Fictional Women in Mathematics

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This article will argue that the situation for female mathematicians in fiction has *improved*, but that there is still cause for *concern*. You may wonder why you should care about this at all since these fictional women are (by definition) not real and therefore unlikely to be dues paying members of the AWM! With this in mind, in addition to providing examples of female mathematicians in literature, I will try to convince you to share my interest in mathematical fiction as a tool for shaping public opinion about our discipline.

For the past eleven years, I have been reading, collecting, analyzing and cataloging works of fiction that have explicit mathematical content. My "Mathematical Fiction Homepage" (http://kasmana.people.cofc.edu/MATHFICT) presently lists 931 novels, short stories, films, plays, comic books and television shows. These range from well-known examples (such as the film "A Beautiful Mind" [1]) to the obscure (like the lesbian pulp novel "Sorority House" [2]). The works featured on my Website also vary widely in age, with the oldest having been written in 410 BC and the most recent being a novel I have not yet read, since it is scheduled to be released later this month.

Many of these works really have little to say about women in mathematics. However, this article will focus on two subsets of the entire collection which do. On the one hand, there are works of fiction in which a female character is shown doing some sort of advanced mathematics. (I will refer to those characters as "female mathematicians" even if they are not *professional* mathematicians.) On the other hand, there are also works of fiction which either directly or implicitly suggest that almost all people who do advanced mathematics are male.

One way to support my claim that the situation is better today than in the past is to compare the relative frequency of each category among the oldest and most recent works listed in the database. For instance, only **five** of the one hundred forty-eight works which were published prior to 1950 contain female mathematicians:

- Charles Kingsley's "Hypatia or New Foes with an Old Face" [3] relates the tale of the ancient Greek mathematician, Hypatia.

- "The Romance of Mathematics: Being the Original Researches of a Lady Professor of Girtham College" [4] by Peter Hampson Ditchfield is an interesting and unusual piece about a female math professor in the 19th century.

- In G.B. Shaw's "Mrs. Warren's Profession" [5], a female character scores well on the math exam at Cambridge and goes on to become an actuary.

- Miles Breuer's "The Captured Cross-Section" [6] features a female mathematician who is rescued from another dimension by her husband, also a mathematician.

- "She Wrote the Book" [7] is a film about a shy, female math professor whose life changes drastically when she gets amnesia.

Considering the status of real women in mathematics during these same years, it can be seen as a pleasant surprise that there are even this many female mathematicians in such "ancient" fiction. However, it is less pleasant to note that it was more common for fiction from that era to suggest that women are not mathematically inclined. I count seven works out of those written prior to 1950 in which female characters are portrayed as being conspicuously bad at math.

In contrast, among the thirty-five works in the database published since 2009, **fifteen** feature female mathematicians. Three of those are fictionalized accounts of the lives of real women (one about Sonia Kovalevskaya [8] and two more about Hypatia [9,10]), three feature girls who are so mathematically talented as to deserve to be called "prodigies" [11,12,13] and four of them feature fictional female characters who are successful, professional mathematicians [14,15,16,17].

The tremendous increase in the percentage of works featuring female mathematicians (from about 3% prior to 1950 to about 43% in the past two years) indicates an improvement. Moreover, the collection of more recent works does not seem to suggest that women are generally less suited to be mathematicians. For instance, although the male math prodigy in "Monster's Proof" [16] has an older sister who is failing algebra, it is also the case that his *grandmother* was the mathematician responsible for the amazing conjecture which forms the basis of the plot. Similarly, although "The Twisted Heart" [18] features a romantic relationship between a male mathematician and a female non-mathematician (as did so many of the works from before 1950), it is "balanced" by "36 Arguments for the Existence of God" [14] featuring a relationship between a male philosopher and a female mathematician. So, collectively, they do not suggest any generalization about gender and math.

One might speculate that this trend is a direct consequence of the improvement in the situation for real women in mathematics over the same period. However, fiction need not bear any resemblance to reality. Consider "Leaning Towards Infinity" [19] and "Distress" [20], which were published one year apart but convey very different views of math conferences. According to "Leaning Towards Infinity", men in mathematics do not care whether the theorems presented by other men at conferences are true but instead attempt to prevent the speaker from being able to say anything, interrupting them with vague objections at every possible opportunity. They behave even *worse* towards the one female mathematician at the conference, scribbling the word "Miss" (which could have two meanings here) next to her name on the schedule and then taunting her with sexual remarks during her talk until she eventually bares her breasts to the audience. In contrast, Violet Mosala, an African woman who received a Nobel Prize "for rigorously proving a dozen key theorems in general topology", is treated like a star by an adoring audience and by news outlets when she makes a presentation at a mathematical physics conference in "Distress".

