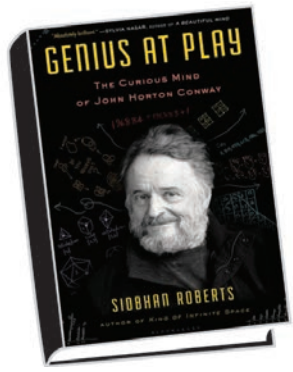
Genius at Play: The Curious Mind of John Horton Conway



A review by Elizabeth T. Milićević

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Genius at Play: The Curious Mind of John Horton Conway
By Siobhan Roberts
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In her biography of John H. Conway titled *Genius at Play*, Siobhan Roberts explains that the only medium through which Conway is capable of reaching out to other humans is through "a giant prosthetic carapace of mathematical knowledge and mathematical appetite" (p. 296). If there were a reliable way to document such mathematical encounters with Conway, and to apply a reasonable metric for the distance between encounters, I would wager that a significant number of us in the mathematical community would achieve a somewhat lower "Conway number" than we have "Erdős number." On their first trip to the United States from Belgrade, Serbia even my non-mathematician in-laws encountered Conway in his preferred natural habitat: the common room in the Princeton mathematics department. He somehow manages to both be everywhere and to have something to say to everyone; one of his USA/Canada Math Camp students deemed Conway "the closest thing the world has to a polymath" (p. 346).

Even so, I find the title of Roberts' book to be an imperfect reflection of the inspiring story she reveals. Perhaps the general public, having a rich fascination with the notion of a crazed mathematician as portrayed in a wide variety of media, will cling to the promise on the book cover of exploring a mathematical "genius," and thus be drawn to read Roberts' honest and detailed account of this intriguing character. There is sufficient support provided throughout this biography that Conway is indeed a genius, often in the form of direct quotations from other prominent research mathematicians who are in a position to evaluate his work. However, Conway's world view of mathematics, and his own position therein, is considerably more inclusive than the jacket cover of this biography reveals. As a working professional in the field, I find that the title does not work its mainstream "mathematical genius" magic on me. Once I started to read, however, I found a surprising and compelling resonance between my own methods for engaging with

The biography's title plays into public fascination by mathematical genius, reflecting only a small fraction of the story inside.

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my work, my profession, and myself and those of this curious Princeton professor.

The dominant first-person narrative of direct quotations gives the biography its true backbone. My own experience of the book and subsequent reaction to it are thus molded in large part by my direct response to the protagonist himself, and this review consequently weaves back and forth between a discussion of the writing itself and the impression the author's portrayal of Conway left upon me. I myself have never met Conway, and my impressions of him are exclusively a result of my experience reading Roberts' biography. It is intended as a great compliment to Roberts as a biographer that my opinion of the book is centered primarily around the subject himself, rather than its author.

There is absolutely no denying Conway's supernatural gift of being able to see patterns and connections that no one else would be able to see, and the biography explores Conway's primary mathematical contributions in great detail. Initially, when arriving to a point in which Roberts was poised to explain some actual mathematics, I held my breath and prepared for secondhand embarrassment to overcome me, as the nonmathematician's explanation of a theorem often over simplifies the mathematics or paints too broad a landscape in a language of sweeping exaggerations. To my great relief, the mathematics student and professor alike can read these passages in Roberts' account without blushing, since these sections are portrayed in the same raw, truthful, and intimate manner as the personal accounts. Indeed, I was delighted to actually learn some very intriguing mathematics by reading a book not penned by a fellow mathematician! For a beautiful summary of the main theorems of Conway which are highlighted in the book, I refer the reader to Joseph O'Rourke's meticulous mathematical review in the *College Math Journal* [1].

