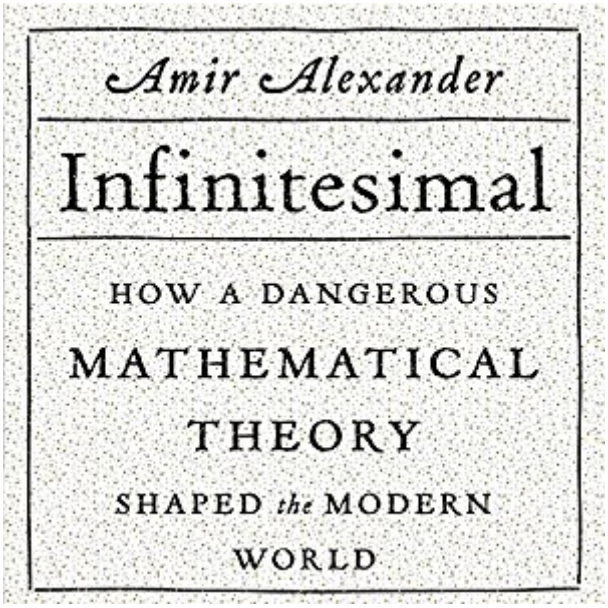
Infinitesimal: How A Dangerous Mathematical Theory Shaped The Modern World



Synopsis

Pulsing with drama and excitement, Infinitesimal celebrates the spirit of discovery, innovation, and intellectual achievement - and it will forever change the way you look at a simple line. On August 10, 1632, five men in flowing black robes convened in a somber Roman palazzo to pass judgment on a deceptively simple proposition: that a continuous line is composed of distinct and infinitely tiny parts. With the stroke of a pen the Jesuit fathers banned the doctrine of infinitesimals, announcing that it could never be taught or even mentioned. The concept was deemed dangerous and subversive, a threat to the belief that the world was an orderly place, governed by a strict and unchanging set of rules. If infinitesimals were ever accepted, the Jesuits feared, the entire world would be plunged into chaos. In Infinitesimal, the award-winning historian Amir Alexander exposes the deep-seated reasons behind the rulings of the Jesuits and shows how the doctrine persisted, becoming the foundation of calculus and much of modern mathematics and technology. Indeed, not everyone agreed with the Jesuits. Philosophers, scientists, and mathematicians across Europe embraced infinitesimals as the key to scientific progress, freedom of thought, and a more tolerant society. As Alexander reveals, it wasn't long before the two camps set off on a war that pitted Europe's forces of hierarchy and order against those of pluralism and change. The story takes us from the bloody battlefields of Europe's religious wars and the English Civil War and into the lives of the greatest mathematicians and philosophers of the day, including Galileo and Isaac Newton, Cardinal Bellarmine and Thomas Hobbes, and Christopher Clavius and John Wallis. In Italy, the defeat of the infinitely small signaled an end to that land's reign as the cultural heart of Europe, and in England, the triumph of infinitesimals helped launch the island nation on a course that would make it the world's first modern state. From the imperial cities of Germany to the green hills of Surrey, from the papal palace in Rome to the halls of the Royal Society of London, Alexander demonstrates how a disagreement over a mathematical concept became a contest over the heavens and the Earth. The legitimacy of popes and kings, as well as our beliefs in human liberty and progressive science, were at stake - the soul of the modern world hinged on the infinitesimal.

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Customer Reviews

This book is much more than an esoteric history of an area of mathematics. It tracks the ancient rivalry between Ã¢Â Âˆrationalists Ã¢Â Â™ and Ã¢Â Âˆempiricists Ã¢Â Â™. The dominant rationalists have always believed that human minds (at least those possessed by educated intellectuals) are capable of understanding the world purely by thought alone. The empiricists acknowledge that reality is far too complicated for humans to just guess its detailed structures. This is not simply an esoteric philosophical distinction but the difference in fundamental world-views that have deeply influenced the evolution of western civilization. In fact, rationalist intellectuals have usually looked to the logical perfection of mathematics as a justification for the preservation of religion and hierarchical social structures. In particular, the rationalists have raised the timeless, unchanging mathematical knowledge, represented by Euclidean geometry, as not just the only valid form of symbolic knowledge but as the only valid model of the logic of Ã¢Â Âœproof Ã¢Â Â•.In particular, this book focuses on the battle between the reactionaries (e.g. Jesuits and Hobbes), who needed a model of timeless perfection to preserve their class-based religious and social privileges and reality-driven modernists, like Galileo and Bacon. The core of the disagreement was over the nature of the continuum, which was based on Euclid Ã¢Â Â™s definition of a line as an infinite number of points. This intellectual argument implicitly links back to reality: is matter made of distinct atoms with empty space between them or are there no gaps between continuous matter? Although the model of the reactionaries was always Euclid’s geometry, they never recognized they were only dealing with unreal definitions, as they faked out their arguments with appeals to ’real’ lines etc. As such, they vigorously rejected the new concept of "indivisibles" (or "infinitesimals", the roots of calculus) and all ideas that were grounded in empirical studies of reality (like physics and the atomic hypothesis). Failure to admit debate about reality led Italy back into the Dark Ages while Northern Europe set off on the course of modernism.As other reviewers have noted, this book would have benefitted quite a bit by including the story of the rivalry between Leibniz and Newton, who are

