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978-0-521-75994-6 - Flatland: An Edition with Notes and Commentary

Edwin A. Abbott, William F. Lindgren and Thomas F. Banchoff

Excerpt

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Introduction

Edwin Abbott's *Flatland* is the story of a two-dimensional universe as told by one of its inhabitants, a square who is introduced to the mysteries of three-dimensional space by a sphere. Since the time of its publication in 1884, Victorian customs have become obscure, the meanings of words have changed, and historical allusions, which were obvious to a contemporary, now require explanation. The present edition is intended to enable a modern-day reader to understand and appreciate the "many dimensions" of this classic satire. The extensive annotations to the text include mathematical notes and illustrations, which enhance the usefulness of *Flatland* as an elementary introduction to higher-dimensional geometry; historical notes, which show connections to late-Victorian England and to classical Greece; citations from Abbott's other writings and the works of Plato and Aristotle, which serve to interpret the text; commentary on close parallels between *Flatland* and Plato's "parable of the cave"; notes on the language and literary style of the book, including definitions of obscure words; and an appendix, which gives a comprehensive account of Abbott's life and work.

A Romance of many dimensions.

The word "romance" in *Flatland*'s subtitle means a prose narrative that treats imaginary characters involved in events quite different in time and place from those of ordinary life. The two-dimensional world of *Flatland*, inhabited by geometric figures, is manifestly different from that of ordinary life; nonetheless, a great majority of its early readers were well acquainted with the "physical space" of Flatland. Flatland's space is the familiar Euclidean plane, the principal object of study in Euclid's *Elements*, a fixture in the curriculum of Victorian public schools.

The phrase "of many dimensions" is a play on various meanings of "dimension." In the literal (geometric) sense of the word, *Flatland* is a

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primer on the geometry of higher dimensions. But Abbott was not a mathematician and did not intend to write a geometry text; he would be surprised to learn that his “romance of many dimensions” has become a standard introduction to higher-dimensional geometry. He meant “dimension” primarily in a figurative sense and, in this sense, *Flatland* indeed has many dimensions: It is an extended metaphor expressed in the language of mathematics; it is a satirical commentary on Victorian society; it is a geometric version of Plato’s parable of the cave; it is an expression of religious principle; and it is an illustration of Abbott’s theory that imagination is the basis of all knowledge. Another dimension of *Flatland*, Abbott’s use of play, has frequently been misjudged. The book certainly abounds with cleverness and play of wit, and Abbott certainly intended it to be amusing. But those commentators who have characterized *Flatland* as a mere humorous trifle have badly underestimated a book that is written in the same spirit of playful seriousness that pervades the Platonic dialogues.

Flatland as Victorian England/Flatland as classical Greece.

Although Abbott was not the first person to posit a two-dimensional universe inhabited by geometric figures, he was the first to imagine such a space endowed with a highly developed social and political structure. Abbott’s primary model for this structure is not that of late-Victorian England, which is unquestionably the target of his satire, but rather that of classical Greece. Abbott’s contemporaries would have found Flatland’s society as familiar as its space, for the traditional public school education placed a heavy emphasis on the Greek and Roman classics.

There was a widespread conviction among Victorian writers that the Greeks had been like the English and “that the historical situations of the two civilizations were essentially similar. Although this attitude did not survive much beyond the first quarter of the twentieth century, it was fundamental to Victorian intellectual life and determined the outlook of much Victorian scholarship, criticism, and commentary on the Greeks.” To maintain the similarity between the two civilizations, writers like Matthew Arnold had to rationalize away fundamental differences and ignore morally distasteful elements in Greek society. Others (with whom Abbott would have agreed) argued that classical Greece had not been like England, and England should not model itself on classical Greece (Turner 1981, 11, 61, 252).

In writing *Flatland*, Abbott used “historical imagination” not to reconstruct the past but to reconstruct the present in the past. He devised an extended geometric metaphor by projecting late-Victorian England onto a two-dimensional space with a “civilization” in various ways similar to that of classical Greece. Further, he heightened his satirical commentary on the present by making prominent in this imaginary civilization some of

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the very aspects of classical Greece that its Victorian apologists had rationalized away—for example, slavery, a rigid class system, misogyny, and ancient forms of social Darwinism.

Flatland and Plato's parable of the cave.

