REVIEWS
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In his visions, Évariste Galois inhabits a mathematical universe. It is a surreal world, but fully physical: “It has lands and landscapes, boulders and crevasses, infinite stretches of ugly trees...and isolated phosphorescent flowers imploring wanderers to care for them forever” (pp. 4–5). Évariste moves within it with all his senses finely attuned—observing, listening, and feeling. It is the landscape of his mathematics and he, alone among his peers, is privileged to enter it.

So it is in Marco Abate’s comic-book novel of Galois, as described in the first segment of The Shape of Content. In this piece Abate captures both the promise and the challenge of this collection of mathematically-inspired literary work. Abate’s surreal depictions of an alien world communicate the seductive strangeness and beauty of mathematics, known to practicing mathematicians who spend a good deal of their lives within its realm. But Abate’s tale also captures the crushing loneliness of the genius who surrenders himself to the bewitchments of mathematics. For young Évariste, granted entrance to a magical alternative reality, is ill-prepared to handle the more mundane tasks of life. A misfit on the streets of 19th century Paris, he blunders along from disaster to disaster, eventually losing his life in a duel at age 20.

Can the chasm that destroyed Galois, the great divide between the pure mathematical and the mundanely human world, be bridged? That is the challenge at the heart of The Shape of Content. In short stories, poems, biographies, and other creative formats, the various authors take on this question, exploring the deep interconnections that bind these two worlds together. No one reading this book can fail to be impressed by the depth of interpenetration between the mathematical and the worldly, and how permeable the boundaries between them can be.

The Shape of Content came out of a series of workshops held at the Banff International Research Station for Mathematical Innovation (BIRS) in Canada between 2003 and 2006. The meetings brought together professional mathematicians (and other mathematical scientists) with authors, poets, artists, playwrights, and film-makers to work together on mathematically-inspired literary works. The Shape of Content is a selection from the works that originated and evolved at the BIRS workshops through this cross-disciplinary cooperation.

With 37 different pieces by 21 authors, The Shape of Content is a testament to the dazzling diversity of artistic possibilities around the common theme of mathematics. At the same time this very diversity precludes a conventional review of the collection that would do justice to its numerous and various components. In its place I offer only a personal commentary on a small selection of the pieces that I personally found

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particularly appealing and/or insightful. All the while I am fully aware that another reader would come up with a very different—and equally worthy—list.

Chandler Davis’s poems, with deceptive simplicity and economy, take direct aim at some of the core beliefs of mathematics. “[I]s our discourse timeless?” he wonders in a poem entitled “Our Study” (p. 50). The question goes to the heart of the mystery of mathematics, a field that from the time of Euclid onwards has viewed its results as eternal and fixed. But Davis is skeptical:

Some of what was real to me once has now become not error, quite, but less real.

And similarly, what is true now might not necessarily have been as true centuries ago. Mathematical truth, it appears, has its own history.

In “Presence” (p. 51) Davis explores the delicate relationship between a mathematician and that ghostly and unnamed but irreducibly real “presence”—mathematics. Does mathematics accommodate itself to the wishes of its practitioner? Clearly it does not. Does the mathematician, then, simply follow a predetermined and inevitable mathematical trail laid before him? That, Davis suggests, is not right either. For him mathematics is like a “most trusted horse” or a mountain slope:

Surely though I command my horse
her power and step are beyond my directing
and surely though I will find my trail on the mountain
the mountain meets her own schedule

The work of a mathematician is a delicate and continuous give-and-take with this “presence.” It may not mould itself to the shape of his or her desires, but it is not a hard and unchangeable monolith either.

Davis uses a literary form to focus on mathematical themes, but he does more than that. His poems delicately examine some enduring assumptions that have contributed to the chasm that has opened between the “mathematical” and the “human.” Is mathematics timeless? Does it change throughout human history, and if so how, and to what extent? Is it shaped by human desires, or is it given to us, hard and unyielding? None of these questions has a simple answer in Davis’s poems.