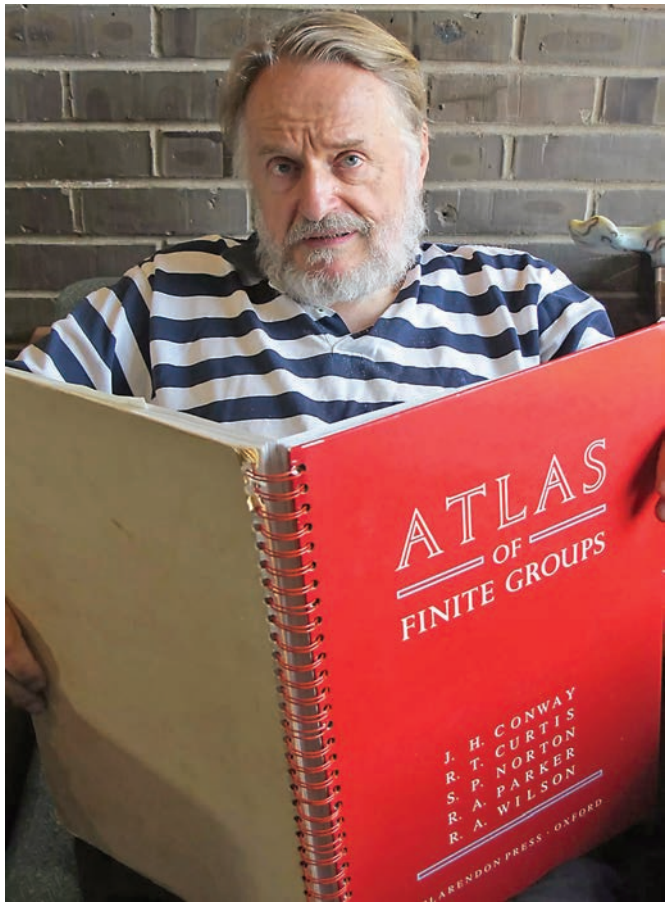

Figure 1: Conway's contribution to the classification of finite simple groups represented a turning point in his battle with the "imposter syndrome."

In sharp contrast to the implications of the biography's title, highlighting an eccentric personality and an eclectic body of work, Roberts' presentation humanizes Conway to an unexpected degree. We are provided a firsthand account of the plight of a working mathematician, as we are taken behind the scenes to witness the imperfect struggle of one mathematician's obsessive quest to reveal truth and its simplest possible explanation. We are introduced early on to Conway as a graduate student at Cambridge, where he spent the majority of his time not working on any of his first several thesis problems, but then frantically conjuring up a means to either cover up this fact or distract his advisor with some other interesting mathematical musings. Roberts directly addresses the realities of trying to do mathematics while working through depression, and simultaneously steering clear of the manic state, which lures one to the other side. Throughout his career, Conway also struggled greatly with the "imposter syndrome," working alongside mathematicians who Conway was sure viewed his professional accomplishments and mathematical fascinations as beneath them. Conway claimed momentary victory over the imposter syndrome when he discovered what we now call the "Conway group," an indisputably important contribution to the classification of the sporadic simple groups, now chronicled in the *Atlas of Finite Groups* proudly displayed in Figure 1. At that point, Conway vowed to stop feeling guilty about pursuing ideas that some mathematicians might consider recreational—he fully released himself to *floccinaucinihilipilificate*, a word he created that means "to engage in mathematics which others would deem worthless" (p. 98). He will think about absolutely anything, but when he thinks about anything, he thinks deeply. Although Conway claims to possess mathematical taste, he also chooses not to exercise it (p. 282), frittering away his time on studying what some might perceive as childish frivolities, but then occasionally beating the "grown-ups" at their own games (p. 196).

