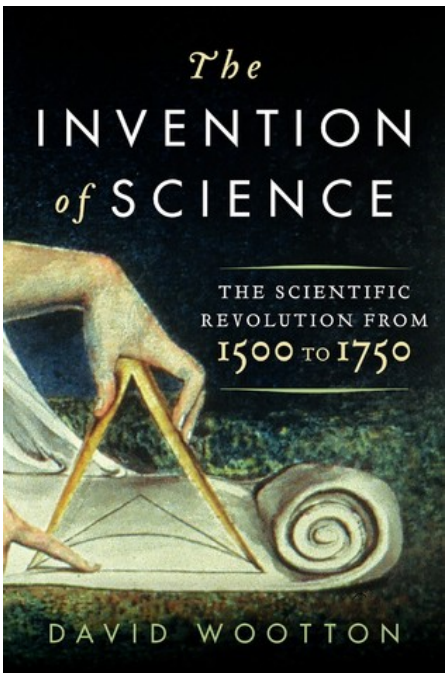

The Invention of Science: The Scientific Revolution from 1500 to 1750

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A companion to such acclaimed works as The Age of Wonder, A Clockwork Universe, and Darwin's Ghosts—a groundbreaking examination of the greatest event in history, the Scientific Revolution, and how it came to change the way we understand ourselves and our world.

We live in a world transformed by scientific discovery. Yet today, science and its practitioners have come under political attack. In this fascinating history spanning continents and centuries, historian David Wootton offers a lively defense of science, revealing why the Scientific Revolution was truly the greatest event in our history.

The Invention of Science goes back five hundred years in time to chronicle this crucial transformation, exploring the factors that led to its birth and the people who made it happen. Wootton argues that the Scientific Revolution was actually five separate yet concurrent events that developed independently, but came to intersect and create a new worldview. Here are the brilliant iconoclasts—Galileo, Copernicus, Brahe, Newton, and many more curious minds from across Europe—whose studies of the natural world challenged centuries of religious orthodoxy and ingrained superstition.

From gunpowder technology, the discovery of the new world, movable type printing, perspective painting, and the telescope to the practice of conducting experiments, the laws of nature, and the concept of the fact, Wotton shows how these discoveries codified into a social construct and a system of knowledge. Ultimately, he makes clear the link between scientific discovery and the rise of industrialization—and the birth of the modern world we know.

The Invention of Science: The Scientific Revolution from 1500 to 1750 Details

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From Reader Review The Invention of Science: The Scientific Revolution from 1500 to 1750 for online ebook

Jani-Petri says

I did not in the end have the patience to finnish this.

Mark Hebwood says

I was so looking forward to liking this book. But in the end, I did not really warm to it. I do not say this lightly, and it even takes me some courage to admit it. Why so? Because the history of ideas is a subject close to my heart, and I wrote a longish essay at university about the development of historiography in the 17th century. That does not mean I am an expert on this subject - far from it - but it *does* mean that I researched some of the dynamics this book explores in quite some depth, and that I was hoping to re-discover the joy I had at university through reading the book. But for the most part, I did not, and here is why:

This book is a proper work of scholarly research

Now, this of course would rather speak in favour of it than against it. But after decades spent outside the world of academia, I had forgotten what academic research can be like. The part I had forgotten is that many scholars find it necessary to define the scope of their topic clinically, aiming to make clear precisely where they stand relative to other scholars, how they differ from other research, and who they regard as their intellectual influence.

And again, there is not necessarily anything wrong with this. But, come on, David, was it really necessary to spend *50 pages* on whether the term "scientific revolution" is appropriate or not to describe the three centuries since the discovery of America? The term was invented by Thomas Kuhn, a key scholar in the field, whose book *The Structure of Scientific Revolutions* was met with so much acclaim that the key term from its title re-surfaced in the research of other eminent thinkers (notably Alexandre Koyre, *The Astronomical Revolution: Copernicus, Kepler, Borelli*.

