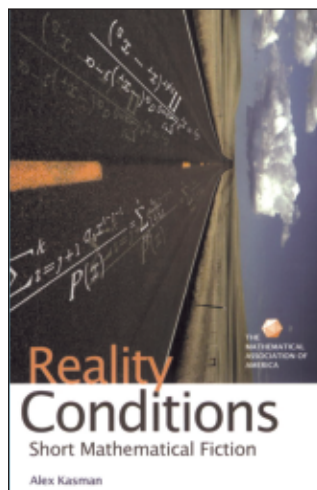# Reality Conditions

Reviewed by John Swallow

Alex Kasman came to write his first collection of short stories, *Reality Conditions*, as a professional—that is, as a professional mathematician. Not so long ago he sensed a growing interest, mostly within the mathematical community, in the genre of mathematical fiction. He sought out a suitable database of reviews, and, discovering that none existed, he created one: the now widely-recognized Mathematical Fiction website [2]. He was then able to survey the literature, welcoming the assistance of the site's many visitors. Finding something missing—gaps of "ideas, stories, and facts" (page vii)—Kasman arrived at a true unsolved problem or two, and he set to work writing. From murder mysteries to tall tales, from historical reconstructions to alien encounters, the stories in *Reality Conditions* are informative and charming, and occasionally even striking. Although their craftsmanship is not exquisite, they are sure to entertain readers both inside and outside the mathematical community.

Some mathematicians may worry about the import of a genre with the appellation "mathematical fiction". After all, would we dare read fictional

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mathematics? Rest assured: there is no need to sound the alarm. In fact, what makes *Reality Conditions* so effective and attractive is the undeniable authenticity of Kasman's mathematical perspective. Kasman's writing affirms that mathematics is that vein of truth mined with a pickaxe of logic, and he is as reluctant as any of us to trivialize the complex, or to play fast and loose with the details. Kasman knows what it means to be a mathematician: the sign of creativity and brilliance is an intuition for what lies beneath a rock's contours, and yet success requires the simple labor of filing a nugget down to reveal the gem within.

Part of Kasman's aim in *Reality Conditions* is to introduce the laity to mathematics, to use short stories as a pedagogical vehicle for teaching, and his stories successfully meet this goal. Kasman introduces foundational notions of group theory and topology, and a few ideas from algebraic geometry even make their appearance. He examines the blurred boundaries separating pure and applied mathematics (and those separating mathematics and physics), and he explores as well the aesthetic sense in mathematics. For reasons of space and difficulty, the portraits of foundational notions are

necessarily more realistic, while higher-level abstractions are rendered in more stylized sketches. At the end of the book Kasman provides notes on each of his stories, reflecting his desire to instruct with accuracy while entertaining. Many of these notes would work well to initiate discussions about mathematical ideas; he draws attention to related mathematical concepts and published material and delineates clearly what is truth and what is fiction.

As important as mathematical concepts are to some of the stories, though, Kasman is also interested in introducing readers to prominent issues in the mathematical community. The welcome and support afforded to women in research, for instance, forms the backstory of one. Another story, "Monster", is in part a satire on the increasing need to sell mathematics to the public. "Another New Math" ruminates on the prospects for mathematical expertise in the politics of school reform, while the title story "Reality Conditions" raises the specter of the suppression of mathematics departments, reminiscent of events at the University of Rochester in the mid-1990s.

Kasman's appreciation for the foibles, anxieties, and crimes of those at all levels of the academic hierarchy is especially delightful, and much of the world of *Reality Conditions* is located close to the campus. We encounter students hoping for quick solutions to their daily homework, bright intellects looking for love and seeking solace in coffee shops, graduate students both awed and frustrated by their professors' brilliance. We recognize assistant professors as well as students-turned-entrepreneurs who are desperate to show parents and peers that they haven't chosen unwisely. Faculty long to be appreciated by their students and respected by their professional colleagues. Students and researchers alike are tempted to cheat—and then to rationalize the urge.

Occasionally, the transition from the story proper to the introduction of a mathematical concept, or the transition from the story to a mini-lecture on mathematical history, is too apparent and abrupt. While we might initially conceive a story in terms of mathematics as content and fiction as form, too transparent a division weakens the final result. Leaving the structural supports visible is the primary occupational hazard in writing mathematical fiction.

Weaving mathematics and fiction together is certainly an art, and our expectations for the genre are nontrivial. Mathematical fiction must explore the intersection of the world of mathematics with the rest of humanity. We expect to find illuminated, for mathematicians and nonmathematicians alike, the interplay between mathematical concepts and such disparate fields as philosophy, history, psychology, aesthetics, and perhaps even religion. A tall order, perhaps, but surely not one without

merit, and one that has already been achieved for the scientific community in science fiction.

Fortunately, authors of mathematical fiction have many formulas available to assist them. One might, for instance, embed a mathematical fact, say from geometry or topology, in the physical world and then scrutinize its consequences. Or one might focus on the thoughts of a mathematically inclined character, examining the psychology of doing mathematics from the first tremors of an initial hunch to the exuberance of—or disbelief in—the completed proof. A writer might also pen a detective story expressing the thrill of the chase, or even present some detailed mathematics together with a significant historical backstory.

A versatile writer, Kasman uses all of these, and then some. "Eye of the Beholder", for example, takes the Pythagorean notion that "all is number" to an extreme conclusion. "Progress" asks, by presenting a sequence of mathematical examples, whether mathematical judgments are a function of one's historical period, or derive instead from an individual's maturity. Kasman employs stereotypical comic-book heroes who humorously condition reality to match mathematical theories of space, and he also finds room for deeper intellects, such as Bev in "Eye of the Beholder", who draw us into their consciousness. Some of Kasman's stories are brief exercises in mathematical writing, rather than fully-formed short stories, and these mathematical vignettes are similar to the shorter pieces in Clifton Fadiman's anthology *Fantasia Mathematica* [1]. Finally, in a genre not known for appropriating literary texts, "Reality Conditions" combines elements of the Sumerian *Epic of Gilgamesh* with honest reflections on the challenges of a mathematical career, as a way of approaching the quest for immortality.

