

Daoism maintains that people in culture develop advanced cognitive abilities and create unnatural binaries such as good > < evil, big > < small, useful > < useless, etc. Zhuangzi devalues this through the analogy of artisans doing their job instinctively without being conscious of their ability (pp. 96–97; 114; 148). Daoists see life of wandering symbolic of unencumbered existence in nature, acquainting with everything and enjoying its being without belonging to anything. They view nature as the most accomplished but without a designer and a grand plan (pp. 98, 191).

**Tsai’s cartoons**

Zhuangzi’s stories as such are absent in Tsai’s cartoons. He has chosen only select parables from the core portions of Zhuangzi’s writings for illustration. Understanding Zhuangzi’s writings is too difficult for the West due to the cultural contrast between China and Europe<sup>8</sup>. This accounts for why Zhuangzi was not known to the West, despite translation of his writings in Europe as early as in 1939 (ref. 9) and analytical introduction in the US since 1994 (ref. 10).

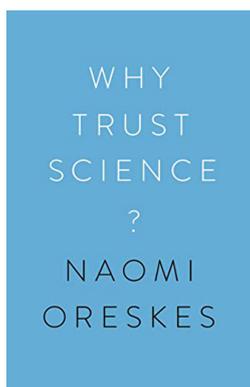
Tsai’s drawings supported by English translation boxes of minimum words signify the Daoist message in the stories excellently well. His craft of imaging Zhuangzi’s humorous but profound stories through effortlessly communicative graphics is amazing. Uninterrupted thin lines of rare beauty in Tsai’s cartoons dazzlingly mediate between Zhuangzi’s ideographs rooted in Daoist transcendence and their English translation of Bruya moored in existence. One captures the connotation of Tsai’s cartoons better, thanks to Edward Slingerland’s eminently knowledgeable forward and Bruya’s comprehensive introduction, which jointly let access to Zhuangzi’s biography, philosophy and historical context.

Despite the rare potential of Tsai’s fascinating cartoons to signify profound philosophical thoughts, they seldom substitute verbal explanation. Indeed, they serve as stepping stones for millions, not initiated in Chinese classics, to access the complex philosophical universe of Zhuangzi’s writings.

2. Watson, B., *The Complete Works of Chuang Tzu*, Columbia University Press, New York, 1968.
3. Chai, D., *Early Zhuangzi Commentaries: On the Sounds and Meanings of the Inner Chapters*, VDM Publishing, Saarbrücken, 2008.
4. Graham, A. C., *Chuang-tzu: The Seven Inner Chapters and Other Writings from the Book Chuang-tzu*, Allen & Unwin, Boston (trans. 1981).
5. Wang, B., *Thinking Through the Inner Chapters*, Three Pines Press, New York, 2014.
6. Coutinho, S., *An Introduction to Daoist Philosophies*, Columbia University Press, New York, 2014.
7. Hansen, C., *A Daoist Theory of Chinese Thought: A Philosophical Interpretation*, Oxford University Press, New York, 1992.
8. Cook, S., *Hiding the World within the World: Ten Uneven Discourses on Zhuangzi*, State University of New York Press, Albany, 2003.
9. Waley, A., *Three Ways of Thought in Ancient China*, Allen and Unwin, London, 1939.
10. Liu, X., *Classifying the Zhuangzi Chapters*. Savage, W. E. (trans. 1994), Center for Chinese Studies, University of Michigan Press, Ann Arbor.

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**Why Trust Science?.** Naomi Oreskes. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2019. xii + 360 pages. Price: US\$ 24.95.

any fact or theory can be called into question by anybody at any time, as long as they are using the scientific method; science can only falsify hypotheses and not prove any hypothesis correct. Scientists can make mistakes, sometimes inadvertently and sometimes by fraud. Many scientific findings turn out to be irreproducible, leading to the so-called replication crisis. Why then should the public and policymakers trust science? What arguments can we make to persuade people to trust science?

*Why Trust Science* began as the Princeton University Tanner Lectures on Human Values by Naomi Oreskes, Professor of History of Science at Harvard University, USA. Her two lectures were followed by comments and critiques by four distinguished scholars. The two lectures by Oreskes, the four commentaries and a detailed response by her, have now been published together in the book under review.

