

Geometry, Physics, and Social Commentary

Edwin A. Abbott, *Flatland, A Romance of many Dimensions* Dover Publication, Inc. New York, 1992 (\$1.00). First publication 1884.

Ian Stewart, *Flatterland, like Flatland, only more so*, Perseus Books, Cambridge, 2001 (\$25.00).

Flatterland and its predecessor *Flatland* present popularized and generally accessible views of the modern geometry of their respective times. They each follow an inhabitant of a two-dimensional space whose mathematical and social viewpoint is expanded through the miraculous appearance of a visitor from a higher dimensional world. The earlier work, a product of the late Victorian era, brings us to see how worlds of one or two or four dimensions might appear to their respective inhabitants. Ian Stewart's *Flatterland*, an update on *Flatland*, gives us a perspective on the social concerns and the richer geometry of our own era. The more recent book also touches upon physics giving brief descriptions of modern concerns about quantum theory, particle physics and cosmology.

Flatland starts with an extended description of a dour and forbidding two-dimensional world. Each inhabitant has a social role fixed by birth and determined by its number of sides. Women, being linelike, have the fewest sides of all and stand at the very bottom of the rigid hierarchy. A three-dimensional visitor moves into this world and brings one of the inhabitants out to see a richer geometry. During his travels he, and we readers, get an artful geometry lesson. Upon return to Flatland, this Marco-Polo-like inhabitant is disbelieved and imprisoned for life. The high status members of the society see him as a danger to the social hierarchy and repressive political structure. Dover Publications says that "...*Flatland* has maintained a unique place in imaginative scientific literature for over a century. The product of Edwin A. Abbott (1838-1926), an English clergyman and Shakespearean scholar whose avocation was mathematics, this charming narrative of two-dimensional world has achieved renown both as an unequalled presentation of geometrical concepts and as a barbed satire of the hierarchical world of the Victorians." I can endorse Dover's view of their product except that I cannot quite see the charm stressed in this quote.

On the other hand, I did find *Flatterland* rather charming. Its premise is that one hundred years after the events described above another traveler arrives and whisks away another flatlander, this time a young woman, to see and learn about a wide variety of concepts in geometry and then physics. It is jokey. For example, the name of the heroine is Victoria Line and her mother is Jubilee Line. (On the *London tube*, get it?) The guide on this tour is a childish toy, the "Space Hopper." Despite the jokes, the math is pretty well done. The hopper explains the basic concepts of this mathematics and even describes some of its applications. We see lots of different kinds of spaces, many more than would have been mentioned in high school or basic college courses. We learn how geometry works in each of the spaces. It is all tied together by a modern description which defines the different spaces by their symmetry properties. It is good solid math. In addition, the treatment is light-hearted and mostly good fun. About half-way through, the book switches from math to modern physics. Some of the physics discussions were excellent. I thought Stewart's description of Schrödinger's cat was both correct and illuminating. But the book also includes some subjects, like string theory, that are not yet fully understood. Because string theory is often discussed by using spaces of two and ten and eleven dimensions, this subject is a natural for the book. But its discussion was necessarily sketchy and not as illuminating as the math in the earlier part of the book.

Like Abbott, Stewart reaches beyond mathematics to political and especially social concerns. In *Flatterland*, Victoria's travels start out, naturally enough, from her own family circle. We see a traditional nuclear family with the father working outside the home and the mother working at home. Despite the passage of time since *Flatland*, the two dimensional society remains quite hierarchical, but its totalitarian features have apparently abated. Victoria (or Vikki) herself is a young woman living with her family but without obligations to school or employment or anyone.

The hopper arrives, and Vikki leaves with him. In her travels she devotes herself to mathematics, but hardly to social or political concerns. Upon her return, Victoria will communicate her new-found knowledge to her women-friends via a two-dimensional internet. Unlike the hero of *Flatland*, Victoria is quite unworried that she will be imprisoned for her forbidden knowledge. In this presentation, the main social problem in

the two-dimensional world is that the men oppress the women and condemn them to a lower status. The reason and the excuse for this oppression is the females are believed to have lower dimensionality than males's two dimensions. Victoria is going to speak out against this gender oppression.

Victoria does not seem to be a very good argument for her own liberation. She has good qualities; she is intelligent and wonderfully curious. However she is unrooted, thoughtless, and irresponsible. She appears to have neither job nor school responsibilities, with no close confidant or acquaintance save her own diary. Vikki unexpectedly disappears from the family home, her home, for several months without any farewell or any other piece of communication with family or friend. Nonetheless, at the end, she is about to lead the females in her society in a new direction. She will do this by using a new piece of knowledge, gained in the last pages of the book. At this very last moment, she has unexpectedly learned that Flatterland females have a projection into the third dimension, invisible to all Flatlanders, but visible to space travelers. She hopes to liberate her society's females by pointing out that, seen from the three dimensional world, they are exactly as two-dimensional as the males! The *deus ex machina* of space travel will thus resolve the social problems of Stewart's Flatland. The sharp social and political satire of Abbott's work has been replaced by a basic complacency, slightly leavened by a fashionable concern for gender issues.