. We are told in the afterword that these essays were carefully written either by the mathematicians themselves or by Mariana Cook based on personal conversations she had with them. Each is supposed to provide a glimpse into the background and motivations of its author: an "outer view of the inner world".

How successful are the essays at doing this? Overall, I think they do a commendable job. For me, the most enjoyable essays are the ones that seek to capture the moment of inspiration—that moment when the mathematical objects we have been carrying around in our minds seem suddenly illuminated by a flash of understanding. Some of the authors manage to do quite well with

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[1]*In addition, Princeton University Press has made available a twelve-minute interview with Cook. It can be accessed at* http://press.princeton.edu/video/cook.

[2]*I did learn the answer to this one. The tortoise was a pet named "Henry", and unfortunately he did not live long enough to enjoy the fame associated with his appearance in the book.*

this: for example, I found the following passage very much in accord with my own experience:

Marie-France Vigneras: "Think of yourself in a forest. You enjoy the beauty of nature and it is not cold, but light becomes dim and it is time to leave the forest. You try a tiny path but it ends quickly. You walk back and try another one; they all look the same and it is darker. You stop and stay motionless. You wait and wait, with your senses alert to see the invisible, to feel the undescribable, to listen to the silence. And it happens suddenly: one direction becomes more dense, or more luminous. To experience this intense moment is the reason why I became a mathematician."

Other mathematicians will almost certainly find their own encounters with that "intense moment" reflected in the essays.

The essays are also packed with interesting personal anecdotes. We see such moments as Andrew Wiles's first encounter with Fermat's Last Theorem (at age 10!), the tumultuous night that led to the discovery of the Gross-Zagier formula, and Roger Penrose's chess-filled walks with his father and brothers. These little bits of insight help to humanize the mathematicians involved and are one of the more attractive features of the book.

Another theme weaving through many of the essays is how crucial teachers are to the development of mathematicians. A great number of people mention specific teachers (from all levels of the educational system) who have had an extraordinary influence on their careers. I found the following example quite striking:

Marcus du Sautoy: "My math teacher pointed at me during a lesson and bellowed, 'du Sautoy! I want to see you after the class.' I was twelve. I was terrified. Had I done something wrong? When the bell rang for the end of the class he took me round the back of the maths block. 'Now I'm in real trouble,' I thought. But then my teacher proceeded to explain that he thought I should find out what mathematics is really about. According to him, the mathematics we were learning in the classroom wasn't real mathematics. He pointed me in the direction of a number of books including *A Mathematician's Apology*, by G. H. Hardy. He suggested I read Martin Gardner's column in *Scientific American*. It was a revelation. I read about prime numbers, the language of symmetry, the strange world of topology. I experienced the thrill of my first proof. Hardy wrote about mathematicians being makers of patterns, patterns that had to be
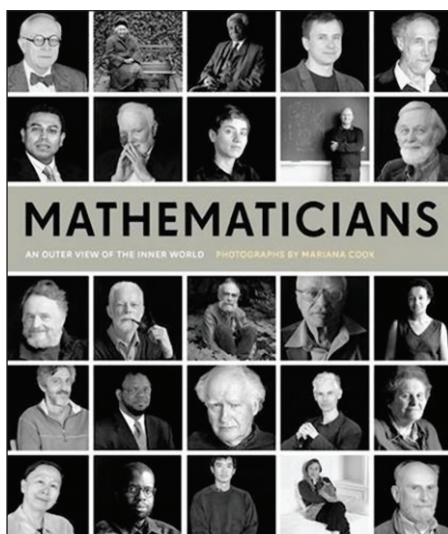
beautiful. It was like I'd been learning a musical instrument, only allowed to play scales and arpeggios, and for the first time someone had played me a piece of real music."

There are many other such vignettes throughout the ninety-two essays. We are treated to memories of parents, schoolteachers, college professors, advisors, and senior colleagues and shown how such people all have roles to play in the nurturing of mathematical talent. This book sends a clear message that competent teachers at all levels are necessary for the health of our profession.

The book does have some flaws, though. Given the number of writers featured, one should not be surprised that there are differences in quality between the essays, but the unevenness was more noticeable than I expected. Whereas the best essays (which unfortunately always feel too short) open up a window into the more personal side of doing mathematics, the worst are little more than a lifeless recounting of accomplishments. Other essays are afflicted with a malady (quite common among mathematicians) whose symptoms might include such things as a discussion of childhood memories transforming suddenly into an encomium for non-Abelian versions of Hodge theory for Kähler manifolds.[3] Some of the pieces contain striking metaphors, others cross a line into purple prose. I think this disparity does not detract too much from the book, though, as it helps to emphasize the variety of the people profiled.

