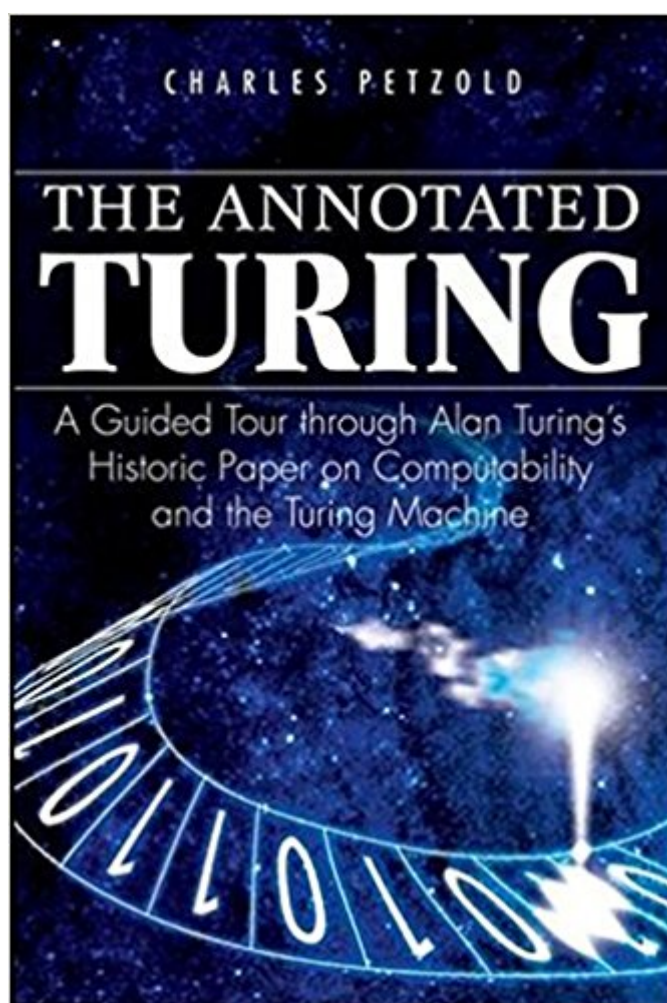


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# The Annotated Turing: A Guided Tour Through Alan Turing's Historic Paper On Computability And The Turing Machine



## Synopsis

Programming Legend Charles Petzold unlocks the secrets of the extraordinary and prescient 1936 paper by Alan M. Turing. Mathematician Alan Turing invented an imaginary computer known as the Turing Machine; in an age before computers, he explored the concept of what it meant to be computable, creating the field of computability theory in the process, a foundation of present-day computer programming. The book expands Turing's original 36-page paper with additional background chapters and extensive annotations; the author elaborates on and clarifies many of Turing's statements, making the original difficult-to-read document accessible to present day programmers, computer science majors, math geeks, and others. Interwoven into the narrative are the highlights of Turing's own life: his years at Cambridge and Princeton, his secret work in cryptanalysis during World War II, his involvement in seminal computer projects, his speculations about artificial intelligence, his arrest and prosecution for the crime of "gross indecency," and his early death by apparent suicide at the age of 41.

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## Customer Reviews

Before digital computers ever existed, Alan Turing envisioned their power and versatility...but also proved what computers could never do. In an extraordinary and ultimately tragic life that unfolded like a novel, Turing helped break the German Enigma code to turn the tide of World War II, later speculated on artificial intelligence, fell victim to the homophobic witchhunts of the early 1950s, and committed suicide at the age of 41. Yet Turing is most famous for an eerily prescient 1936 paper in

which he invented an imaginary computing machine, explored its capabilities and intrinsic limitations, and established the foundations of modern-day programming and computability. This absorbing book expands Turing's now legendary 36-page paper with extensive annotations, fascinating historical context, and page-turning glimpses into his private life. From his use of binary numbers to his exploration of concepts that today's programmers will recognize as RISC processing, subroutines, algorithms, and others, Turing foresaw the future and helped to mold it. In our post-Turing world, everything is a Turing Machine – from the most sophisticated computers we can build, to the hardly algorithmic processes of the human mind, to the information-laden universe in which we live.

English mathematician Alan Turing (1912–1954) is the author of the 1936 paper "On Computable Numbers, with an Application to the Entscheidungsproblem" that introduced the imaginary computer called the Turing Machine for understanding the nature and limitations of computing. His famous 1950 article "Computing Machinery and Intelligence" introduced the Turing Test for gauging artificial intelligence. American writer Charles Petzold (1953–) is the author of the acclaimed 1999 book *Code: The Hidden Language of Computer Hardware and Software*, a unique exploration into the digital technologies of computers. He is also the author of hundreds of articles about computer programming, as well as several books on writing programs that run under Microsoft Windows. His Web site is [www.charlespetzold.com](http://www.charlespetzold.com).

