

You Can't Get There from Here: Tracing the Logic of Proof

by William M. Briggs

Proof: The Art and Science of Certainty, Adam Kucharski, Basic Books, 2025, pp. 368, \$25.00 hardcover.

Adam Kucharski is not happy that our “convicted felon” President “sowed widespread division and refused to acknowledge his 2020 defeat.”

His highlighting of this incident early in *Proof* serves as an excellent introduction to the subject of argumentation, for here we have two people, Kucharski and Trump, seemingly looking at the same evidence and yet coming to diametrically opposite conclusions. Both Kucharski and Trump regard their cases as *proved*. How can this be?

The solution is that either both men do not consider the same evidence or, if they do, they do not accord it the same weight or meaning. Kucharski's argument is that Trump lost 2020, presumably because the sources Kucharski relies upon (and not mentioned in the

book) dismiss Trump. We never learn what Trump's argument or evidence was; we do see Kucharski's accusation that Trump's conclusion was based on “false claims.”

The inclusion of this fracas in his new book, the goal of which is to show how proof works, is generous because besides giving us only positive examples of proof, Kucharski includes negative ones like this, instances where argument fails badly. Kucharski is teaching us in a sly manner not to wade into debates until you are well prepared, and to never ever engage in the Appeal to Unseen Experts Fallacy lest you risk having people dismiss your work as the result of a political hack.

So much for the book's strengths. A clear failing was leaving out a succinct definition of proof, and how it can be

reached. I can remedy this. A *proof* is the collection of evidence probative of some conclusion, from which the conclusion can be deduced. The proof is *local* (my definition) if the evidence itself is unexamined, suspect, or even wrong, yet where the conclusion still follows from this (possibly) tainted evidence. The proof is *necessary* or *universal* if that evidence is itself subject to proof in the same way, as is the evidence of that second-level proof, and etc., all the way down the chain to first principles.

Perhaps the difference between local and necessary or universal proofs is not yet fixed in the reader's mind. This example could help:

That Sally has a keen sense of humor is locally proved via a syllogism if we accept as evidence that all feminists have keen senses of humor, and that Sally is a feminist. To turn this into a universal proof, the evidence that all feminists have keen senses of humor must itself be proved. Have a go and report back to us how your attempt fares.

Mathematics provides examples of universal proofs, building complex theorems starting from axioms, themselves only proved by recourse to intellection, by carefully showing how one proposition follows from another, the whole becoming an enormous and endless web of proof.

Kucharski teaches us the valuable difference in math between proofs by construction and existence proofs. The former are rightly considered more revealing. A non-mathematical analogy might clarify the distinction. You come

downstairs in the morning and discover the nutty donut you've been saving is missing. Somebody must have taken it. This is an existence proof that a donut thief is at large. If you follow the crumbs to the bed of your grandson, and later extract a confession, this becomes a constructive proof of the identity of the thief. Knowing *how* or *who* or *what* is superior to only knowing *that*.

We also learn the standard story in *Proof* how ideas of proof developed in mathematics. Folks were at first skeptical or outright hostile to negative numbers and infinity and the like, and only gradually coming to see the light. The only formula Kucharski shows us is Weierstrass's Monster, an unloved and unwelcome function for which "it is impossible to calculate the derivative at any point." He says the function is "ugly and awkward." Here beauty is relative. And, alas, the reader never learns what a derivative is or why anybody would want one.

The lesson scientists and mathematicians usually take from stories of our benighted ancestors rejecting reality is that we today are superior and would never do silly things like scoff at negative or imaginary numbers. We have open minds. This is a false lesson. The truth is the opposite: if the majority of scientists have always been dismissive and hostile to new ideas, and have enjoyed castigating and casting out into the darkness those who bring them, then that is exactly what we should expect to happen today, and every day. And, of course, that is what we do see.

What is accepted as proof—local proof—is often a matter of tribe and custom.

Euclid is touted by Kucharski as a master of proofs, and so he is. His *Elements* are used to this day to teach how far pure reasoning can go. We learn that Lincoln thought so, too. He boned up on Euclid's proofs so that he could become a better advocate against slavery. Kucharski spends a good portion of the book on this. Here is the result:

To show that person A could not legitimately enslave B, Lincoln first assumed that A could enslave B. This implied that a legitimate argument for creating slaves existed. B could therefore use the same argument to enslave A, which contradicted the original assumption that A was the enslaver of B. If one person had the right to enslave another, Lincoln concluded, then a person A could be both enslaver and the enslaved. Hence a person did not have the right to enslave another.

As a proof this succeeds. Not in proving slavery illogical, but that Lincoln should have put in a few more hours with Euclid.

Supposing B is enslaved by A, B telling A, "I have a right to be an enslaver, too" is unlikely to convince A that it is B's turn to be the enslaver. B's argument cannot be used to enslave anybody, and it doesn't contradict the assumption A is the enslaver, because, of course, A is the enslaver. It's only true that B could not *simultaneously* be enslaved by and also the enslaver of A, if slavery were legitimate. It is also a truth that fortunes change and B could end up on top.