Several writers have noted the most significant “Greek connection” in *Flatland*—its parallels with Plato's parable of the cave. In the seventh book of the *Republic*, Socrates describes a cave containing prisoners who have been kept fixed since childhood by bonds on their legs and necks. Their bonds prevent them from turning their heads, and so they cannot see the fire burning above and behind them. Between the fire and the prisoners there is a rampart bordered by a low wall on which certain men place various artifacts; the fire casts shadows of these objects on the cave wall in front of the prisoners. These shadows and the voices of the men on the rampart are the only “reality” that each prisoner knows (*Republic*, 514a–518b).

In *Flatland*, Abbott has amplified Plato's metaphor and rendered it into the language of geometry by substituting a two-dimensional plane populated by geometric figures for the cave and its prisoners. Although Abbott does not explicitly acknowledge the source of his model, and the details of the two stories are by no means identical, the derivation of *Flatland* from Plato's parable seems unmistakable. Most significant, each text contains a metaphorical account of both the nature of the human condition and the journey of an individual soul from ignorance to knowledge.

Abbott's “geometrization” of the cave parable is particularly appropriate because of the importance that Plato attaches to mathematics. Plato included geometry in the educational curriculum for the guardians of the State because it “is the knowledge of the eternally existent” and tends to draw the soul to truth, and is “productive of a philosophical attitude of mind, directing upward the faculties that are now wrongly turned earthward” (*Republic*, 527b).

Precursors of Flatland.

The study of higher-dimensional geometry began with works by Hermann Grassmann (1844), Arthur Cayley (1846), and Bernhard Riemann (1854); by the time *Flatland* appeared, hundreds of articles on the subject had been published. Interest in higher-dimensional spaces was by no means confined to the scientific community, and a number of these articles were directed at a general readership. Several writers of popular essays on higher dimensions illustrated the difficulty of understanding four-dimensional space by portraying two-dimensional beings living on a surface and unable to perceive anything of three-dimensional space. This

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dimensional analogy, which is fundamental to *Flatland*, was used by three writers whose works might have influenced Abbott: Gustav T. Fechner, Hermann von Helmholtz, and C. Howard Hinton.

The German psychologist and philosopher Fechner was the first person to use “flatland” as a device for understanding higher dimensions. In two essays, “*Der Schatten ist lebendig*” (“The shadow is alive”) and “*Der Raum hat vier Dimensionen*” (“Space has four dimensions”), first published in 1845, he describes a shadow man capable of moving about on surfaces and interacting with other shadows. Abbott, who was fluent in German, might have read them in *Kleine Schriften*, a collection of Fechner’s satirical essays (Fechner 1875, 243–276).

Between 1868 and 1879, the German scientist and philosopher Helmholtz published several lectures and papers with similar titles and contents that considered how humans come to understand the nature of space. He used an example of two-dimensional beings whose movements are confined to the surface of a solid to argue that our notion of space is not, as Immanuel Kant supposed, an *a priori* intuition but rather is determined by our experience. Abbott could have seen the essay, “The origin and meaning of geometrical axioms,” which appeared in the English philosophical journal, *Mind* (1876).

Hinton has been described as a “hyperspace philosopher.” His essay “What is the fourth dimension?” (1880, 1883) is the first of several that he wrote to popularize four-dimensional space. Abbott might have learned of Hinton’s essay from his friend Howard Candler, who was the mathematics master at Uppingham School where Hinton was the science master between 1880 and 1886.

Another precursor of *Flatland*, an essay entitled “A new philosophy,” appeared without attribution in the November 1877 issue of the *City of London School Magazine*. The thesis of this satirical essay is that mathematics is the only “science” that can provide an unshakable foundation for a philosophy or religion. According to the proposed “Geometrical Philosophy,” the universe is composed of an ascending chain of spaces, each having its dimension one greater than that of its predecessor, as well as a descending chain of spaces, each having its dimension one less than that of its predecessor. Although the *City of London School Magazine* was a student publication, it is possible that Abbott himself was the author of this noteworthy essay (New Philosophy 1877; Valente 2004).

Abbott could have found the idea of using a mathematical setting for his story in Lewis Carroll’s *Dynamics of a Particle*. Carroll prefaces this small pamphlet of political satire with a brief account of a love affair between a pair of linear creatures moving across a plane surface. This preface, he says, illustrates “the advantage of introducing the human element into the hitherto barren region of mathematics” (Carroll 1874).

