The Genius Plays! A Review of *Genius at Play: The Curious Mind of John Horton Conway*, by Siobhan Roberts

Reviewed by Timothy Sibbald

Siobhan Roberts continues to impress with this book, her second biography of a mathematician. She has clearly put in a lot of legwork and had remarkable access to her subject in her exploration of John Conway. This is an impressive book that details Conway's remarkable career in a fascinating ride through decades of recent math events.

The book begins by detailing how Conway would play games routinely. He seems to have almost used games as a form of procrastination, and yet his mathematical ability shone through at the right moments. The playfulness, in his early years, is punctuated with humorous moments such as his proof that a person's tongue can be folded in four different ways (not to mention the etymological interruptions).

Conway's legacy entails multiple forms of mathematics. Arguably they are interrelated, but they are distinct in layman's terms and it may be the mathematical relatedness that makes the mathematics itself so powerful. Conway's interest in knots appears to have arisen about the same time as his interest in flexagons—paper folded polygons that change their faces when flexed. Are the two related? Then there are the number games, in which we see him asking people for a number and then telling them four squares that add to that value (Lagrange proved that four squares is always enough), or asking for a birthdate and identifying the day of the week.

In some places the mathematical scenery, rather than a single item, becomes the focus. An example is that Cantor's discovery of different infinities is explained along with Conway's generalization to surreal numbers, but the coverage is not as in depth as his multiday presentations would be. This does not detract from the book, because the reader is sure to find a variety of interesting ideas along the way. Not long after surreal numbers are introduced, the game of Dots and Boxes is mentioned—the reader is not trapped in any topic too long. It is this variety that makes the book a cornucopia of ideas that will inspire at multiple levels. A teacher can immediately challenge a class with the sequence 1, 11, 21, 1211, 111221, 312211 and so on, which is explained, and may find the connection between codes and sphere packing to be more a passing interest than a school endeavour.

It is interesting to read about Conway's early adoption of the computer for the Game of Life, an iterative geometric sequence that high school students can find remarkable for the variety of behaviours that can evolve. However, it is surprising to find that Conway has a distaste for the Game of Life because it has diminished the recognition of everything else he has done. An example is FRACTRAN, a row of 14 fractions that, with a very simple algorithm, apparently generates the powers of 2 with exponents that are only prime numbers! This is a curious way of combining fraction skills with the concept of an algorithm that leads to something much more significant. Similarly, Roberts mentions how the Game of Life led to the discovery of another iterative geometric pattern generator, called Rule 110, that is a universal calculator (anything can be calculated by beginning with the appropriate geometric pattern and determining the sequence to the right stopping point).

The overall message of the book is philosophically on the same page as many math teachers. If you tinker with mathematical amusements, the larger concepts will start to emerge through experience. It may well have been the interest in games that led to Conway's interest in codes. That interest, while showing the importance of communication in mathematics, led to the discovery of a sporadic group, which led to Conway's involvement in the Atlas of Finite Groups—a major modern achievement in mathematics. As the book develops we find that there are unresolved questions, such as that no one is really sure of the characteristics of the monster group, with 8×10^{53} elements.

Siobhan Roberts has created a fascinating read and an excellent addition to every mathematically enthusiastic teacher's library. It is also suited to mathematically keen high school students.

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