If Davis’s sparse poetry is a finely honed tool crafted to examine the core mysteries of mathematics, Emily Grosholz’s poems blur the boundaries between the human, the physical, and the mathematical. “Trying to Describe the Reals in Cambridge” (p. 96) moves seamlessly between the waning light on the northern Cambridge landscape and the unceasing flood of real numbers. They are not, she writes, like the numbers used for counting things, but are “number flooded...a sourceless unplumbed river”

like moonplate cumulant in tiers above
the river of waning sunlight.

Ultimately the mathematical reals dissolve not only into natural light, but also into the humanly real, for in their infinitude of possibilities, “they are the shape and cardinal of freedom.”

Marjorie Senechal’s “The Last Second Wrangler” (p. 141) is a true tale intertwining love and marriage, war and politics, brilliant scientific insights and fatal errors, with a steady mathematical current running through it all. It is the story of the English mathematician Eric Neville and his love for the brilliant but controversial Dorothy Wrinch. Their affair, in Senechal’s telling, lasted through four decades, three marriages (never to each other), academic exile (for both), and physical exile (for Wrinch). When, from the 1930s onwards, Wrinch became embroiled in a fierce and long-lasting controversy
over the structure of proteins, Neville stood by her and was the most stalwart of her shrinking band of defenders.

Wrinch proposed a novel algorithm for deciphering the molecular structure of proteins from Patterson diagrams of their x-rays. In Wrinch’s method, a “star” diagram is systematically replaced by a set of “pinwheel” diagrams that disclose the true position of the molecules. The problem, as Wrinch well knew, is that

in complicated cases, different pinwheels can match the same star. Then the algorithm forks, each branch leading to a different picture. And all of the pictures are true. (p. 155)

And so it was for Neville and Wrinch, countless possibilities, roads taken and untaken, in life, in love, in career. Mathematics, in Senechal’s telling, is both life-force for its adherents, and metaphor.

“The Tolman Trick” by Manil Suri is a poignant short story about Roland Tolman, an expert in water turbulence, who begins to realize that there is a fundamental flaw in the mathematical breakthrough that had made his career. As his life’s work unravels at a meeting in pastoral Oberwolfach, the seemingly placid surface of academic respectability is disrupted by fierce professional rivalries and underhanded dealings. Tolman seeks refuge in the perfect water flows of nature, but the results are mixed. Is nature the embodiment of perfect mathematical solutions, as Tolman’s imposing thesis advisor had confidently claimed? Or is it, as he begins to suspect, the sum-total of ceaseless turbulence, which mathematical order can never quite grasp?

Suri’s story flows seamlessly through numerous levels, beautifully capturing the social dynamics of academic meetings, the psychological strain of mathematical work, and the deep interpenetration of the mathematical with the natural and human worlds. In the end Tolman is offered an alternative way out of his predicament, through a fleeting human connection with the beautiful non-mathematician wife of a colleague.

There is, of course, much much more in The Shape of Content: poems by Madhur Anand, S. Isabel Burgess, Robin Chapman, Adam Dickinson, Susan Elmslie, and Philip Holmes; short stories by Sandy Bonny, Lauren Gunderson, and Alex Kasman; a historical account by Florin Diacu; a personal recollection by Randall Wedin; extracts from plays by Ellen Maddow and Paul Zimmet; essays on mathematically inspired art by Claire Ferguson; a humor essay by Colin Adams; and a “prose poem” by Wendy Brandts. It is my hope that the small sample of works discussed here will prove an alluring foretaste, drawing readers to engage with the other works of this remarkable collection.

Galois, in Abate’s telling, was the ultimate victim of the chasm between the mathematical and the human worlds. But there is also a heroine in Abate’s tale, who was more fortunate: Héloïse, a troubled young woman living in present-day Paris, also immerses herself in the world of Galois’ visions. In this strangely beautiful landscape, the two strike a deep human connection and Héloïse, at least, is saved. Inspired by her mathematical affair she reconnects with her true self, leaves her unhappy marriage, and makes a fresh start in her life.

Does engagement in mathematics tragically separate us from the world of living men and women, as it did for Galois? Does it lure us away to a wondrous but enclosed world, which only the very few will ever enter? Or can it serve as a unique and revealing conduit towards the human world, as it was for Héloïse? The authors of The Shape of Content, in their myriad different ways, believe that it can.