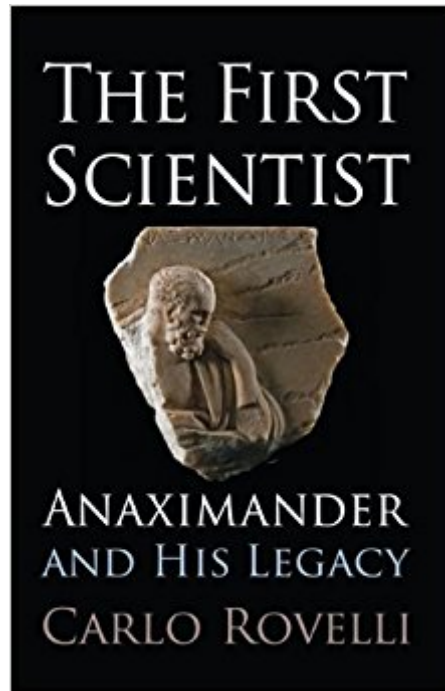




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# The First Scientist: Anaximander And His Legacy



## Synopsis

“Marvelous. . . . A wonderful book.” —Humana.Mente “Rovelli is the dream author to conduct us on this journey.” —Nonfiction.fr “At this point in time, when the prestige of science is at a low and even simple issues like climate change are mired in controversy, Carlo Rovelli gives us a necessary reflection on what science is, and where it comes from. Rovelli is a deeply original thinker, so it is not surprising that he has novel views on the important questions of the nature and origin of science.” —Lee Smolin, founding member and researcher at the Perimeter Institute for Theoretical Physics and author of *The Trouble with Physics* Winner of the Prix du Livre Haute Maurienne de l’Astronomie Carlo Rovelli, a leading theoretical physicist, uses the figure of Anaximander as the starting point for an examination of scientific thinking itself: its limits, its strengths, its benefits to humankind, and its controversial relationship with religion. Anaximander, the sixth-century BC Greek philosopher, is often called the first scientist because he was the first to suggest that order in the world was due to natural forces, not supernatural ones. He is the first person known to understand that the Earth floats in space; to believe that the sun, the moon, and the stars rotate around it seven centuries before Ptolemy; to argue that all animals came from the sea and evolved; and to posit that universal laws control all change in the world. Anaximander taught Pythagoras, who would build on Anaximander’s scientific theories by applying mathematical laws to natural phenomena. In the award-winning *The First Scientist: Anaximander and His Legacy*, translated here for the first time in English, Rovelli restores Anaximander to his place in the history of science by carefully reconstructing his theories from what is known to us and examining them in their historical and philosophical contexts. Rovelli demonstrates that Anaximander’s discoveries and theories were decisive influences, putting Western culture on its path toward a scientific revolution. Developing this connection, Rovelli redefines science as a continuous redrawing of our conceptual image of the world. He concludes that scientific thinking is the legacy of Anaximander — is only reliable when it constantly tests the limits of our current knowledge.

## Book Information

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## Customer Reviews

Carlo Rovelli received his Ph.D. in physics at the University of Padua. He has conducted research at Imperial College, Yale University, the University of Rome, and the University of Pittsburgh and is currently professor of theoretical physics at the University of Marseille. He is author of more than 150 scholarly articles and the books *Quantum Gravity* and *What Is Time? What Is Space?*

This is a very cool "read" about a real pioneer in the fields of philosophy and science. The prose style is very good and the information is excellent.

It's hard to make an assessment of this book. On its face, it seems to be a historical study of the place of Anaximander in the development of modern science. And, for the first half of the book, it really is that. But from there, Rovelli takes off into a much more loosely bound discussion of truth, reality, relativism, religion, language, and the fate of the world. It all start with Anaximander. It's a cliché that history is told by the winners. But if science is a "winner", then Rovelli is telling the winner's history of science. His claim, at the highest level, is that Anaximander produced the first "scientific revolution", the beginnings of science itself. What Anaximander does is remarkable. But I'm not convinced by Rovelli that Anaximander's thought traces the beginning of a solid line toward modern science. Here are some key aspects Rovelli calls out in Anaximander's thought as a progenitor of science:- that the world may be different than it appears to us- knowledge as a progression of dialogue and debate based on questioning what has previously been thought- a new model of the shape and position of earth (not flat, resting on a foundation of some sort, but a cylinder freely floating in the universe) Certainly, in the terms of Anaximander's thinking, and in the absence of any explicitly mythological elements, there is a strain that we could call "naturalistic." But I think

