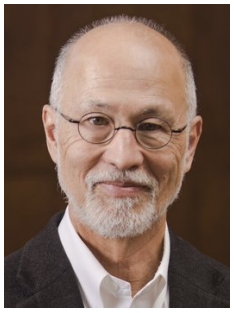
Exercises in (Mathematical) Style, *John McCleary*, MAA Press/AMS, 2017 (xiv+275 p.) isbn: 978-1-4704-4783-8.





John McCleary

Ording's *99 Variations on a Proof* (2019) and *Rationel mon* $\mathbb{Q}$*, 65 exercises de style* (2010) by L. Duchêne and A. Leblanc (which is possibly M. Audin) are not the only mathematical books that are inspired by R. Queneau's *Exercises de Style* (1947). Also the present book by McCleary is presenting 99 short stories (not more than three pages each) of properties involving binomial coefficients.

Of course binomial coefficients are an easy subject and they show up in many different practical situations, while the mathematics is often not demanding and can be followed by most readers with an elementary knowledge of mathematics. Only some of the stories require (elementary) calculus and fewer even go beyond that. The items that require calculus get a star, two stars for complex numbers and three stars if more is required.

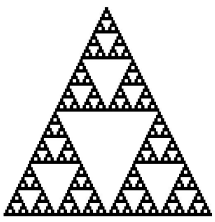
Unlike Ording who is presenting proofs of one and the same property, McCleary's short stories involve many different things (but mostly proofs) related to binomial coefficients. Because counting and choosing k from n or distributing n over k can appear in so many different contexts there are many ways to present a property. Some of the stories are just historical facts, while others are fictitious with dialogues, in which the persons are discussing the problem.



Raymond Queneau
1903-1976

We also find several styles of poems, a music score, a puzzle, graphical proofs, proofs without words, several letters, a stage play, a lipogram (no letter 'e'), a book review, tweets, etc. Many of the stories are inspired by an historical fact or event: a letter from Gauss to M. LeBlanc (Sophie Germain), a discussion between Newton and Abel. There are several fictitious letters for example one by Newton written in his style, one by Leibniz signed as Georgius Ulicovius Lithuanus (an alias that he used when a political sensitive matter was discussed), and one letter to a princess by Euler (referring to the historical *Letters to a German Princess* that he wrote to Friederike Charlotte of Brandenburg-Schwedt and her sister). However, several of the proofs are just classical mathematical ways to prove things, only the property that is proved is different, but I would not count that as different *styles*, they are just different properties. But there are quite different mathematical styles of course. A proof of a property à la Bourbaki is definitely different from an elementary classroom proof. An original example is a kind of puzzle where formulas and words (grouped by word type) are given and the problem is to put them together to form a proof. Another one, called *Mutperation satticsits*, is about permutation statistics and is completely written in a dyslectic phrasing. Not all of the stories are proofs or require action from the reader tough. The first one for example is just introducing the notation.

On the mathematical side we find statistical aspects, but we also find several problems relating combinatorics to prime numbers. The reader is also confronted with some q-theory, cellular automata, tilings, generating functions, hypergeometric series, and some calculus and elementary algebraic structures, Pascal's triangle is often used to derive the elementary properties. It also appears when cellular automata are discussed and Pascal's triangle modulo 2 or 3 leads to a Sierpinski triangle.



As the other two Queneau-inspired books, this is again one written by somebody who is savouring the joy of math, and that is very contagious. The stories give historical background, they can inspire teachers to design exercises, or you can read a story for fun instead of swiping 10 minutes of your life away on your smartphone.

Adhemar Bultheel