Lincoln's argument would be like if the Central Powers to escape their fate in 1918 tried arguing that since the Allied Powers were conquerors in WWI, the outcome would be as legitimate if the Central Powers were conquerors, therefore neither side had the right to be the conquerors. They would have had more success trying to prove the existence of humor-filled feminists.

What's most interesting about this example is that many, including Kucharski, found Lincoln's argument convincing. This demonstrates the well-known tendency to support any argument whose conclusion aligns with a desirable belief, a frequent misstep in pursuit of proof. Here, the many, and stronger, *moral* arguments against slavery were already convincing to most, so that it was easy to accept Lincoln's attempt as providing desirable intellectual-sounding proof.

High sounding arguments, especially in our age those backed by equations or computers, or, Lord help us, AI, are always welcomed. This is why scientists were trotted out during the covid panic (my term) to put their endorsement on any number of "solutions" proposed or made mandatory by our rulers.

Kucharski himself was involved in our global medical contretemps, and the largest portion of his book is given over to weaving in a sort of apologia for his side's actions.

Take vaccines. There came to be a lot of weird, and wrong, theories held by the "vaccine hesitant." Like how the vax contained nanobots programmed

to do nasty things. Or (my favorite) that they made recipients magnetic. Or that vaccines were part of a plot by an elite cabal to kill off a large chunk of the globe. That one surprised me most, because the sort of person who believed in dastardly plots of devious Machiavellians also had ample and sustained growing evidence of the incompetence of woke rulers, people who, it was obvious, could therefore never pull off such a feat. Ignorance, fear, suspicion and distrust caused these false beliefs, all local proofs based on rumored and faulty evidence.

But then that palpable fear was caused, often purposely, by officials like CDC boss Rochelle Walensky, a doctor herself, who insisted that if you got the shot you could not get sick nor could you pass on the bug, and that it was impossible there could be any harmful side effects for this new medicine, a first in medical history. Observations refuted her claims before they were even made, which were in any case absurd. So how could a doctor say such things? Was she, and the many others repeating her, telling noble lies to induce desirable behavior? Or were all these people merely incompetent, believing their own flawed local proofs?

Kucharski also seeks to explain how these kinds of things happen, but with a twist. He asks, "How is it possible that people can seemingly care about truth but also happy to share content that is false?" His answer is that for some "truth is just one of several competing priorities." He quotes researchers who

say, "People often share misinformation because their attention is focused on factors other than accuracy." He speaks of the "illusory truth effect," which is when a proposition is more likely believed the more often it is heard. This is why, as all know, propaganda and advertising are effective.

Our author is right to apply these analyses to those who shared curiosities like nanobot-infested vaxes, but he neglects to focus the same scrutiny to people like Walensky or Neil Ferguson, whom we meet in a moment. He is also silent on why authorities believed and pressed ridiculous covid "solutions," like those ONE WAY stickers on grocery store floors, the shamanistic six-foot "social distance" rule, why sitting in restaurants maskless was safe but why standing without one was certain death. In some locales it became *illegal* not to play along with this goofiness. The danger of rushing to embrace local proofs applies to everybody, even caring bureaucrats.

Directing us to think back before the panic, Kucharski asks, "what probability would people have put on an infectious disease shutting some borders for years and confining people to their homes for months on end in large swathes of the world? Would anyone have even thought to put a probability to such an event?"

He meant these as rhetorical, but the answers are yes, and the probability is not as small as one would have hoped. And incidentally, no *disease* can ever

close a border. Only politicians and bureaucrats can.

All probability is conditional on the evidence one has. Kucharski in asking his questions was supposing, correctly, that most of his audience would not have had much evidence about overreactive pandemic responses before 2020. But some did. Some knew of people like Neil Ferguson, whose hysterical model in 2020 gave us the dismal phrase “Two weeks to flatten the curve!” This wasn’t Ferguson’s first attempt to have folks strap tinfoil to their heads and run screaming in circles. Among others, in the late 1990s Ferguson predicted up to 150,000 would die from mad-cow disease (177 did); in 2005 he predicted up to 200 million would die from bird flu (440 died); in 2009 he predicted some 65,000 Britons would ease out of their burdens because of swine flu (457 died). And, of course, in 2020 he predicted 2.2 million Americans would keel over from covid by that August 2020. (We document all these and more in our 2020 *Price of Panic*, including the many officials eagerly planning pandemic responses of the kind we saw. Like “lockdowns.”)

With covid, Ferguson did better, and it must have pleased him this was the best model he ever made, even though his prediction was nearly fifteen *times* too high. In any case, his “lockdown” recommendation was warmly embraced by rulers, and by folks like Kucharski. Remember people arrested for standing alone on beaches in the open air? The idea was that people would be made to

stay inside in close quarters with family members, only venturing outside at a fixed hour to rattle pans together in honor of their captors. The spread of the bug would therefore, the reasoning went, be slowed.

