

Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace

By **Leonard Mlodinow**, *The Free Press – A
division of Simon & Schuster, 2001, 306 pp.*

Euclid's Window is a clear exposition of the 'story of geometry' and the development of our understanding of the physical space that we live in, with a proper and accurate conveyance of trends and developmental threads to the educated lay reader. The author's attempt, though good-natured as it may be, at humour to perhaps liven up the storytelling, however, comes across not very effectively—the humour seems dry and unappealing, and is often misplaced, making the writing a little inconsistent in style due to the relatively serious nature of the history of geometry.

The scope of Mlodinow's book is not limited to geometry—as the title might lead one to expect—but includes the physical understanding of the structure of the universe, to good effect. *Euclid's Window* is divided into five chapters, each describing a revolution in the history of geometry and space with an eminent mathematician or physicist being central to its causation. This history is thus traced from the time of the ancient Greeks when the parallel postulate was set down in Euclid's *Elements*, through the coordinatization of space (Descartes), and the discovery of non-Euclidean spaces (Gauss) whose application was found in the theory of space-time (Einstein), to present day, where physical theories—from superstring theory to M-theory (Witten)—add extra dimensions to the ordinary three dimensions of the spatial world and claim that the structure of space determines the nature of matter and forces.

The style of writing receives some praise from reviewers ("The book is written with grace and charm." —Edward Witten, Fields Medal winner; "Readable and entertaining." —Amir Aczel, author of *Fermat's Last Theorem*) but I personally find the wry humour and playful tone unappealing and, at times, even unpleasant, a distraction from the historical storyline. Take for example: "Descartes wavered (in accepting Queen Christina of Sweden's invitation to her court) ... He had no access to weather.com, but he certainly knew of the climate—and the personality—that awaited him." That this statement contains anachronistic content is of no matter; the point could be carried across in a much more straightforward manner. Mlodinow jibes at the peculiar behaviour of the ancients—peculiar from the modern perspective, that is—and pokes fun at numerous figures and events from the past. The wittiness appears to diminish towards the end of the book (the last two chapters, to be specific) perhaps because it is easier to laugh at those who have come before us than at our contemporaries, or might it be that the reader is simply used to Mlodinow's style? A factor contributing to the ineffectiveness of the humour is that it is often misplaced as Mlodinow comments on side characters in secondary threads of the exposition, making it seem that he is quite anxious to grab any opportunity to attempt at humour. Such comments are certainly irrelevant.

It would be unfair to overemphasise the criticisms of the writing style for Mlodinow does

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indeed gives a fairly compelling exposition of the events and developments in the history of geometry and space. The interested lay reader should pick up this book to understand what the present state of geometry is and how and why this came to be.

The history is told quite accurately for Mlodinow did “extensive historical research” (as claimed by the back flap of the book) and interviewed contemporaries such Edward Witten, Murray Gell-Mann and John Schwarz. The technical mathematics and physics is also explained quite accurately as Mlodinow is able to elucidate at times difficult concepts to the lay reader, often by the use real life examples and situations, some of which are involved in the actual motivation of physical theories. (One thing that takes some shine away from this is that these examples are often involving his two sons, Alexei and Nicolai, which I presume is meant to add a personal touch but which I do not find amusing.) However, in the last two chapters, some technical terms are used without much explanation (e.g. charge and the names of elementary particles), but this does not result in any abstruseness that might serve to obscure the broad outline, as only a rough understanding is required—and such a rough understanding is presumably present in educated laymen—to follow this outline.

Another thing deserving praise is that *Euclid’s Window* shows the continuity of the historical thread—the chapters only serve as a rough demarcation but does not result in Mlodinow expounding in chunks; the historical storyline flows through chapter boundaries and gives a more realistic picture of how the discoveries in geometry grew upon one another. For example, although the third chapter is entitled “The Story of Gauss”, not only mathematicians Bolyai and Lobachevsky are mentioned, who together with Gauss were the pioneers of hyperbolic space, but also Riemann, who gave a visual interpretation of elliptic space. From here, we see the primacy of the completeness of the exposition of events over having clear, well-defined chapters. This continuity makes it easier for the reader to perceive trends and helps to show the history does not develop in a linear fashion, no separate revolutions linked up by the passage of time, but rather, involves the simultaneous or collaborative work of disparate groups of mathematicians.

An implicit point on the close intertwining of abstract geometry and the structure of the physical space we live in is mentioned throughout and is certainly well-conveyed to the reader. The book is not solely about the ‘story of geometry’; if we strictly keep within the mathematical scope of geometry, the book should only dwell on abstract concepts and not also speak about the physical world. But Mlodinow chose to also mention the latter which in fact helps to explain the development of geometry better and is in fact a more holistic view of things (physics does, after all, motivate theories in mathematics). This point is especially obvious in the last two chapters.

In conclusion, *Euclid’s Window* is a suitable popular science book for the educated lay reader interested in knowing the developments in the history of geometry and space. Although the attempts at humour sometimes detract from the proper delivery of the historical exposition, Mlodinow’s ability to elucidate technical concepts, ensure continuity and imply trends, such as the symbiosis of developments in geometry and the understanding of the physical universe, results in a good and enriching read.

Reviewed by

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