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Edwin Abbott Abbott.

The author of *Flatland*, the eminent biblical and English scholar and Victorian headmaster Edwin Abbott Abbott, was born in 1838 in Marylebone, where his father was headmaster of the Philological School. Abbott was educated at the City of London School (CLS) under George F. W. Mortimer before entering St. John's College, Cambridge, where he was senior classic and senior Chancellor's Medallist in 1861. He was ordained deacon in 1862 and priest the following year. After teaching briefly at King Edward's School, Birmingham, and Clifton College, Bristol, he returned to CLS as headmaster in 1865. The school that he inherited from Mortimer was highly regarded, and under Abbott it became one of the best day schools in England. He reformed the traditional curriculum, brought new methods of instruction, and improved the quality of the assistant masters. Abbott was a gifted teacher who sent a large number of students to Oxford and Cambridge. At the same time, as an administrator he ensured that the greater number, those not meant for the universities, received a sound general education.

His student and biographer, Lewis Farnell, asserted that Abbott's "claim to be remembered must chiefly rest upon what can only be called his genius for teaching." Nonetheless, the enduring interest of his life was the problem of presenting Christianity to his contemporaries in a way that would ensure the permanence of traditional beliefs without requiring the acceptance of miracles (Obituary 1926b). He "retired" at the age of 51 and devoted himself to biblical scholarship; between 1900 and 1917, he published an immensely detailed, fourteen-volume study of the four Gospels.

Various commentators have remarked that *Flatland* seems out of place with the rest of Abbott's literary output; nevertheless, it is quite similar to two other pseudonymous, first-person accounts that Abbott wrote: *Philochristus* (1878), the story of a Pharisee in the early first century, and *Onesimus* (1882), the story of the Greek slave in St. Paul's Epistle to Philemon. In these stories, as in *Flatland*, a protagonist is transformed by the revelation of a being of a higher order, but when he attempts to spread this good news, he meets with frustration and even persecution.

The first and second editions of Flatland.

The first edition of *Flatland* probably appeared in late October 1884. *Flatland* is on Seeley and Company's "List of New Books" in *The Literary Churchman* (24 October 1884, 452). Abbott autographed copies to several friends in October 1884, and the earliest review appeared in *The Oxford Magazine* (5 November 1884) (see Appendix A4).

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We do not know how many copies of the first edition of *Flatland* were sold. In the nineteenth century, publishers typically issued 500 to 1,000 copies, and the great majority of books never went into a second edition. In any case, the first edition sold out quickly, and a second edition was published. The title page of this edition is dated 1884, but the following evidence suggests that it did not appear until 1885: The significant changes to the text are based on a letter, which the Square sent to *The Athenaeum* in response to a review of *Flatland*, and the reviewer's response to that letter. Both the Square's letter and the reviewer's response appeared in *The Athenaeum* on 6 December 1884 (Appendix A2). An advertisement for Seeley and Co. in the *Times* of 21 January 1885, describes *Flatland* as "just published" with no mention that it is a second edition. Abbott inscribed a second edition to Howard Candler in February 1885. The first advertisement for *Flatland* in the *Times* that mentions a second edition appeared in the 18 March 1885 issue.

Subsequent editions.

Flatland had been long out of print in England when it was reissued in June 1926 by Sir Basil Blackwell. The text of Blackwell's edition was only slightly different from the second edition, and it had much the same appearance as the original. This edition included an introduction written by the physicist, William Garnett, who was among Abbott's first pupils at the City of London School. In his introduction, Garnett cites an essay written six years earlier in which he characterized Abbott as a prophet who had foreseen the relevance of the dimensional analogy for understanding the passage of time in relation to space.

In 1885, Roberts Brothers of Boston issued the first American edition of *Flatland*, essentially the uncorrected first edition with Americanized spelling. In 1898, Roberts Brothers was acquired by Little, Brown and Co., which continued publishing *Flatland* until the middle of the twentieth century. Much of the popularity of *Flatland* in the United States is attributable to a co-founder of Dover Publications, Hayward Cirker, who chose *Flatland* as one of his firm's first titles in mathematics in 1952. The publication of the Dover *Flatland* made the second edition readily available to American readers for the first time. In the past thirty years, publishers have issued dozens of "editions" of the book, which differ from one another only in their introductions. The first translation of *Flatland*, the Dutch *Platland*, appeared in 1886; since then, it has been translated into sixteen other languages.