Kucharski was tasked with tracking infections, which as he details, is far from easy in large populations. One of his premises was that lockdowns worked. That premise is why he was puzzled when variants of the bug didn’t track as he expected: “Maybe Alpha [the first known variant] was genuinely more transmissible, which would explain why it could emerge and spread so easily during a lockdown ... [Or] If people weren’t adhering to the lockdown in certain areas, then any variant that happened to emerge in those locations could grow and ripple out into other, more diligent communities.”

He used abduction to arrive at these possibilities. Sherlock Holmes, Kucharski tells us, used abduction. Which is picking the best from a set of explanations. The problem with that might be obvious to you: what happens when the list of explanations does not include the correct one? Then, as we said in the military, you are in deep kimchi. You will come to a local truth, but not a universal one.

The possibility Kucharski didn’t consider was that lockdowns exacerbated the spread of the bug. Every year in the northern hemisphere deaths from all causes, especially those caused by communicable diseases, peak around the second week of January, and bottom

out in summer. The signal is huge—and well known. In winter people are forced inside, and there they share their bugs freely. Call this a voluntary seasonal lockdown.

So how was all this forgotten in 2020? Panic. Married to the managerial mindset that experts ought to be in charge of all things because “science.” Panic kills, but managerial panic kills hardest. The better name for this is scientism. Kucharski understands, in theory, that what is best morally or ethically is not a question of science, like when it is used, he says, to “justify racism.” But he doesn’t see that how it applies for his own support of lockdowns.

Even if these harsh measures worked as advertised, they instituted the precedent of allowing governments to mandate destructive confinement, and to insist that no one may be able to buy, or to sell, except he who has taken his medicine. Recall that in the beginning of the panic, “vaccine passports” were laughed at as a “conspiracy theory.”

Outside of mathematics, we often cannot reach proof, not even locally, but are left with uncertainty. That is expressed using probability. So it’s depressing but necessary that the dreaded P-value is here to confuse us all once again. This is the statistical measure that allows researchers to fallaciously conclude that the correlation they saw in their data is “really” a signal of causation. Kucharski rightly tells us because of P-values “proven”—his scare quotes—“scientific hypotheses were treated as established facts.” An error.

Yet we don’t quite see in *Proof* what this mathematical trickery is, except that P-values “require a conceptual leap.”

And how!

What we want is the chance that a hypothesis is true *given* whatever set of evidence we entertain. What are the chances it will rain given how it looks outside? What is the probability this vaccine will stop me from catching covid given the government promises it is perfect? Given the experimental and observational data we have, what is the probability this new treatment won’t make you go blind in its quest to allow you to lose weight while still eating as much as you like?

However difficult the mathematics to calculate these quantities, the questions and answers are easy to understand. Even better, anything you want to know can be put in these simple terms. This is not what is usually given to us in science.

As in previous reviews in these pages, I’m going to tell you again what P-values are, but you won’t believe me. Or, if you do, you will think I have missed something, else why would so many make the mistake of relying on them? I won’t blame you for holding either opinion. What we get is *not* the chance the hypothesis is true, but the probability of seeing experimental data *we did not see* assuming the hypothesis is *false*. That is the mighty P-value. If the P-value is wee, we *decide* the hypothesis is true. This isn’t even a local truth; it is pure fallacy.

So why, then, are P-values used? Because they give objective-sounding answers, and in science, as everywhere, appearance is, if not everything, then at least it is much. They also make decisions for scientists, and even though these are fallacious decisions, being relieved of any burden of thought is always welcome. (Never forget that conclusions can still be true for other reasons; they are never true because we P.)

Kucharski gives examples of proposed replacements, like “confidence intervals,” which fail in other ways too complex to mention here. He never introduces the approach above, which is to give the probability of the hypothesis. I differ with him, too, on the benefits of “randomization,” thinking it only a way to minimize cheating and confirmation bias, whereas he thinks it does real work. But since our recommendations on how to arrange experiments would be much the same, we can argue these subtleties elsewhere.

We also meet many examples of difficulties in research when outcomes and causal ascriptions are uncertain. For instance, William Gosset, whose pen name was Student of the famed Student “t-test” (whose outcome is a P-value), warned against glibness in twin studies: “Some way of distinguishing the children from each other is necessary or the mischievous ones will play tricks.” One can never have enough of these, as they are antidotes to ubiquitous textbook over-certainties.

Lastly, maybe a reader in the publishing business can help me. I’ve yet to come across books like this that don’t have the Mustachioed Menace from Germany sidle in stage right and start shouting at the audience that one of his clones will surely surge into power unless we follow the author’s sage advice, whatever it might be. In Kucharski’s book we don’t meet The Enemy until late, but there he is bludgeoning us about Big Lies. No, not the ones told by *our* side in the political debate, those issued by the *other* side. Is this a known marketing strategy? I really want to know.

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