In crafting a mathematical argument, Conway's goal is to find the simplest explanation possible. These pursuits were typically the result of countless hours spent toiling over an inconceivable number of examples until the patterns emerged. Conway has an uncanny ability to sort through and process an incredible number of bifurcations on a single problem, elevating this messy case splitting to an art form (p. 332). As Conway explains, "It's a mistake to assume that what mathematicians do is esoteric, deep, and difficult. All the great discoveries are very simple" (p. 338). Conway does mathematics because he likes knowing

things. He writes because he has sought to understand something and has finally distilled that understanding into the simplest possible terms. Professionally, the impetus to write is typically that we *know* something is true, and that we have found one explanation for *why* it is true. To Conway, however, a proof is not a synonym for understanding, and he always seeks the latter.

Figure 2: Conway seeks opportunities to talk mathematics to nearly anyone, but especially students like these participants in the "Modern Mathematics" International Summer School in Bremen, Germany.

Conway calls himself a "professional nonunderstander" (p. 264), claiming to be "confused at all times" (p.150). He even carries this permanent state of confusion into all of his classes and invited talks, categorically refusing to prepare beforehand. Roberts explains the rationale behind Conway's "more honest way to lecture, showing the false starts and 'stuckedness' that are crucial to the mathematical process" (p. 74). Ironically, somehow a man who dives headfirst into his lectures with minimal planning has provided me with a deep source of pedagogical self-reflection, as I acknowledge the value of uncovering the tracks we work so hard to hide in our own articles and textbooks, and thus seek ways to make the behind-the-scenes more transparent to our students and our research colleagues. Such contradictions were often the richest source for professional inspiration as I read this biography, their controversial nature whispering in my ear to turn one more page. For example, Conway is a firm believer that almost everyone is capable of doing mathematics (p. 369) and notoriously spends hours discussing mathematics with students, as seen in Figure 2. On the other hand, Conway simultaneously instructs a group of high school students at the conclusion of one of his USA/Canada Math Camp mini-courses to "take it as axiomatic that you are stupid" (p. 348), a divisive quote which nevertheless fully reflects his own mathematical self-image.

Roberts' biography of Conway is not a new release, having been published in 2015, and consequently there is an extensive sequence of beautiful and thorough reviews you can consult if you are trying to determine for yourself whether or not you should read this book. I am not an expert on finite groups, combinatorial game theory, or other fields on which Conway has made a lasting impression, so the impetus for me to continue turning the pages did not arise from a fascination with the specific mathematical results presented in the book. Rather, I found myself mesmerized by Conway's personality and tenacity and their compelling and often inspirational portrayal. I was stimulated by the self-examination inspired by reflecting upon Conway's many internal contradictions. I was haunted by meta questions that arose in Conway's excerpted monologues. Is mathematical knowledge created or discovered? (p. 52) Does the cathartic effect of math permit someone like Conway to completely forget the outside world? (p. 355)

Conway would be delighted that, up to this point, I have not mentioned what is arguably his most famous mathematical attribution. But what Roberts depicts as Conway's most despised creation permits the most salient closing analogy. Conway's "Game of Life" continues to tantalize and thrill those who are in search of specific constructions illustrating the theorem that the Game of Life is a Turing machine, or—as Conway prefers to explain—Life contains all the digits of π. Delightfully, Roberts' biography, much like the protagonist's Game of Life, permits the possibility that *everyone*—the casual mathematical spectator up through the professional mathematician—will find themselves repeatedly embedded and reflected somehow in Conway's story.

Reference

[1] Joseph O'Rourke, Review of *Genius at Play: The Curious Mind of John Horton Conway*, *College Math. J.* **46** (September 2015), 309–314.

Image Credits

Figure 1 courtesy of Siobhan Roberts.
Figure 2 courtesy of Dierk Schleicher and the 'Modern Mathematics' summer school 2015.
Author photo courtesy of Patrick Montero/Haverford College.

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Elizabeth Milićević earned her PhD from the University of Chicago in 2009. Her research program studies flag varieties using the methods of algebraic combinatorics, representation theory, and geometric group theory. She has been supported by grants from the Association for Women in Mathematics, the Simons Foundation, the National Science Foundation, and the Australian Research Council.