Now, apparently, the term "revolution" is so ingrained in the scholarly psyche that we need a tedious chapter discussing whether naming conventions established by contemporary scholars are appropriate or not. I was hoping this book would deepen my insights into a crucial development in the history of ideas. Certainly, one or two pages on this would have sufficed?

So I was off to a disappointing start. In fact, I would have preferred it if David had discussed his research methodology to put his analysis onto a sound footing. Surprisingly, David chose not to talk about that at all. That is surprising in a work of scholarly research. But worse than being merely surprising, in the case of this monograph, it is also disappointing. It is disappointing because it omits a necessary building block without which much of what David says lacks rigour. Well, I thought so, anyway.

Methodology: What's in a word?

The methodology that I am quibbling with is a linguistic approach to historical analysis. Frequently, David

traces the usage of a certain expression back through the ages, and identifies a time when the expression was not widely used. He then concludes that the concept the expression denotes cannot have existed in the time period before it was coined, and by extension concludes that the concept behind the expression developed first with the emergence of the word.

The issue I have with this method is subtle. I do not deny that language reflects 'reality', and that speakers (users of the technology 'language') define words through usage and consensus of what they stand for. The expression 'internet' did not exist in ancient Greece, the word 'gay' meant something entirely different in 1730 than it does now, and there is rarely ever the need today to use the word 'abacus', for example.

So yes, I agree that language reflects society, and that 'linguistic archaeology' can be a useful and appropriate tool to infer the state of mind of past societies or communities. But I wonder how this method needs to be applied, and what the conclusions are that it allows.

How to apply the tool

The problem with "linguistic archaeology" is that it requires a statistician, not a historian, to use it properly.

The first time David uses the linguistic method is in his discussion of the term "discovery". Basically, he says that prior to the discovery of America there was no term in the European languages that expressed the concept of "first finding evidence for something hitherto unknown". David argues that the absence of the term also denotes the absence of the concept, and highlights the dominance of the Aristotelian, anti-empirical, method.

I actually find David's idea convincing, and brilliantly insightful *in principle*. But I do not trust myself to accept if fully. And the reason is that David has not shown me evidence that frequency of usage actually jumped after 1492 from near-zero to something significantly non-zero. Actually, he never even defines what metric he uses to identify an increase in usage. It is number of occurrences per text per year? If so, where are the numbers? I want to see a bar chart. And this introduces another problem - how long does the time series have to be before I can conclude that the word 'discovery' really did not exist pre-Columbus? 100 years? 200? If I apply the benchmark of modern science, I could not accept the hypothesis as 'true' unless I can show that the frequency of usage increased to a significant level within a clearly defined confidence interval. And that is a problem unless I count words in all relevant texts on a given subject since antiquity.

To be fair to David, he does mention EEBO and ECCO (Early English Books Online; Eighteenth Century Collections Online) and comments on the efficiency of search algorithms these facilities offer (p592), so there is evidence that he applied some form of structured statistical anaysis. But he never goes into his methodology, he never shows us the results, and he most certainly does not publish the numerical evidence.

None of this invalidates his insights. But what I would see as lack of rigour in this regard diminishes the confidence I have in David's results. And this is a problem because his methodology of linguistic archaeology permeates the book. I suspect David is far more gifted linguist than he is a statistician.

What conclusions can we draw when applying the tool?

To make things worse, I did often not agree entirely with the conclusions he drew. To stay with the example of "discovery", David concludes that prior to the discovery of America, the concept of 'discovery' did not exist, because the word did not exist. But I wonder. To me, it is more plausible to suggest that discoveries were happening so rarely in pre-'Americodiscovery' times that people had not coined a word for it. So after

Columbus, the Aristotelian stranglehold on natural philosophy weakened sufficiently to allow 'findings that had hitherto not been made' to occur at an ever-increasing rate, and because of this a catchy expression had to be coined.