The most striking stories reveal mathematical situations in unexpected circumstances. In "Murder, she conjectured", Kasman introduces the reader to the mathematical process of discovery and proof, but he has a New York Police Department psychologist, rather than her friend the mathematician, lead the mystery's investigation. The mathematician, while eager to be helpful, still plays Watson to her Holmes. At the end we find the museum guide, representing the general public, as interested as the mathematician in the mystery's solution.

"Reality Conditions" takes up a fundamental question about existence: the extent to which nature and nurture define human life. While granting that both are crucial to an appreciation of any individual's actions, the story avoids the debate about their relative importance. Instead, "Reality Conditions" considers the question from the point of view of the individual, asking how each of us can know the conditions our own nature and nurture

have imposed on us. We see that we might spend our life searching for the precise constraints, but learn only at the end what they had been. We come to realize that mathematics similarly depends on foundational constraints, but that without doing mathematics, we cannot fully appreciate the boundary conditions.

For the writer of mathematical fiction, more dangerous than the seeming paradox in the name "mathematical fiction" is a particularly mathematical conceit: that the essence of elegance is to be found in the realm of ideas, that language is no more than the vehicle for the final apprehension of abstraction. But just as intuition alone does not a mathematical proof make, creativity or brilliance in imagining backstories, characters, and action does not suffice for the writer. As one of Kasman's characters puts it,"It is the things that are left out of the story that give it power" (page 99). The processes of grinding away the unnecessary and irrelevant, of perceiving how symbols and analogies might connect, of simply polishing and repolishing the prose, these are what generate strength and elegance in a piece of short fiction.

Unfortunately, in this regard some of the stories in *Reality Conditions* fall short. In general, readers seeking incisive descriptions and precise connotations from an experienced wordsmith will be disappointed. Even passing by the occasional misspelling and dubiously placed modifier, readers may still yearn for more finesse when the action is slow, or when the narrator appears to be an independent observer of the action. Many descriptive details in "Unreasonable Effectiveness", for example, which is essentially a single conversation between two characters, are rough and unconvincing. The story moreover misses the opportunity to engage the reader early on, settling too late into narration derived unambiguously from a particular character's point of view. The sullen voice that Bev uses to open "Eye of the Beholder" is not always sustained as she goes back and forth between chronicling the past and commenting in the present. Sometimes Kasman's turns of phrase, recognizable as common mathematical speech patterns, work against our willing suspension of disbelief. The narrator of "Murder, she conjectured" sounds remarkably like someone we might encounter at teatime, a colleague giving a post-mortem on office hours: "Then, Beth and Trevor began asking questions. It was clear from the very beginning that they did not have any straightforward questions to ask. Since they did not know exactly what they were hoping to learn, the questions were all rather vague" (page 18).

However, when the stories are fast-paced—which is more often than not—or flashbacks are used to shorten scenes, these sorts of shortcomings are much less serious. Markers of mathematical authenticity even become advantageous in narration by mathematicians. In "Reality Conditions," the narrator Goldfarb displays a habit mathematicians know so well: inserting brief examples into explanations almost reflexively, anticipating the charge that one's presentation has become too abstract. Remarking on the powerful odors that wafted from a nearby factory during his childhood, Goldfarb explains, "…once they started making one, lemon let's say, then they'd keep making it, vats and vat of it" (page 65), and his tic reappears again only two sentences later, when he says, "When the scent changed, from lemon to mint for example, the world changed with it." With mannerisms like these, Goldfarb dwells close to our hearts.

As a whole, the collection successfully meets the author's pedagogical goals, and the book would be a worthy addition to a seminar for first-year undergraduates on mathematical ideas and culture. In fact, with the disarming honesty and openness evidenced in the preface and the author's notes, the book would be well received by a variety of audiences. For the student new to the world of mathematics, the stories provide an accessible and entertaining look into some significant mathematics, as well as into what it means to be a mathematician. For the mathematician, they offer an amusing perspective on everything from the oddities of mathematical temperaments to the politics of professional reputation. What many of us will appreciate most about *Reality Conditions* is the authentic snapshot it takes of the human side of being a turn-of-the-century mathematician in America.

Among the wider public, those who love mathematical fiction in the tradition of *Fantasia Mathematica* will certainly appreciate *Reality Conditions*. It's even an odds-on bet that the readership will be greater still. In the wake of Sylvia Nasar's *A Beautiful Mind*, Ron Howard's movie of the same title, David Auburn's *Proof*, and Nick Falacci's and Cheryl Heuton's television series *NUMB3RS*, it's tempting to claim that mathematics is gaining ground in American culture. Nearly fifty years ago, Fadiman observed that "an entirely new audience for popular works touching on mathematics has developed" [1, p. xviii]. Perhaps it is so again, and more excellent mathematical fiction is just around the corner.

References

[1] CLIFTON FADIMAN, compiler and editor, *Fantasia Mathematica: Being a Set of Stories, Together with a Group of Oddments and Diversions, All Drawn from the Universe of Mathematics*, Simon and Schuster, 1958, New York: Copernicus, 1997.
[2] ALEX KASMAN, The Mathematical Fiction Homepage, `http://math.cofc.edu/faculty/kasman/MATHFICT/default.html`.