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Mircea Pitici (Editor): The Best Writing on Mathematics 2015, Princeton University Press, 2016. ISBN:9-78-069-1169-65-1, USD 24.95, 392 pp.

REVIEWED BY CIARÁN MAC AN BHAIRD

The 2015 edition of the *Best Writing on Mathematics* is the 6th in the series, and contains 29 essays which cover a wide range of intriguing topics. All readers, whether professional mathematicians or statisticians, teachers or those with a general interest in these subjects and their applications, will find engaging articles to consider and discuss with their peers.

In this review, I will provide a very general overview rather than an in-depth analysis of all the essays, and give further details on specific papers which grabbed my attention. I am aware that some may not share my preferences, so for added insight, I would first direct the reader to the excellent introduction from Mircea Pitici, the book editor. This contains his thoughts on the *Best Writing on Mathematics* series, this specific edition of the series and an overview of the chapters. Furthermore, he gives an extensive list of new books on mathematics which is a very useful resource for the reader, as is the provision of a webpage which gives an extended introduction with supplementary online materials (`http://assets.press.princeton.edu/chapters/s10558.pdf`).

One of several recurring themes in this book is that of mathematical games and puzzles, for example, there is Mutalik's paper on the importance of puzzles or mathematical problems to our development as humans, Mulcahy and Richards on the impact of Martin Gardner's mathematical puzzles, Walsh on the mathematics behind the game *Candy Crush*, Freiberger on the chaos of mathematical billiards and several more. It is refreshing to see the historical development of certain topics included in several essays, for example Rougetet's work on the earliest written material found on the game of Nim, and Rittaud and Heeffer on the Pigeonhole Principle. Many

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more areas are considered, with papers which can be loosely characterised as covering topics in geometry, statistics, philosophy, art, and synthetic biology. Several of these papers are described in more detail in other extant reviews of the book, and also in Pitici's introduction.

The contributions I found most absorbing in this book were those which are related, albeit sometimes tenuously, to mathematics instruction and education. A prime example is the first essay, *A Dusty Discipline* by Barany and MacKenzie. It is particularly striking, considering the struggle that many mathematics instructors at third level in Ireland have had in recent years to hold onto blackboards in our classrooms. This essay may not convince those who are trying to remove blackboards. However, the focus of the essay on the role of the blackboard in teaching and research, and its influence on how we present and think about our work should resonate with everyone who uses them.

In light of the recent substantial changes made to second level mathematics in Ireland, readers may find many points of common ground with Zhang and Padilla in their observations on the differences between US and Chinese mathematics education. They present on why Chinese students consistently outperform their US counterparts in mathematics, and give a list of recommendations on how to address this gap. The much shorter *The Future of High School Mathematics* by multiple authors is also very interesting from an Irish context. While the paper does not reveal anything new in terms of the issues it discusses, it re-emphasises five key points for the reform of high school mathematics, which are not just applicable to the US. They state that *Despite understandable controversy ... the Common Core standards provide a useful framework for further efforts, provided they are viewed as a living document to be modified as recommended by experience.* The reference to *a living document* is perhaps a point that all involved in curriculum and associated changes, including those who comment on such changes, should consider carefully.

Hanna and Mason's *Key Ideas and Memorability in Proof* was an absorbing read. They consider mathematical proof and, in particular, discuss Tim Gower's 2007 paper (Mathematics, Memory and mental arithmetic). They dissect Gower's observations on the *width* and *memorability* of proof and place this in the context of several

other works in the area of proof. The word *beauty* is mentioned in this essay, a word which is often overused in mathematics and this is expanded upon by Cellucci in his paper *Mathematical Beauty, Understanding and Discovery*, one of the longest articles in the book. This essay was an interesting journey through many different understandings and misunderstandings, from ancient through to modern times, of what mathematical beauty actually is (Cellucci does not provide a definition).

Perhaps one of the biggest challenges that faces the mathematical community is trying to explain the *beauty* or significance of their work to others. Strogatz's paper, based largely on his *Elements of Math* series in the New York Times, gives a very interesting perspective. He discusses three groups (he contends) that most people in a general audience will fall into in relation to mathematics, i.e. the traumatized, the perplexed and the naturals. He maintains that when someone is teaching or writing about maths, they need to give the first two groups special consideration or attention. He stresses the importance of *providing illumination, making connections and being friendly* and expands on these using examples from the writings and teaching skills of the great Richard Feynman, Stephen Gould and Lewis Thomas. I found his position particularly compelling, in an environment where the promotion and effective communication of mathematics, statistics and science to students and the public is becoming an increasingly important part of our mission as researchers and instructors.

Ciarán Mac an Bhaird Ciarán Mac an Bhaird is a lecturer in mathematics at Maynooth University and Director of the Mathematics Support Centre. His current research interests are mostly in mathematics education, but he also conducts research in algebraic number theory and in the history of mathematics. Ciarán is from Co. Monaghan and works on the small family farm in his spare time.

Department of Mathematics and Statistics, Maynooth University
E-mail address: ciaran.macanbhaird@mu.ie