More seriously, I wonder how successful the book is at fulfilling all of Fradd's goals for it. For example, he writes in the afterword that "We need to get beyond the stereotype that it is 'hard' and only for a few special people". But consider the following quotes:

Noam Elkies: "Toward the end of high school, I'd already attained some initial recognition in both mathematics (perfect score in the International Math Olympiad, progress on an open Erdős problem) and music (Juilliard performances and BMI, Broadcast Music Inc., awards for my compositions), but it became clear that I could not aim for careers in both."

Don Zagier: "I skipped one grade and then another and another and another, graduating finally from high school at the age of thirteen. After a year

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[3]*An exaggeration, of course, but the disease is familiar to everyone who knows a mathematician. And the phrase "non-Abelian version of Hodge theory for Kähler manifolds" does occur in the book!*

in England I went to college at MIT, completing a five-year program in two years, and graduated with two bachelor's degrees at the age of sixteen. I finished my Ph.D. thesis at nineteen."

Burt Totaro: "Now, two big pieces of luck come in. First, my parents and I met a psychology professor, Julian Stanley, who was a strong advocate of allowing children to skip grades if they were able to. That worked out well for me. I was ready to start college at thirteen. The second piece of luck is that the university that was willing to take me was the center of American mathematics, Princeton."

The above passages were chosen for shock value, but they help highlight an underlying tension in this book. The problem, of course, is that it's hard to demonstrate that mathematics isn't only for a few special people solely by profiling a few special people. Near the end of the afterword, Fradd writes "you will see how similar mathematicians are to us...", but contrast this with the photographer's opening statement in the preface:

Mariana Cook: "Mathematicians are exceptional. They are not like everyone else. They may look like the rest of us, but they are not the same."

This is a long way from getting beyond stereotypes about mathematicians.

Also, the way in which the mathematicians were selected may have the unintended effect of making the upper echelons of mathematics appear to be a closed world. In the introduction (written by Robert Gunning), we learn:

Robert Gunning: "The selection is not intended as a list of the 'top' current mathematicians but rather is somewhat random. The project began with some of the mathematicians who were Brandon Fradd's teachers and friends at Princeton and expanded with suggestions from those individuals of others throughout the world who could convey a sense of the variety of people who currently practice mathematics."

This methodology results in the book taking on a distinctive flavor—a quick count shows that twenty-nine of the profiled mathematicians list an affiliation with Princeton University or the Institute for Advanced Study. Upon browsing through the book, one of my colleagues quipped "It's the Princeton Math Department Yearbook!" Expanding our scope a little, we find that forty-seven (just over half) of the profiled mathematicians list affiliations with one of Princeton, IAS, Harvard, MIT, or Berkeley and that about two-thirds are either faculty members or graduates of one of these institutions.

This underlines a second tension present in the book—there are indeed a great many different backgrounds represented among the ninety-two profiles, but there is also a great deal of convergence in the career paths of the mathematicians selected. In the majority of the essays, there comes a point where the writer says something along the lines of "and then I arrived at _____ and began to work with _____", where the first blank contains the name of an elite mathematics department and the second contains the name of a famous mathematician (often one profiled in this book as well). There are exceptions, of course, but I worry that the book sends a subtle message that only those who can fill in the two blanks above with the right sort of names have any chance at all of being profiled in a coffee-table book about mathematicians. Mariana Cook makes much of the democratic nature of mathematics in her preface, and I wholeheartedly agree with her, but the book nevertheless strikes me as having a little bit of an aristocratic flavor.

If you are looking for an interesting peek into the backgrounds and motivations of some of the leaders of our profession, then this book belongs on your coffee table. The photographs and essays do help to humanize their subjects, but the writing is so brief that I don't know how much nonmathematicians will learn about the nature of our vocation. What comes across clearly is that mathematics is a creative enterprise and that mathematicians are incredibly passionate about it. Maybe that is all that can be expected.

I am not sure that it will do much to sweep away conceptions that mathematics is a very difficult subject suitable for only a very few people, as there are too many extraordinary people profiled and many of them take the opportunity to enumerate extraordinary achievements. I think it works much better as a book for mathematicians, as it does a wonderful job of illustrating how we all share the same love for mathematics.

In the preface, Mariana Cook states, "I have photographed many people: artists, writers, and scientists, among others. In speaking about their work, mathematicians use the words 'elegance', 'truth', and 'beauty' more than everyone else combined." If this is the impression people are left with, then perhaps the book will have done its job.