This interpretation changes the gist of David's argument only subtly, but I think the difference in viewpoint is still important enough to mention. It is different to say "the frequency of discoveries increased materially" from "discoveries did not exist pre-Columbus".

But it is a beautiful book

So I must admit, what I see as vagueness in the key methodology David employs did not allow me to trust his findings as much as I would have needed to for a truly satisfactory learning experience.

But there are chapters in the book in which it did live up to my expectations. These are chapters 4 to 6, in which David brilliantly lays out the interplay between discoveries and the impact they have on the way we view the world. The discovery of America was to be the ultimate death-knell for the Aristotelian 4-sphere model of the world, which in turn paved the way for the development of perspective painting and a commensurate re-interpretation of the position of 'man' in the world, and of the world in the cosmos.

The book is full of beautifully reproduced paintings, drawings, and woodcuts. At one point, I was so excited by the illustrations that I thought I'd buy a first-edition copy of Robert Hooke's *Micrographia*. I even found one on Abe Books for £80,000, plus £12 shipping. Twelve pounds shipping? The cheek of it...

Ok so I didn't buy it. But I *did* buy a facsimile copy. And I bought some other books from the time, like Johannes Kepler's *Somnium*, or Francis Godwin's *Man in the Moone*, arguably the first ever science fiction novel.

So in the end, I did have a fun time with the book, and you can see I *did* get excited about the time. But since it is a proper scholarly treatise, and not pop-science, I could not get past what I saw as a methodological weakness. But if your opinion on this differs, or you are able to overlook the issue, you will probably gain interesting insights reading it.

So in the end, I would still recommend the book, even though I did not get the rich intellectual experience I was hoping for.

Warwick says

This is a book with a simple argument to make: that the scientific revolution was a real thing, it definitely happened, and it happened at a specific point in time, namely, ‘between 1572, when Tycho Brahe saw a nova, and 1704, when Newton published his *Opticks*’. In that century and a half, a staggering number of new truths about reality became understood – we went from living at the centre of a universe of celestial spheres, reading manuscripts to glean the lessons of the ancient Greeks, to living on a terraqueous globe orbiting the sun, and studying printed books from a new breed of modern experimental scientists. And it was all driven by advances in instruments, a new awareness of the potential for discovery, and a growing conviction that empirical experience was more important than philosophical dogma or classical authority.

The simplicity of Wootton's premise is, in a way, a clue to his defensiveness. He is explicitly arguing against

the claims of ‘postmodernist’ historians, who have suggested that successful scientific theories are, in terms of historical description, not fundamentally different from unsuccessful ones, and that anyway scientific ‘truths’ are culturally dependent and enforced by political authority. Wootton is having none of this.

More power to him; but unless you have gone through life with a steely conviction of the right-mindedness of Bloor's strong programme, Wootton's intramural aggression may quickly become tiresome. His arguments are aimed at his historiographical opponents, not at the general reader. And he is not above frequent asides to make this point explicit (‘It should be obvious that he was not right about this’; ‘the notion…seems to escape Boghossian’). Time and again he interrupts his narrative to bring the evil relativists on stage behind him, so we can shout at them like a pantomime audience. *Look out, it's Simon Schaffer! It's Michel Foucault, with waxed moustaches and a black cape! Boo! Hiss! They're behind you (for a given local value of ‘behind’)!*

I imagine that fifty or sixty years ago, histories of the scientific revolution presented a standard timeline of Great Men And Their Discoveries. Happily, things have moved on a bit since then; and yet, reading Wootton, I found myself yearning for some basic facts and figures about what actually happened and who did what. In the end, this is not (as its subtitle claims) a ‘history of the scientific revolution’ at all, but rather a history of the attitudes and thought processes that contributed to or grew out of it. Instead of looking at a steady progress of breakthroughs and developments, Wootton concerns himself with changes in the era's conceptual tools; he analyses texts in great detail, focusing on specific items of vocabulary as markers of changing attitudes – indeed, some chapters seem to consist of little more than a timeline of neologisms – and he lavishes much more time and attention on the coining of such terms as ‘discovery’, ‘fact’ or ‘experiment’ than he does on actual discoveries, facts or experiments.