Each of these fictional representations is unrealistic, in one case because things are really not that bad and in the other because they are not that good (e.g., the Nobel selection committee is not known for appreciating the rigor of topological proofs).   However, there are reasons that those of us who care about mathematics ought to care about them. First, regardless of whether they are accurate, they reflect biases that truly exist in society.   It is useful to know that there are some people who imagine the field of mathematics to be so entirely unwelcoming to women and others who see no reason that her theorems in topology could not make a woman the most famous researcher in the world. More importantly, people reading these books will be influenced by these representations even though they know full well that they are works of fiction. I truly believe that some talented young mathematicians could be convinced not to major in math because of the unpleasantness of the profession portrayed in "Leaning Towards Infinity" and that others may be steered towards a career in math by the more positive image in "Distress".

Since I often view mathematical fiction as a form of propaganda, I do end up differentiating between those that will help "our cause" (the field of mathematics itself), and those that will hurt it. But, to avoid any misunderstanding, let me emphasize at this point that I am not advocating censorship or book burning or any other limitations on free speech. Authors certainly have a right to portray an image of mathematics that I dislike, whether they do so because they truly believe it or because they simply think it makes a good story. I am only saying that mathematicians ought to be aware of the representations of our field in fiction, to know what the general population thinks and hears about our discipline. Moreover, just as authors have a right to portray math as they want to, we have a right (and perhaps a duty) to criticize misconceptions and to promote those works of fiction that might enhance the health of mathematics.

If I have convinced you at all that mathematical fiction is of greater importance than as something to read for pleasure, consider what you think about the following examples:

• In "Antonia's Line" [21], a female mathematician is presented as being so emotionless and caught up in her computations that she does not care about her young daughter. Such "cold" mathematicians have long been a stereotype in fiction, though they are usually male. Is it good or bad to see it applied to women as well?

• Some female mathematicians are presented as being "ordinary women", breaking the stereotype of the nerdy or emotionless mathematician. They can be sexy, as in "The Fractal Murders" [22], where a woman who studies chaotic dynamics becomes the romantic interest for the hard-boiled private eye. They can also be fashionable, as in "The Givenchy Code" [23] (advertised with the tag line "cryptography is the new black"), whose heroine states: "Apparently math majors are supposed to be surgically attached to their calculators and wear plastic pocket protectors. It's an irritating stereotype. Like saying blondes have more fun. I'm a blonde, and believe me, that's one old adage that simply doesn't hold true." Of course, these representations of women as objects of sexual desire or shop-a-holics are stereotypes as well, and it may not be comforting to know that one is being replaced by another.

- In "Zilkowski's Theorem" [24], a woman after whom a theorem was named admits that she did not actually write the proof but instead seduced a man into writing it for her. I can not criticize this story as an isolated entity. It is beautifully written and there is nothing inherently implausible about the plot. Yet, given the prejudices already existing in society and the unfortunately large number of works of mathematical fiction in which women are shown as being unable to do math, will the practical impact of this story not be to reinforce the misconception that unqualified women steal jobs that ought to go to male mathematicians (cf. [25])?

- It was a cliche in the male dominated world of classic science fiction that logic and equations comprise a masculine way to understand the world while the feminine approach is based on intuition and emotion. Although this idea appears to be less acceptable in science fiction today, the same theme arises in two recent fantasy novels by women [26,27] which contrast wizards using a quantitative approach to magic with mathphobic witches.

- "Sorority House" [2] is a novel about lesbian romance at college written under a pseudonym by two science fiction authors in the 1950s. Being a "pulp novel", it was intended as a cheap thrill for some readers and is by no means a great work of literature. On the other hand, it contains a wonderful subplot about a student with no particular interest in mathematics who decides to prepare for her calculus course by reviewing high school geometry. She accidentally buys David Hilbert's rigorous and theoretical book on axiomatic geometry, but is smart and dedicated enough to teach herself from it. She not only learns to appreciate mathematics but inspires her jaded math professor as well.

- In the Pulitzer Prize winning "Proof: A Play" [28], the proof of an important new theorem is found in the home of a famous mathematician who died after suffering from a long-term debilitating mental illness. The central plot revolves around the question of whether it was written by him or by the college-age daughter who was caring for him. One of the characters in the play is a male graduate student who views math as a "young man's game" and cannot name a single female mathematician. His skepticism about the daughter's claim to be the author of the proof is surely intended to be influenced by sexism. However, I believe that the playwright intended the audience to be unsure about the answer to this central question, and perhaps even considered her gender to be a factor that might sway them against thinking the daughter wrote the proof. In fact, there are quite a few clues in the play that ought to incline the audience to disbelieve her, and even more of these were added for the film version. (A scene in which she cries to herself "I stole it...I stole it from him..." was among those added to the movie script.) Interestingly, despite asking many people who have seen the play or movie, I have yet to find even one who was not certain through the entire show that the proof was hers. Would the audience have been more willing to believe the father had authored the proof if the other character had been a son instead of a daughter?

These are just a few examples of the 124 entries tagged with the phrase "female mathematicians" out of the 931 entries currently included on the "Mathematical Fiction Homepage". I encourage you to visit the website to learn more about this body of literature, to contribute to the website (by voting, posting comments, and suggesting works to be added), to take advantage of

mathematical fiction as a resource for understanding and shaping public opinion of mathematics and, finally, to consider writing your *own* mathematical fiction.

References

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