



## The Arrow of Time

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In our century, the subject of time has become an area of serious inquiry for science. Theories that contain time as a simple quantity form the basis of our understanding of many scientific disciplines, yet the debate rages on: why does there seem to be a direction to time, an arrow of time pointing from past to future?

In *The Arrow of Time*, a major bestseller in England, Dr. Peter Coveney, a research scientist, and award-winning journalist Dr. Roger Highfield, demonstrate that the commonsense view of time agrees with the most advanced scientific theory. Time does in fact move like an arrow, shooting forward into what is genuinely unknown, leaving the past immutably behind. The authors make their case by exploring three centuries of science, offering bold reinterpretations of Newton's mechanics, Einstein's special and general theories of relativity, quantum mechanics, and advancing the insights of James Gleick's *Chaos*.

## **The Arrow of Time Details**

Date : Published June 23rd 1992 by Ballantine Books (first published 1988)

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Author : Peter Coveney , Roger Highfield

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## From Reader Review The Arrow of Time for online ebook

### Dorian Driscoll says

I read this book many years ago, when I was far less able to appreciate its topic, but the one memorable part of it had little to do with science:

"Ludwig Boltzmann was on a seaside holiday in an Adriatic village. It was meant to be a relaxing break from his studies in Vienna to help him overcome a period of illness and depression. But Boltzmann was agitated...Wildly fluctuating moods had taken him to the brink of despair and led to a stay in an asylum near Munich. Even the smallest irritation could cause him deep distress--such as his wife's insistence today on delaying his return to Vienna by taking his suit to be cleaned.

Frau Boltzmann took the suit with her as she and her daughter set off for a swim in the Bay of Sistiana. It was then that her husband committed the ultimate irreversible act. he tied a short cord to the crossbars of a window casement and made a noose round his neck. Then, alone in his rented apartment, he killed himself. His daughter Elsa returned to find him hanged." (21)

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### Remo says

Gran introducción a la entropía en los sistemas físicos y biológicos. A pesar de que los choques atómicos son reversibles y viendo dos átomos chocar no sabemos si nos están pasando una película hacia atrás hacia delante, parece que todos los procesos sólo pueden ir en na dirección. Ese es el efecto e la entropía. La introducción es clara y muy completa. Cosas que al principio parecen esotéricas van cobrando forma y, sin ecuaciones, uno llega a sentirse cómodo con el proceso de aumento de desorden que nos cuentan los autores una y otra vez. Al final aprendemos algo de termodinámica y todo, a pesar de la fama de hueso que tiene la materia. Muy buen libro.

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### BasziK says

not finished

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### Harsh Rao says

AWESOME!!

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### Ashish Jaituni says

I read it many many years ago! It is a very good book. I recommend it to anyone who is interested in Time and Physics.

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## **Bryan Higgs says**

It could have been a great book, but fell far short:

- 1) The writing style was turgid,
- 2) Too much credit was given to Ilya Prigogine and his Brussels School, and
- 3) They talked endlessly about "dissipative irreversible systems" without showing how they might explain the arrow of time, rather than being merely evidence for it.

In more detail:

I just finished slogging through this book. It was not much fun, and neither was it terribly enlightening. I found the writing style to be rather turgid; there was no ability to enliven the reader's appreciation of the subject by conveying a sense of enthusiasm. Instead, the style was too academic, and tended to focus endlessly on the work of the Brussels school, led by Ilya Prigogine (who won the 1977 Nobel Prize in Chemistry for his work in dissipative structures and their role in thermodynamic systems far from equilibrium). Prigogine was mentioned so many times that it became annoying, regardless of how well one might regard Prigogine and his work.

The book contains many interesting topics, including lots of examples of dissipative, irreversible systems in chemistry and biology and beyond. However, the writing made these topics less interesting than they should have been, and it was by no means clear how such dissipative, irreversible systems could explain why the arrow of time flows (points?) in one direction only. It seems more likely that they provide yet more evidence that it does, but shed little light on why.

The book jacket says "... Picking up where Stephen Hawking's "A Brief History of Time" left off, ... ". I guess they were trying to ride the coat-tails of Hawking's deservedly very successful and delightful book. Don't be fooled; this book is a very different animal indeed.

Ilya Prigogine (who died in 2003) wrote a foreword for the book, in which he is quoted: "I warmly welcome this book, which is written on a high scientific level while being accessible to a wide public." I beg to differ; the book is not very accessible at all. I really had to work hard and grit my teeth to get through it, and I have a Ph.D. in Physics. A truly lay reader would likely have more difficulty.

Recently, I have been reading a lot of books about the latest discoveries in Physics and Cosmology (and the history of these discoveries, back to Galileo and beyond). There are many interesting and engaging books on these subjects. This is not one of them. The sad truth is that this book could have been (and should have been!) so much better.

Not recommended.

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## **Lemar says**

Tough sledding but worth the effort. Coveney tackles the anomaly of time. Other aspects of physics submit to equations that work mathematically which means that they work in either direction. Time is different. Many physicists sidestep this issue, not Coveney who devotes this book to analyzing the problem and introducing leading theories about why time travels in only one direction.

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### **Tim says**

The authors, one a science writer and the other a physicist - both British - provide a popular but robust survey of the current representation of time in scientific research. Basic physical theories of the cosmological and the microscopic contain no arrow of time as humans experience it. Newtonian mechanics, general relativity, and quantum mechanics are time invariant in the sense that the systems these theories describe are reversible. But thermodynamics, the authors argue, particularly exploration of the Second Law, offers a path to reintroduce to physical theory the irreversible arrow of time evident in chemical and biological systems as well as human experience. To the question whether there is in the universe an objective arrow of time they answer an emphatic 'yes' though as of their writing a grasp of irreversible time seemed yet to elude physical science. They recommend particularly the exploration of non-linear dynamical or chaotic systems as models of cosmological, macroscopic, and microscopic phenomena as well as the interfaces between these. One particularly fruitful observation they make in their shift against a strictly reductionist scientific program involves the role of numbers in measurement. The problem of measurement admits an array of difficulties. Not least, measurement is a critical interface between subjective and objective systems. Measurement converts physical phenomena to numbers in some manner. Resulting measures, though, are limited not only by subjective considerations attached to the act of measuring or objective considerations attaching to the measurement mechanism. Measurement also is intrinsically limited by the properties of numbers. For example, measurement mechanisms and our means for computing with measure-derived numbers are limited in the precision to which we can handle irrational numbers or even infinitely repeating rational numbers such as  $1/3$ .

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### **Les Weiler says**

Interesting overview of time as it applies to broader science.

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### **Ravi says**

An excellent book that tries to answer the question of what is time and can it flow backwards? Essentially humans depend on circadian clocks to conceive and understand time, this clock is irrelevant to the rest of the universe, possibly time does not exist.

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### **Scott says**

Time seems, in our perception, to "flow" from past to future, although nothing in classical physics, relativity, or quantum mechanics requires that this be so. So what's the dilly-o? This is the question that this book explores. Be warned: it gets pretty science-y.

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### **Paul says**

The author mentions Ilya Prigogine even more often than Mr Collins refers to Lady Catherine de Bourgh in *Pride and Prejudice*, and in a manner that reminds me of Mr Collins!!!

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However there are some very good points in the book, but it felt repetitive towards the end. I learned something interesting about irrational numbers too

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