I have a very high tolerance of this kind of semantic approach, but even I found it a bit exhausting after a while. Finally hitting a chapter on Newton, you rub your hands with anticipation, only to read: ‘My first goal in this chapter, then, is to establish why Newton was hostile to the word “hypothesis”…’ and your heart just sinks. Wootton's arguments about how language reflects mental attitudes are well-made and convincing, but what you don't get in this book is much sense of the grubby reality of early-modern science – the long nights, the sweating over furnaces, the trial and error of different practical approaches.

Combined with his combative stance vis-à-vis other historical treatments, it all serves to make his undoubted learning sound uncomfortably like pedantry in places. (This is not helped by a somewhat finicky approach to notation: Wootton uses Latin numerals for endnotes and Roman numerals for footnotes, so that many sentences end in a superscripted mishmash of characters: ‘…even then it was at first confined to political revolutions??????ⁱ’.)

Overall, I'm unsure how much I'd recommend this. On the one hand, it really has changed the way I think about the long seventeenth century, especially in terms of how I interpret the language of all these early scientists. And fundamentally I share Wootton's impatience with a lot of relativist history. All the same, the sad truth is that I'm just left craving a plainer, more chronological description of the key breakthroughs of the period. Doubtless many such histories exist, but this one, which positions itself as a new standard, feels too polemical to be in a position to fully replace them.

M.C says

He dudado entre tres y cuatro estrellas, pero al final ha pesado la gran erudición demostrada. Hay partes pesadísimas en la obra, de escaso interés, como cuando analiza el origen de ciertas palabras. pero en general

el tema es tan interesante de por sí que hace que soportes esas partes torturantes y sigas adelante. Lo mejor las reflexiones historiográficas.

Jim Coughenour says

This book will look, I trust, realist to relativists and relativist to realists: that is how it is meant to look.

The Invention of Science isn't an easy book to read. Neither is it particularly difficult, thanks to Wootten's felicitous prose. But it does require a high degree of concentration as Wootten ranges both far and deep in his exploration of how "science" got its start. His argument is intentionally provocative, precise, plainly stated and copiously supported. The writing is lively, witty, even barbed – qualities generally absent in scholarly texts. I also appreciated Wootten's approach to the footnote/endnote conundrum: references are saved for the endnotes to accommodate readers who want to hunt down sources; but comments that amplify the argument are placed at the bottom of the page, to keep the reader in the flow. In addition, he's placed a series of "longer notes" at the end of the book, where his basic arguments are outlined with *brio* (and more ancillary texts).

In Wootten's account, science is essentially "the triumph of experience over philosophy." All the standard characters are there – Galileo, Kepler, Boyle, Newton – but also an entertaining, anarchic host of lesser-known scientists, mathematicians, theologians and *philosophes*, doctors and clergymen. Wootten gives the standard accounts an interesting spin, looking as much at the tools of thought as at the tools of discovery and invention (telescopes, prisms, air pumps). He investigates the history and meaning of words such as *discovery*, *invention*, *facts*, *experiments*, *laws*, *hypotheses*, and even more ordinary and apparently obvious terms such as *progress* and *common sense*. Another excellent review on this page found this procedure a problem. I didn't. I was fascinated – although, as I said at the start, one needs a strong cup of coffee and plenty of quiet concentration to make it through a few of these chapters.

This is a book that fully lives up to its title. I read it after reading Noam Chomsky's recent lectures – as a kind of luxuriant, deeply satisfying postscript – but that was just to amuse myself.

Gabrielle Taylor says

Very granular at times but necessary to lay the groundwork for the language and fundamental understandings required to define and describe science at its origin.