usually credited with the invention of the calculus. As this book shows, this 17th Century rivalry had much older roots. Indeed, the book could also have been improved by establishing this acrimonious debate back in Classical Greece, where the atomic model, first proposed by Democritus, was immediately seen as an atheistic proposal that threatened traditional religion. The modern reader might assume that science has now firmly voted for the atomic model but the extensive use of the calculus embedded in Quantum Physics has preserved the conceptual features of the continuum advocates, so that we are now faced with the paradox of waves and particles. None-the-less, even readers with minimal competence in mathematics will enjoy discovering how this tiny idea of the infinitely small punctured an ancient dream: that the world is a perfectly rational place that is governed by strict mathematical rules.

I like the book, though I found it a bit overlong and sometimes redundant. Further, I suspect that the author may have the cart before the horse in thinking that failure to study infinitesimals stultified Italy, rather than the other way round. Also, I sometimes found the going hard because the author failed to distinguish between an infinitesimal and an indivisible. Nevertheless, it was fascinating to learn that the Jesuits opposed the study of infinitesimals on theological grounds whereas in northern Europe Ã¢Â Â“ Protestant countries Ã¢Â Â“ the concept was generally accepted and led to development of calculus. I had no idea that Thomas (nasty, brutish, and short) Hobbes had so vigorously opposed the concept of infinitesimals, and perhaps more surprisingly I had never heard of John Wallis, who was sort of the hero of the book and vigorously defended the concept of infinitesimals in England (and invented the symbol for infinity). Indeed, unless Alexander is exaggerating, it appears that without Wallis, Newton would not have developed the calculus. Nevertheless, I find it very hard to believe that England prospered and Italy stagnated simply because England developed mathematics and Italy did not.

Interesting, fascinating, enlightening. Infinitesimal introduced me to concepts and characters I had never encountered and showed me how a long forgotten series of catfights among snooty-nosed intellectuals led us to the world we live in. The closest equivalent concept I have at hand is the struggle between Keynesian and Hayekian economics.At the same time, I got the feeling that the author had been paid for x pages, but his thesis only required 4x/5. He filled the remaining 20% with a never-ending re-explanation of the basic struggle. It was helpful the first few times; by page 200 (out of almost 300), I started to bleep over them.Still: an awesome book that helps explain where we came from and why we’re here. Isn’t that what we’re all looking for?

The author has succeeded in writing a compelling account of how the work of brilliant 17th century mathematicians provoked conflicts of great cultural significance within the Catholic Church. He also explains with clarity how these conflicts had relevance to the reformation and the evolution of European political entities. The profiles of individual actors in mathematics and the Church are fascinating although it can be challenging to follow the large number of Italian names and places.The underlying mathematical theory of indivisibles, which was the cornerstone of the conflict, the forerunner of calculus and perhaps even atomic physics, is explained with enough clarity that most readers without a background in math will readily understand it. I enjoyed reading Infinitesimal as a brilliant history of religion, science and philosophy as they interacted 350 years ago, a glimpse of mathematical genius and a multifaceted biography of extraordinary people.

The author writes very interestingly about the religious and political positions with regard to---of all things!--the nature of the continuum that in 17th century Italy and England impeded the development of the calculus, and about the oddly-motivated positions taken by Gallileo and John Wallis that ultimately broke that barrier. But, though a portrait of Newton adorns the dust jacket, he has strangely little to say about the final chapter (Fermat, Newton, Leibniz) of his story, or about any of the other important mathematics that was gong on during the centuries in question. Promotes the view that mathematical developments are culturally determined, which is surely only part of the story.

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