



A compendium of paradoxes

Matt Cook: *Sleight of mind: 75 ingenious paradoxes in mathematics, physics, and philosophy*. Cambridge: MIT Press, 2020, 368 pp, \$34.95 HB

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Matt Cook and collaborators' *Sleight of Mind* is a compendium of paradoxes, covering a wide range of domains from logic to pure and applied mathematics to physics. It is a mostly reliable guide to this terrain, and those with the requisite technical background will find its style and enthusiasm engaging.

Sleight of Mind's greatest strengths are its breadth of coverage and user-friendly structure. The selection of 75 paradoxes is thorough, diverse and judicious. It encompasses the expected greatest hits (e.g., Zeno, Monty Hall, the Liar, Maxwell's Demon), along with many nice cases that are less well known outside specialist circles (e.g., Thomson's Lamp, St. Petersburg, Simpson's Paradox, the relativistic Barn and Pole).

Sleight's entries share a common convenient structure. Following the initial setup, Cook states the two competing claims constituting the apparent paradox, with a brief justification for each claim. This is followed by a Discussion and Resolution section which typically explains which of the claims is correct and why.

Paradoxes are inherently tricky, and a challenge facing any popular book is to get the details right while maintaining an engaging style. *Sleight* generally succeeds here. While it covers topics as varied as transfinite set theory, statistics, fractals, social choice and quantum mechanics, the book rarely resorts to hand-waving. Cook tries heroically to give complete and correct explanations, even when this requires chains of definitions and mathematical formalism. If there is anything to fault here, it is that *Sleight's* heroism sometimes runs to the quixotic, as in the 15 pages devoted to proving Gödel's first incompleteness theorem.

Though quite serviceable on the whole, *Sleight of Mind* has a few flaws that make it difficult to recommend unreservedly, especially when compared to other offerings in its genre.

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First, it is unclear who *Sleight* was written for. Most books on paradoxes are authored by experts in a particular discipline and aimed at students in that discipline, with the goal of displaying problems, concepts and reasoning styles that might prove useful for future studies. But Cook is not a philosopher, nor a logician, nor a mathematician, so *Sleight* cannot offer this sort of insider's perspective on most of its chosen puzzles. Cook has a PhD in economics, a subject which makes few appearances in the book. And Cook's lack of expertise on these topics sometimes shows—more on this below.

It is also hard to recommend *Sleight* as a friendly introduction for general audiences, as it demands a level of technical facility that is often offputtingly high. The very first page of Chapter 1, on paradoxes of infinity, warns ominously that “readers unfamiliar with set builder notation may reference the Notation Guide at the end of the book”. In the next four and a half pages, we get definitions of *cardinality*, *bijection*, *countable*, *countably infinite*, *Cartesian product*, \aleph_0 , 2^{\aleph_0} and \aleph_1 , a proof by diagonalization that the reals outnumber the naturals, and a statement of the continuum hypothesis. Cook marches through this material while freely wielding set notation and presupposing familiarity with concepts like *union* and *real number*.

And all of this before getting to the very first paradox! It is hard to imagine a reader who is savvy enough to follow this introduction, but also green enough to find anything novel in Cook's treatment of Hilbert's Hotel and other basics of transfinite arithmetic. Unfortunately, Cook stumbles a bit even at this early stage, seeming to confuse real numbers and irrational numbers in the diagonal proof on page 11.

Occasional glitches like this aside, the mathematical content in *Sleight* is generally solid, if sometimes overly ambitious. Cook's lack of expertise in philosophy is more apparent. To his credit, it is clear he has made a good-faith effort to understand the relevant debates and current consensus on his chosen puzzles. When the book is in summary mode—which is most of the time—the result is usually a recognizable picture of mainstream thinking. Cook's own ideas show through from time to time, though, and the viewpoint on display is unmistakably a philosophical novice's.

To take one example, the most cited philosopher in the book seems to be ... Russell? Quine? You would be forgiven for those guesses, but Cook's hobbyhorse is Ayn Rand, who is repeatedly called upon to illuminate such topics as rationality, logic, justice, concepts, and the nature of number. Whatever one thinks of Rand's fiction and politics, few philosophers would name her a distinguished thinker on paradoxology.

A second issue. As I mentioned, *Sleight* presents a resolution of each paradox it discusses. Where professional opinion remains divided, we generally get a look at the main contenders with their strengths and weaknesses. On rare occasions, though, Cook goes out on a limb and advances his own original solution. These efforts are not among the book's high points.

One example appears in Sect. 4.1, on the Sleeping Beauty paradox. Cook acknowledges the lack of academic consensus on Sleeping Beauty, but believes he has a solution which is “objectively true, comprehensive, and sufficient for resolving the apparent contradictions” (63). After more than two decades of extensive scholarly discussion, this would be an impressive and welcome feat.

Unfortunately, Cook does not deliver on his promise. What we get is an extended analogy between the Sleeping Beauty scenario and a gumball machine which dispenses red or blue balls inscribed with numbers. The balls' colors and numbers correspond to the result of the Sleeping Beauty coin toss and the day on which Beauty is awakened. Cook suggests that, on one way of understanding the machine's operation, the halfer's position on Sleeping Beauty is correct, while the thirder's view is vindicated on another understanding. I would like to say more about Cook's proposed solution, but I cannot make further sense of what he has in mind (and neither could an expert in formal epistemology with whom I have discussed the section). Given that Cook's analysis makes no attempt to answer the key arguments on any side of the debate, it is exceedingly unlikely that he has accomplished what he thinks he has. It is a surprise that MIT Press's referees approved this part. Were no philosophers consulted?

On the whole, though, *Sleight of Mind* is a good book. I especially enjoyed the last three chapters on paradoxes in classical physics, relativity and quantum mechanics, whose writing Cook wisely delegated to a trio of experts. The idiosyncrasies in the rest of the book may be irksome to philosophers but are mostly harmless. On the whole, Cook succeeds at presenting an impressive panoply of complex ideas with gusto and rigor.

If you are only going to buy one book about paradoxes, should this be it? That is less clear. Michael Clark's *Paradoxes from A to Z* beats *Sleight* on sheer numbers, covering 94 paradoxes in its third edition. It is also written by a distinguished philosopher-logician, and will probably provide greater intellectual nourishment to aspirants in those fields. But *Sleight* is better organized and more readable, and Clark's book lacks *Sleight's* fine physics material. Another choice is R.M. Sainsbury's *Paradoxes*. Sainsbury focuses on epistemic and logical paradoxes, taking deeper dives into those subjects than either Cook or Clark. This is a better option for those who prefer something closer to a textbook than an encyclopedia. Agustín Rayo's *On the Brink of Paradox* is another work in this vein by a prominent expert, with just three detailed and technically demanding chapters.

For students with serious interests and background in philosophy, logic or mathematics, I would recommend one of the alternatives above. For the curious general reader who is not scared off by university-level math and a good intellectual challenge, *Sleight* will do fine. I hope for Cook's sake that some of those people exist.

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