Louise says

HIGHLY recommended for science nerds!

This is a sweeping summary, very well sourced and noted, of the basic idea + repercussions of the Scientific Revolution. Here's the whole glorious thing summarized in a perfect little quote: "A basic description of the Scientific Revolution is to say that it represented a successful rebellion by the mathematicians against the authority of the philosophers, and of both against the authority of the theologians."

Well, obviously there's more to it than that, but you'll just have to RAFO. I wrote an unreasonably long,

rambling review that you can read HERE, if you're into that sort of thing.

This review is based on an e-ARC from the publisher via Edelweiss. Even though the book is apparently already out in the UK, it isn't released in the US until December.

Peter Mcloughlin says

This book defends the traditional idea of the scientific revolution as a break in Western history that so radical that it introduced the idea of progress, disenchanted the world , created a worldview based on the idea that knowledge was not based on authority but objective fact. In other words it was the foundation of the mindset of modern people and a clear break from all traditional societies which came before it. It deserves the name revolution. The author looks at many of the strands of this epochal change from causes to long lasting effects. very good.

Bart Jr. says

The Invention of Science is a very wise and erudite volume about the essential changes that were necessary for modern science, i.e. the Scientific Revolution, to occur in the 16th century. These included more efficient ways to disseminate information, such as the printing press, which also aided in building a scientific community; the turn toward both practical experiment and mathematics; the development of the very ideas of progress and discovery; and the way changes in scientific theories, and modern science itself, often required new concepts and language. The author offers prime examples such as the development of the concepts of fact, theory, progress, experiment, law, discovery, etc. This volume is steeped in meticulous historical detail of the scientific figures and times of the 16th and 17th century. A marvelous work of research and scholarship. If you’re interested in increasing your awareness of many of the important concepts which have shaped our modern science and thought, this book is for you. Readers whose interest is piqued by this subject would likely enjoy Conceptual Revolutions by Paul Thagard, which also goes into great detail concerning the role conceptual changes played in specific, important theories of science. The Invention of Science has my highest recommendation; I would give it 6 stars, if I could.

Cindy G. says

I am not really qualified to critique the content of this book, but I will comment for other readers like me who enjoy history of science as amateurs. This is clearly a scholarly work, however I only felt that about 10% of it was above my head (e.g. using historian/philosophy jargon that I needed to either look up or just skip over. Having had one college course discussing Kuhn helped me.) It is a long book, and having made the effort to read it I now regret not having taken a few notes, as there were many "hmmm, very interesting!" moments that changed my basic understanding of an aspect of history. (The whole thing about beliefs about the shape of the Earth was way more fascinating than the cartoonish impression I think many people retain after school.) Wootton's basic thesis is that a series of inventions, discoveries, and new ideas mostly within the 16th-17th centuries were necessary game-changers for real science as we know it to develop. He makes quite a thorough case for each point, though I have seen other published reviews aren't quite convinced these developments aren't just part of a more continuous arc of history. Despite wishing it was a bit shorter, I'm glad I read this. Whether or not his thesis is important to the average person, all the discussions were

worthwhile updates to my understanding of western history.

- An added note: Wootton's thesis was way more convincing to me than that of "The Swerve" by Greenblatt. That (shorter) book was definitely an enjoyable read, but, again, as an amateur, I was not convinced by its grand claims about Lucretius.

