



Part of the ring tunnel at the Large Hadron Collider near Geneva, Switzerland.

## PHYSICS

# A rational reductionist argues his case

Robert Crease enjoys an eminent physicist's turn as the ideal witness to science and its history.

In his 1974 book *The First Three Minutes* (1977), physicist and Nobel laureate Steven Weinberg pictured his ideal reader as “a smart old attorney” who might not know much science, but “expects nonetheless to hear some convincing arguments”. That’s still his approach in *Third Thoughts*. This essay collection (his third for a lay readership, hence the title), ranges widely over science, the history of science and current affairs, taking on everything from dark energy and quantum field theory to socio-economic inequity and the wastefulness of crewed space missions.

The volume mixes new pieces with others previously published in *The New York Review of Books*. Weinberg acknowledges the help he received from the review’s formidable editor, the late Robert Silvers. He clearly apprenticed well: if his ideal reader is an astute lawyer, Weinberg might be described as an ideal witness. He is clear, to the point, frank and transparent about his perspective — “rationalist, realist, reductionist, and devoutly secular”.

Among half a dozen pieces on particle physics are lucid explanations of, for instance, the Higgs boson, Hilbert space and the Large Hadron Collider. Weinberg has a knack for capturing a complex concept in a succinct, unforgettable image. He compares quantum superposition, in which a particle has two states at once, to a musical chord; when measurement collapses the particle to one state, it

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“somehow shifts all the intensity of the chord to one of the notes, which we then hear on its own”. And he describes the discovery that nature obeys symmetries whose consequences can be worked out as “like having a spy in the enemy’s high command”.

A few of the essays delve into history. Weinberg has irked professionals in the field by venturing into their territory, but not because he gets his facts wrong. As a self-confessed ‘Whig’ historian, he believes that the past should be judged by values of the present (the term springs from the name of the long-defunct British political party whose members thought history had been building towards Parliamentary government). Weinberg offers a curious panorama that demotes certain canonical figures, such as Democritus, Francis Bacon and René Descartes.

The ancient Greek philosopher Democritus didn’t make observations, so, although he correctly proposed that matter is made of atoms, Weinberg argues that he “was wrong about how to learn about the world”. Yet Democritus is of supreme importance for the understanding of science history (as Weinberg admits) because he inspired atomic theorists of the early modern period, such as Robert Boyle and other corpuscular philosophers, in their efforts to explain nature

without using theology or teleology. Similarly, Bacon and Descartes, although sometimes scientifically misguided by today’s standards, were vastly important for ushering in the mechanical thinking that Weinberg himself practises. Two essays here convey Weinberg’s responses to critics of his Whig convictions, but I wish he had put the arguments and counter-arguments more forcefully and at greater length.

Weinberg is at his most interesting when probing the big uncertainties in physics. Ultimately, he is not sure, for instance, that he knows what an ‘elementary particle’ actually is, or how best to interpret quantum mechanics. These moments reveal Weinberg’s considerable integrity, where — as one of the smartest and most diligent scientists around — he describes himself as somewhat lost. He has surveyed the present, and all the best paths forward proposed by other scientists; yet, at gut level, he is confident that nothing on the horizon is fully satisfactory, and that other possibilities might be out there. These admissions imply that Weinberg suspects future historians may harbour a perception of today’s thinking very different from ours.

The articles on public and personal matters — Weinberg’s thoughts about taxes, his disappointment with former US President Barack Obama for failing to confront economic disparities more directly, and educators who are honoured with burial in Texas State Cemetery — are less interesting. Yet here, as elsewhere, he is clever: “The only technology for which the manned space flight program is well suited is the technology of keeping people alive in space. And the only demand for that technology is in the manned space flight program itself.”

I read the penultimate essay with anticipation. Weinberg reveals in the introduction that he had not published it before because nobody who read it liked it. You can see why. It’s an earnest piece of amateur philosophizing that compares creativity in theoretical physics to that in the arts, building on Weinberg’s feeling that success in each depends on “a sense of inevitability”. He would have been clearer had he consulted a few philosophical concepts, such as Immanuel Kant’s idea that a beautiful work creates the feeling that it has the inevitability of a product of nature. But Weinberg (whose 1992 book *Dreams of a Final Theory* contains a chapter entitled ‘Against Philosophy’) was not about to take that route. In all these essays, his directness both enlightens and illuminates flaws in his own arguments. Witnesses, of course — even ideal ones — have blind spots. The best thing about Weinberg’s essays is that they do, indeed, make you feel like a smart old attorney. ■

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