The book begins with a helpful introduction by Stephen Macedo, Professor of Political Science at Princeton University, USA, which provides a summary of the entire volume, including the opening chapters, the commentaries and the response. In the first of her two opening lectures, Oreskes clearly sets out the problem facing us today – widespread mistrust of science, by the general public and by politicians and other decision-makers, be it regarding climate change, vaccination or evolution (discussed largely in the US context). She then provides a detailed historical overview of the various arguments people have been making for why we should trust science. Even before properly beginning the historical overview, she dismisses from any further consideration, an argument that scientists themselves often make – ‘[scientific] theories must be correct because they *work*. How else ... would planes fly or medicines cure diseases?’. Oreskes disabuses us of the general validity of this argument by pointing to history; ‘many theories ... that worked ... were later rejected as wrong. The Ptolemaic system of astronomy, the caloric theory of heat, classical mechanics, and the contraction of the earth...’. If we needed another reason to pay attention to the discipline of the history of science, this is it.

Among the arguments that Oreskes considers in her historical treatment, the oldest one, popular in the 18th and 19th

Why should people trust science? Science, we claim, is a work in progress;

1. Watson, B., *Chuang Tzu: Basic Writings*, Columbia University Press, New York, (trans. 1964).

centuries, was that science was trustworthy because scientists were trustworthy, learned people. From this she makes the claim that scientific societies such as the Royal Society were created in order to identify trustworthy men of science. We are then told that this argument lost currency in the mid-19th century, due to the advent of positivism. I believe that authority is still an important reason why scientists themselves trust science outside their domains of expertise, although the burden of authority may have shifted, rightly or wrongly, from 'worthy men' to 'reputed journals'. Moreover, scientific societies have by no means lost their prestige, either among scientists aspiring for membership or for the public and government seeking advice. The US National Academies of Science, Engineering and Medicine continue to publish 'more than 200 books each year, capturing the most authoritative views on important issues in science and health policy' (<http://www.nasonline.org/publications/nap/>). Most of these are solicited and paid for by the US Government.

In the next section of this chapter, Oreskes provides a fascinating account of the second argument that gained popularity starting in the mid-19th century. In short, the argument is, or was, that we should trust science because of the scientific method. Oreskes traces the focus on method to Auguste Comte (1798–1857). Comte, we learn trusted science because it was 'uniquely able to provide positive – which is to say *reliable* knowledge'. And the reliability comes from the use of the scientific method, as opposed to religious superstition. The next logical step in the historical development was a focus on empirical verification 'through experience, observation, and experiment', a 'concept developed most extensively by a group of German-speaking philosophers and scientists, known as the Vienna Circle'.

Oreskes then takes us on a journey through complex and contentious scholarship in the 20th century, that purportedly led to the fall from grace of 'method' as an argument for trusting science. In the first stop in this journey we meet Karl Popper who developed the ideas of critical rationality ('an attitude of scepticism and disbelief that scientists take towards their work') and falsifiability ('what distinguishes a scientific claim from and a non-scientific one is not that there is some observation by which it can

be verified, but that there is some observation by which it can be refuted'). In the second stop we meet Ludwik Fleck, a microbiologist who 'is credited with developing the first modern sociological account of scientific method', and who developed the idea of a 'thought collective' – 'A truly isolated investigator is impossible ... Thinking is a collective activity'. In the third stop we encounter Thomas Kuhn, best known for his *Structure of Scientific Revolutions*, for introducing the ideas of 'normal science' and 'paradigm shift'. In the fourth stop we encounter the philosopher Paul Feyerabend and his book *Against Method*, and the feminist philosophers of science Sandra Harding and Helen Longino, even as Oreskes gives us a rather partisan summary of the infamous science wars of the 1980s and 1990s.

The journey now brings us to a point where the scientific method is no longer of any value in the decision to trust science. How we got to this conclusion is a bit mysterious. The only explicit statement made is that 'There is now broad agreement among historians, philosophers, sociologists, and anthropologists of science that there is no (singular) scientific method, and that scientific practice consists of communities of people, making decisions for reasons that are both empirical and social, using diverse methods'. I find this rather unconvincing. Why should there be a singular scientific method? Yes, there are, and should be, diverse methods. But there is a strong set of commonalities between these methods which makes it easy to distinguish them from decisions made on the basis of superstition, religious or otherwise. I believe that the scientific method is an important component of the argument for trusting science.