he  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is actually more interesting and puzzling than that. In what we have of Anaximander  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is actual writings, there are two concepts that seem difficult, in our own time and terms, to reconcile. One concerns change and multiplicity  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  that  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "all things originate from one another, and vanish into one another.  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  Anaximander is traditionally interpreted in naturalistic terms, although his claim is not unambiguously naturalistic, at least not in modern terms. What he means by  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "originate  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  could as well be given a logical or purely conceptual interpretation as a naturalistic one. And in fact, the cosmologies of ancient Greece commonly told of such things as order and difference as developing from prior unities or chaos. The second concept is the  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "apeiron  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  as the origin or principle ( $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "arche  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ ) of all things.  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "Apeiron  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  is sometimes translated as  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "the infinite  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  or  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "the indefinite  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  or  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "the undifferentiated.  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  I think it a stretch to give an unambiguously naturalistic interpretation of  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "apeiron  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ . In a naturalistic interpretation, you could read it as a truly empirical  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "thing  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$   $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  an undifferentiated substance out of which all the multiplicity of things we are familiar with originate. Or you could see it as a logical concept, as the origin of multiplicity in undifferentiated unity. In fact, I think the distinction between a naturalistic interpretation and a logical one is something we lay over Anaximander  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is thought  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  it simply wasn't  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , at a mature distinction at the time. Correspondingly, what comes after Anaximander is neither pure naturalistic science nor pure rationalism. The themes that Rovelli pulls from Anaximander  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is thought and times are important for the future history of knowledge, but in various guises besides anything we would call  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "science  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  in a modern sense. For example, Parmenides, certainly not a  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "scientist  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , explicitly separated the world as it appears to us (the world of  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "seeming  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ ) from the world as it really is (the world of  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "truth  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ ). Aristotle refined a method of presenting the thoughts of earlier philosophers as a basis for his own arguments and positions, providing an explicit structure for progress in thought, but not a method of science per se. Likewise, Plato  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is rationalist dialectic has roots in dialogue and debate of a conceptual sort, and is embedded in his idealist metaphysics of  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "forms  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , at best a distant kin to modern science. All of this is criticism of Rovelli  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ , is history based on a popular conception of what is meant by  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$  "science  $\hat{A}f\hat{A}\phi\hat{A} \hat{=} \neg\hat{A} \hat{=}$ . And were Rovelli an adherent of that

popular conception, one that revolves around strict adherence to observation, hypothesis, experiment, and *the method*, then he would be a scientific teller of fables about the emergence of science from the darkness of superstition and myth. But he wants to construct a different understanding of what science is, one he refers to at one point as *science as a cognitive activity* (p. 111). He gives at least one explicit definition: [Science] means building and developing an image of the world, which is to say a conceptual structure for thinking about the world, effective and consistent with what we know and learn about the world itself. There *is* a lot packed into that sentence. He says also, *It [i.e., science] is, above all, an ongoing exploration of new ways of thinking.* Rovelli is doing at least two things at once in this part of the book. He is telling a story about the history of science, finding its origins in Anaximander's thought (or more broadly, that of the Milesian philosophers), but he is also, in doing so, recommending that we think a little bit differently about what science is, that we crack away some of the rigid, technical structures we've built around the enterprise of science and get back to something that may have been more fitting to Anaximander's time, a less tightly bound search for the terms in which to understand the world. In doing so, he steps into the territory of modern philosophy of science. In his chapter on *What is Science?* he attempts to find his footing within that debate, with Kuhn, Feyerabend, Lakatos, and others. The discussion is very short, and his criticisms of those thinkers abrupt and controversial. But in a way, that doesn't matter *it's* not the point of this part of the book. The point, I think, is to, with the help of Anaximander's thought, turn our understanding of science in a more conceptual direction *into* an explicit focus not only on facts and observation per se, but on the terms in which we think about and organize the facts and observations of science. Rovelli thinks that, in fact, this is what great scientists do. The second (roughly) half of the book takes off into a broad discussion coming to rest eventually in a discussion of science and religion. While Rovelli is not so strident a proponent of science over religion as some of his contemporaries, you will find familiar themes here *in particular* an attack on *absolutism* as a defining characteristic of religion. Discussions of religion vs. science tend to be one-sided, and Rovelli's is no exception. I found particularly presumptuous this characterization of science as acceptance of uncertainty and religion as assertion of absolutism. In practice, the difference doesn't seem so stark. Scientists often assert absolute positions. Sometimes it's the truth of theories, and

