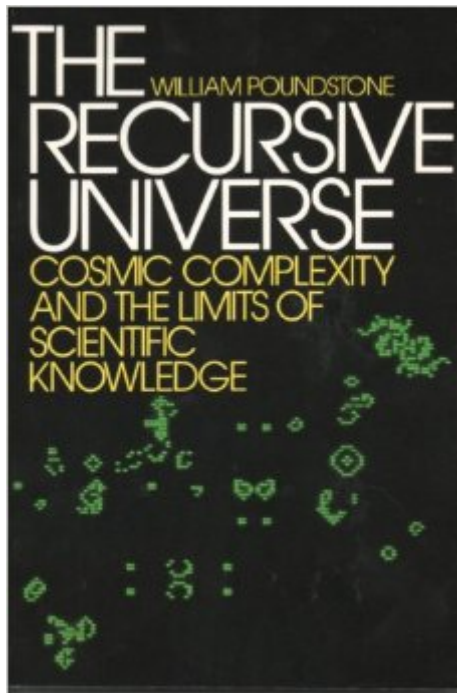


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# The Recursive Universe: Cosmic Complexity And The Limits Of Scientific Knowledge



## Book Information

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## Customer Reviews

I've given many copies of this book to my students--the ones who have particular promise, the ones who ask questions about things. Like the question that Poundstone asks in the book: where did all this complex stuff come from. Of all the complexity literature--Arthur, Kaufman, et al--I've found this the most meaningful. And the use of the Game of Life to illustrate the emergence of the complex is beautifully done.

I read most of this book (library copy) many years ago and one set of concepts had a great impact: The clear explanation of the deep epistemological implications of Leo Szilard's 1929 groundbreaking paper analyzing Maxwell's Demon and the foundations of observational information. I can't recall all the details but the conclusions were clear and startling. It goes much deeper than Heisenberg's uncertainty principle in outlining the fundamental limits of observation and thus empirical/scientific knowledge. Szilard's results would even apply in a "classical" universe. I have yet to see this fully explicated in philosophy departments or other "popular" texts, etc. Recommended as a very good, basic introduction to information and communication theory. Also, try anything by Greg Chaitin for purely mathematical limits to information and [analytic?] knowledge.

A wonderful journey through key concepts in information theory using Conway's "Life" program as a vehicle. This book is a celebration of what is possible when natural law is applied to a random

system, and demonstrates the necessity of limits on systems. Highly recommended for anyone interested in entropy, extreme sensitivity to initial conditions, or cellular automata. I thoroughly enjoyed this book.

Read this book back in the 80s and it, along with two other books--Hofstadter's Godel, Escher, Bach and Rudy Rucker's Infinity and The Mind--completely transformed my thinking. They were the last books to ever have such an impact on me. Hofstadter's GEB is well-known and has aged a little; the other two are less well known and highly recommended. This one relates quite well to recent ideas around Dr S James Gates's supposed discovery of error-correcting informational codes contained within supersymmetry equations, the best explanation of which can be found by searching for his layperson's article, Symbols of Power: Adinkras and the Nature of Reality. He is a reputable theoretical physicist at the University of Maryland, and these ideas are worth digging into. This Poundstone book on Conway's Game of Life and philosophical implications thereof provides an illustration of how life could evolve in the Matrix, if you will, while Dr Gates's work, if valid at all, would provide evidence for such a thing being literally true. To quote from Dr Gates's discussion of John Wheeler's 'It From Bit' idea: 'The "it from bit" principle symbolizes the idea that every item of the physical world has at bottom...an immaterial source and explanation: that which we call reality arises in the last analysis from the posing of yes-no questions and the registering of equipment-evoked responses; in short, that all things physical are information-theoretic in origin and that this is a participatory universe,' In other words, on one level, we are stardust, but on a deeper level, we may be non-material information, not dust at all.

This author has the ability to write very interesting books. Prisoner's Dilemma is one of only a handful of books I have found worth reading more than once. YouTube's Formula was hard to put down. In this book, William Poundstone uses the computer graphics routine, Life, to set up his narratives of cosmology and evolution. If you are a big fan of Life, and enjoy savoring lots of little details about it, then you will enjoy reading this book and seeing Life tied into the larger theories. Otherwise, the excruciating detail can get to be a grind.

Although this book was written in the 80's it is still up to date as it covers timeless aspects of physics. The book alternates chapters on Conway's Game of Life with chapters on physics. There is a lot of clearly explained chapters on information theory including Maxwell's Demon and the solution to that paradox. Also there is information on what happened at the beginning of the universe and

what will happen at the end of the universe. There is also a mini biography of Von Neumann which I found very interesting. Finally, there is a good bibliography of books some of which are still current. I have read several books on this kind of stuff but this is probably the clearest book I have read, especially the part on information theory.

Where does the perceived complexity of the universe come from? Surely from something equally as complex. Or are there exceptions? Consider the irrational number  $\pi$ ; to all appearances, an infinite string of unpredictable numbers -- mathematically indistinguishable from a random and meaningless collection of bits. But unlike an infinite random string of numbers,  $\pi$  can be completely encoded succinctly in the form of a recursive relation with only two terms - all that complexity boiled down to a simple and portable equation. This embodies Poundstone's central thesis, that simple recursion begets complexity. "The Recursive Universe" examines this powerful idea from several angles and draws from a colorful range of disciplines: from information theory to cosmology, thermodynamics to computability theory. Threaded throughout this development is a (perhaps too) detailed account of Conway's cellular automaton, The Game of Life. The game is used as a practical analogy demonstrating that complex forms and behavior -- even self-assembly -- can seemingly spontaneously arise in a world with only simple laws and random initial conditions. Poundstone explains that it takes a certain amount of information to define the recursive rules, but then the recursion "grinds out information endlessly." This profusion of information in the universe is embodied in an increasing number thermodynamic microstates, as entropy marches on in lock-step with growing complexity. But alas, this surplus of new information comes with a cost - we learn we must forget, and that we ultimately must die. Completing the connection between Shannon information and Boltzmann entropy, Poundstone reveals that there is an information cost for each bit of information gained, as the impossible task of Maxwell's demon is described in great detail. And then, as the universe equilibrates and heat death looms, the laws and initial conditions which shaped it become lost to us forever.

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