Having dismissed both authority and the scientific method as reasons to trust science, Oreskes now gives her answer – 'I suggest that our answer should be twofold: (1) its sustained engagement with the world and (2) its social character'. Despite the 'I suggest', she says 'Many scholars in the history and philosophy of science and science studies have ... converged on a new view that does hold up to scrutiny: of scientific knowledge as fundamentally *consensual*'. Oreskes makes a convincing case for her twofold answer. 'Why trust a plumber? Or an electrician? Or a dentist or a nurse? One answer is that we trust a plumber to do

our plumbing because she is trained and licensed to do plumbing... Scientists are our designated experts for studying the world. Therefore, to the extent that we should trust anyone to tell us about the world, we should trust scientists'. And science is consensual because 'through peer review ... scientific claims are subjected to critical interrogation' and 'Tenure is effectively the academic version of licencing'. Thus we should trust science because scientific knowledge is based on agreement and verification by large groups of scientists. While individual scientists may be biased on account of their social, political or ideological prejudices, the community can incorporate different viewpoints and neutralize outliers. From this emphasis on the consensual nature of scientific knowledge, two clever and significant implications follow logically. One is that consensus is rather hollow unless scientific communities are inclusive and encompass geographical, national, racial and gender diversity ('diversity serves epistemic goals'). The other is that traditional or civilizational knowledge, the domain-specific expertise of tribal people, farmers, fishermen, patients and midwives for example, can lay a similar claim to our trust ('the non-expert world is not epistemically vacuous').

In the next chapter entitled 'Science awry', Oreskes provides interesting accounts of five examples where science went wrong. These are (1) the *Limited Energy Theory* of Edward H. Clarke (1820–77) which supposedly provided a 'scientific' argument for keeping women away from higher education: 'the demands of higher education would cause [women's] ovaries and uteri to shrink'; (2) the rejection of continental drift by American scientists because 'European science, like European culture, tended toward the anti-democratic'; (3) 'scientific support' for Eugenics; (4) the denial by many doctors and scientists of the self-reported correlation between the birth control pill and depression, by women, and (5) denial of the evidence for the benefits of dental flossing. While these infamous episodes provide us an opportunity for soul-searching, Oreskes uses them to bolster her main argument by showing that in all these five cases where science went awry, there was 'significant, important, and empirically informed dissent within the scientific community'.

## BOOK REVIEWS

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In the set of four commentaries that follow, Susan Lindee, Professor of History and Sociology of Science at the University of Pennsylvania, USA, argues that we should capitalize on the marvels of technology in everyday use, to create trust in science. Marc Lange, Professor of Philosophy in the University of North Carolina, USA, worries whether peer review is not just 'experts vouching for other experts'? Ottmar Edenhofer, Chief Economist at the Potsdam Institute for Climate Impact Research, and Martin Kowarsch of the Mercator Research Institute, argue that 'scientific consensus does not equal policy consensus'. Finally, Jon Krosnick, Professor of Humanities and Social Sciences at Stanford University, USA, worries deeply about the replications crisis. My interpretation of the final comments by Oreskes is that, while admitting the importance of the various comments made, she does not consider them to weaken her thesis.

In summary, Oreskes believes that we should trust science because it provides

us with a consensus among experts, and we should especially do so when science embraces diversity to serve epistemic goals and accepts that the non-expert world is not epistemically vacuous. I liked the emphasis that Oreskes places on expertise (sustained engagement, in her words), consensus, diversity and civilizational knowledge. But I doubt that these are adequate. Instead, I believe that a mixture of authority and method (the two arguments that she dismisses) as well as expertise and consensus are the raw materials that are needed to construct a convincing case for why we should trust science. I believe that a potential limitation of the approach taken in this book is that Oreskes focuses almost exclusively on (1) why the public should trust science. I think we should also ask two additional questions, namely (2) why scientists trust science outside their domain of expertise and (3) why scientists may trust for mistrust science inside their domain of expertise. The answers to the three questions may be somewhat differ-

ent and these differences may be interesting and instructive in formulating a strong argument for why the general public and decision-makers should trust science. I believe that reputation may be important for the second question and method may be important for the third question. Empirical studies to find answers to these three different questions (perhaps by conducting surveys using questionnaires) may be a worthwhile research project. I also expect that such a research project by scientists will inculcate in us a habit of discussing and debating the question of why people should trust science, and not leave it merely to the observers of science.

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