It was about 10 years ago when I first found Turing's original paper on Internet and thought it wouldn't be so hard to read and understand it (after all it's "mere" computer science). Since then I've tried to digest it quite a few times on and off and never actually succeeded. Most of the time I got stuck on few nitty-gritty and just couldn't move forward. I have even bought/borrowed almost all books on the subject that falls in to "popular science" types. Needless to say, like many such books in same category, they just never go in to details and are practically useless for all practical purposes :). So imagine my surprise when I see a book with title "Annotated Turing" and by none other than Charles Petzold who I've known as author who normally writes programming books. That surprise was only a start. I was simply shocked when I opened the book. It was as-if someone read your dream and made it a reality with absolute precision with zero compromises. If there is one such book like this for all of the milestone scientific papers, there would be a revolution in learning. Let me put out some points what makes this book so perfect. Not just wishy-washy "near perfect", I'm saying SO PERFECT.\*First, the book contains explanation of every single line in Turing's paper.

Literally. The format of the book is a line quoted from Turing's paper in bold and a paragraph or so of explanation and discussions for that line. Author's claim is that you can actually cut out all those lines and stitch them to recreate the Turing's paper in its entirety complete with page numbers! Now that's what I call precision.\*The book also includes all encompassing big picture overview, historical situation, importance, consequences and so on - nicely preparing reader for the journey.\*The book is so readable that I usually forget I'm reading a very technical book that goes in to very core of computer science. It's like nicest computer science professor reads you the paper line by line and answers all your questions, even those completely stupid ones.\*As I'd doubted many times, there are lots of errors in Turing original paper. This book amazingly points them out and corrects even the minor misprints. I'm just surprised how author even know so much "insider" details about those trivial misprints and errors.\*Turing's paper is full of obscure strange symbols (have you seen old gothic German font?) that are common in scientific literature today. Author explains all these symbols, what they mean, where they came from, what are the subtle differences and so on. Just amazing.\*Turing's paper have lot of omissions for explanations and steps which he probably left out as "exercise for reader" to keep his paper short. Sometime you might get stuck in those exercises and if you are not in academia you probably have no external help. This book deals with all these omissions and expands so beautifully on them that I can't imagine if there any better way to describe them.\*Apart from omissions, there are lot of shortcuts that Turing employs with rather flitting explanations or sometime absolutely none. This book covers you 100% for these shortcuts.\*A big part of understanding Turing's paper is actually mentally running his machine's step by step for all the examples he puts out. This book actually does this step-by-step run explanation making it so easier to read and understand quickly.Anyway, some of you might think why one should even bother about reading this ancient computer science paper in first place? Answer is huge changes in the way we have started viewing universe recently. While Seth Lloyd's book "Programming the Universe" does good job of explaining this thinking, the summary is that the universe can be seen as computing machine rather than particle and energies in the realms of physics. There was even a paper that proposed that even a simple system consisting of billiard balls interacting in space is Turing complete! That means by setting billiards balls in some initial points in space and velocity can computer anything that your laptop can compute in theory. To understand advances in this area you have to fully understand what is Turing's machine and what it means to be Turing complete and how one can prove that a certain system is computationally Turing complete. That's where the paper comes in. Text books just don't do justice.

I have a very firm belief that most books, documents, or textbooks on mathematics or the sciences are written by people without souls. This is certainly not one of those books. From the very beginning the author provides very clear and informative summaries, illustrations, and examples so that you can digest one of the most important mathematics papers of the 20th century. He even throws in some subtle humor in the mix (it's easy to miss!). Each successive chapter should leave you with some sense of interest/amazement or thoughts of, "why didn't I think of this?" By the end you will understand how a computer works at its very core. I would strongly recommend this book to anyone who is interested in computers or the foundations of mathematics. It will give deeper insights what computers and humans can, and will never be able to do. One last note: there are certain points in the book (especially near the end) which can be difficult to parse. I would recommend anyone who does not understand first order logic to a great degree to not worry about understanding all the details, but accept the author's commentary and move on, especially if you're reading it for the first time. You should first try to understand the big picture before worrying about the nitty-gritty, and the book will be more enjoyable that way.

what i really liked about the book was that it incorporated the original writings of turing and then provided examples and explanations. it also managed to weave in elements of turings life into the overall development of the book. i have a very solid mathematical background, but primarily in real analysis, and not so much in foundations and logic. so i was very much appreciative having a highly educated tutor to help along the way. when someone has to struggle with the detail and intricacies of proofs and descriptions as appear in turing's work pointing out typos and missing parentheses is beneficial. my only complaint regarding the book is that the indirect proofs are not identified at the very beginning of the proof. many of turing's results are achieved using indirect proof. they can be very confusing on the first reading because my first inclination is to accept what is written as consistent with the development so far. only later did it become clear that turing (and the author) was making an indirect argument. after reading the book i have found it to be a very rewarding project. i wanted to really understand turing machines and their capabilities in much greater detail. i wanted to understand better the terminology regarding formal logical systems. i wanted to learn about alan turing through his work. the book was successful on all three levels for me. if i understand the dates right that appear within the book, the paper which helped shape the foundations of computation was written by an undergraduate student who within a handful of years was helping design machines to decode german messages during world war ii. he was truly a genius whose life ended way too early. I personally think charles petzoid brought his story and his work to life.

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