This edition of Flatland.

The text of *Flatland* that follows is the second edition with one change: The Preface to that edition is the Epilogue to this one. We have made this

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change because this Preface/Epilogue can be properly understood only by a person who has read the rest of the text. Furthermore, it really is an epilogue—the concluding section of a work in which a character, at a somewhat later time, reflects on the preceding events and gives additional details, which serve to interpret the story. Finally, reading this section before reading the text would spoil the effect of the narrative in which the Square describes his passage from the unenlightened “Square he once was” through his “initiation into the mysteries of space” and his subsequent “miserable Fall.”

In his essay “Good readers and good writers,” Vladimir Nabokov maintains: “In reading, one should notice and fondle details . . . Curiously enough, one cannot *read* a book: one can only reread it. A good reader, a major reader, an active and creative reader is a rereader” (Nabokov 1980, 3). It is to the rereaders that we address this annotated edition of *Flatland*.



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Cover. As he did with *Philochristus* and *Onesimus*, Abbott wrote *Flatland* in an archaic style to create an impression of antiquity. In the case of the first edition of *Flatland*, the impression begins with its cover, which is made of vellum (a fine kind of parchment prepared from the skins of calves) wrapped on cardboard. Abbott may have chosen this cover as a reminiscence of the principal form of the “book” in the ancient world—a roll made of glued sheets of papyrus wound about a wooden stick and often kept in a parchment cover.

Cover epigraph. The epigraph, which is taken from *Hamlet* 1.5, points toward and provides commentary on *Flatland*’s central event, the nocturnal “appearance” in Flatland of a sphere, who has come to initiate the Square into “the mysteries of space.” The first line, “O day and night, but this is wondrous strange,” is spoken by Horatio, who has just seen the ghost of Hamlet’s slain father appear and disappear. In his reply, “And therefore as a stranger give it welcome,” Hamlet alludes to the ancient practice of hospitality to strangers. Shakespeare is urging us not to be limited by Horatio’s rationalism but, together with Hamlet, to welcome “things not dreamt of in (our) philosophy.”

It was natural for Abbott to select epigraphs from the works of Shakespeare. He established his scholarly reputation with the publication of *A Shakespearian Grammar*, which he wrote to furnish students of Shakespeare with an account of the differences between Elizabethan and Victorian English.

A Square. Edwin Abbott Abbott’s name contains the surname of both of his parents, Edwin Abbott and Jane Abbott, who were first cousins. The pseudonym Abbott has chosen is a pun—it refers to his own initials, EAA = EA^2 , as well as the modest social status of the “author” who is an ordinary square. *Flatland*’s everyman narrator does not tell us the names of any of his contemporary Flatlanders; nor does he tell us his own name—he is “a square” (“A Square” as it is typeset on the title page), not A. Square.

Abbott made the Square the author of *Flatland* not to avoid responsibility for the book but rather to present it as the memoirs of a two-dimensional being. The anonymous publication of books was common in the nineteenth century, but books that received any degree of celebrity were typically attributed within a few months. The first public indication that Abbott was the author of *Flatland* appeared in the Literary Gossip column of *The Athenaeum* (see Appendix A2, footnote 3). Abbott himself may well have been the source of this item. Certainly, he was the one who revealed that he was the author of *Philochristus*: “I shall publish it anonymously: but shall carefully let it be known that I am the author, for there are reasons why (though I may not like to be abused by *name* in the religious papers) I have no right to shirk the odium of heterodoxy, for the book is heterodox” (Abbott 1874).

Seeley & Co. The firm that published *Flatland* was owned by Richmond Seeley, the second son of Robert Benton Seeley and an elder brother of Abbott’s friend and mentor, John R. Seeley. In 1857, Richmond Seeley took control of his father’s share in the family business, which had been founded about 1784. Seeley continued the

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FLATLAND

A Romance of Many Dimensions

With Illustrations

by the Author, A SQUARE

“Fie, fie, how frantically I square my talk!”

LONDON

SEELEY & Co., 46, 47 & 48, ESSEX STREET, STRAND

(Late of 54 FLEET STREET)

1884