other times, equally forceful, the absolutism of method. And religion is often a dynamic of faith and doubt, and sometimes acceptance of mystery. Broad strokes don't do either side justice. All in all, Rovelli has made me think more deeply about Anaximander, and about what "knowing" really is, in the time of the pre-Socratics. Maybe fittingly, I don't find his account to be "true", but enlightening.

Interesting if you are interested in ancient Mediterranean history. I found it a little repetitive.

Wonderful view of past, present, and future

This stimulating and entertaining book opened up for me the remarkably advanced science of the Ionian Greeks and the life in their independent cities that first birthed and nourished the scientific spirit. Along with so much else. Besides being enjoyable to read the book is profoundly thoughtful: reflecting on what is essential in the rational/empirical tradition and the community that follows it, as well as on what was unique in Anaximander's revolutionary contributions. Rovelli has firsthand insight--he's one of today's most creative theoretical physicists. You get the feeling that he has been where Anaximander was.=====update=====There's an online essay by Rovelli at the Scientific American website that can serve readers as additional background or introduction to the book. It lets you know where this book about Anaximander and the beginnings of science is coming from. The essay is titled "Science as perpetual revolution, from its earliest beginnings to quantum gravity". To get it just google "sciam rovelli". Today's quantum gravity researchers, as they rethink time, space and the workings of a (now quantum) universe do have something in common with those 6th Century BC Ionians who began our geometric explanation of the heavens' motions. There is a clear lineage joining them and I think Rovelli is right to examine the parallels. Much is to be learned as well about the scientific enterprise as a whole by exploring this key period of history.

This book was disappointing on a number of levels. First science requires more than conceiving a new concept- it requires that measurements be made to prove the validity or usefulness of the concept. Thought alone without proof by measurement is not enough. Second the earth was measured long before Anaximander was born and measurement standards adjusted to fit this new knowledge. The greek stadia which can be traced to Babylonian and Sumerian standards was almost exactly 1/10 nautical mile or arc minute on the polar circumference of the earth. The Perimeter of the great pyramid at giza is almost as exactly 1/2 nautical mile or arc minute on the

polar circumference of the earth. During the New Kingdom the Egyptians commissioned the Phoenicians to circumnavigate Africa. Their report included the discovery that "the sun was on the wrong side of the ship as they sailed around the horn" they were below the equator and did not fall off the earth. These Greek scientists in the early common era did not seem to recognize that the polar circumference of the earth was almost exactly 27000 Roman Miles. This level of accuracy required measurement of the position of the stars not the crude measurement of the sun's shadow depicted in this book. The science of metrology is not well served by Dr Rovelli

What is one of the leading theorists of loop quantum gravity doing in the classical world? Well, on the basis of an education I envy him, he's showing us that the Platonic theory of science we virtually assume to be the dominant theory of the classical age has to share space in our understanding with what you might call a theory of scientific practice -- embodied in Anaximander. His story of the Anaximander strand in the classical world is beautifully told. (I'm not equipped to evaluate it authoritatively.) But the pay-off is that the table is set for a re-evaluation of the scientific practice of the current scene in novel terms. Alimento squisito for those with open minds about matters cosmological.

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