Liviu says

another book I read across time and finished the last few pages in these two free days after the New Year - dense, requiring effort (both to understand the prose occasionally and to understand the arguments) and one I wouldn't recommend for a novice reader in its subject (The Scientific Revolution and the crucial change that happened in Western Europe gradually between 1500 and 1700, and most notably between 1600 and 1700) that led to the world of today

There are always arguments whether there was a "revolution", what is "science" and so on, but as the author points out, if you look at the "intellectual life/world view" in 1500, 1600 and 1700 the differences are striking and the fundamental questions tackled in the book are "what happened, was it "predetermined" to happen or an accident that Newton, Locke, Leibniz, Hooke and many others building/responding/arguing with earlier works by Descartes, Galileo, Copernicus and others and being able to freely (more or less) and timely meet, communicate, share, dispute happened to live and work in the same historical period, how it happened etc

Not a "linear" or "events: when, who, how" but a full meditation on the subject also regarding it through the prism of current thinking and arguing with such in addition to presenting a panorama of the epoch

Highly recommended and worth persevering through the book

Brian Clegg says

This is no lightweight book - both literally and metaphorically. It packs in nearly 600 pages of decidedly small print, and manages to assign about 10 per cent of these simply to deciding what is meant by a 'scientific revolution' (the subtitle is 'a new history of the scientific revolution'). While warning of the importance of being aware of the change in meaning of some terms, the author successfully demolishes the arguments of those who argue that terms like science, scientist and revolution can't be applied to the seventeenth century because they're anachronistic. (He doesn't say it, but this is a bit like saying you shouldn't call a dinosaur a dinosaur because the word wasn't in use when they were around.)

What's also very apparent in a section on history and philosophy of science is why so many scientists are dubious of philosophers and historians of science. When an adult can seriously suggest that we can't say that current science is better than that of the Romans - all we can say, suggest these philosophers and historians of science, is that our science is different - it makes it very clear that some academics have spent far too much time in ivory towers examining their philosophical navels and really haven't got a clue about the real world.

We then get into the main content of the gradual process of science, in the current sense of the word, coming

into being. It's certainly interesting in a dry way to see this analytically dissected, though the slightly tedious nature of the exposition makes it clear why popular science has to simplify and concentrate on the narrative if readers are to be kept on track. I appreciate that an academic like David Wootton wants to ensure that every i is dotted and t crossed, but I think that all the arguments of this book could have been made in half the length by cutting back on some of the detail and repetition.

This book, then, is not popular science in the usual sense, but neither is it a textbook. If you are prepared to put the effort in, you will receive huge insights into what lies beneath: one view of the true history of science. That's why the book gets 5 stars. I've learned more about the history of science from this one book than any other five I can think of that I have read in the past. I have to emphasise that 'one view' part, though. History is - well, not an exact science. As far as I can see (I'm not equipped to criticise the content) this is a superbly well researched piece of scientific history, but in the end, the conclusions drawn are down to Wootton and he enjoys making it clear where he is strongly contradicting other historians of science.

There's a huge amount to appreciate here. Wootton convincingly demolishes Kuhn's idea that scientific revolutions require heavy disagreements among scientists, showing how exposure to experience (often thanks to new technology, such as the telescope) can swing the argument surprisingly painlessly. And he shows what a remarkable influence words have on the development of science (music to the ear of a writer). Perhaps most remarkable of all is Wootton's careful, very detailed exposition of the idea that the real trigger for 'modern' scientific thought was Columbus's discovery of America, which demolished the existing model of the Earth and made it possible to see how experience can triumph over the philosophical quagmire of authority.

If you've a fair amount of time to spare and really want to dig into the way that the scientific revolution came about, I would heartily recommend giving this title a try.

Ibraheem says

help me please . i love this book but i want to read it in arabic . is there an arabic copy of this book ?

Steven Peck says

Simply one of the best treatments of the history and philosophy of science I've read. An exploration of how science developed, what tools and cultural conditions made it possible, and how and why it has progressed. It is also presents a very clear understanding of what science is and why it works for explicating nature and making progress in prediction. I teach History and Philosophy of Biology at my university and this has been a treasure trove in detailing the nuances of how and why science is what it is today. A book rich in historical details that I will return to again and again I'm sure.

Cleokatra says

This was a long, tough read for me. I'm a scientist, but I don't read much science history. The book is beautifully written and well researched, so 4 stars.