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BOOK REVIEW

External and internal threats to scientific credibility

Gary Smith: Distrust: big data, data-torturing, and the assault on science. New York: Oxford University Press, 2021, viii + 323 pp, $32.95 HB

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Gary Smith's *Distrust: Big Data, Data-Torturing, and the Assault on Science* explains the diminished credibility of science as a consequence of several converging factors. First, social media and the internet more generally allow for the rapid spread of conspiracy theories and other misinformative narratives that either directly or indirectly call the reliability of science into doubt. Second, some practices employed by scientists—including data torturing and data mining—produce bogus findings that, when exposed, further diminish the credibility of legitimate science. Finally, fascination with artificial intelligence—and excessive faith in its progress—threatens inevitable disappointment.

In Part I of *Distrust*, Smith argues that misinformation represents an exogenous threat to the credibility of science, albeit one whose potency reflects the scientific advances that have enabled the spread of misinformation through social media and the internet more generally. Technological advances could in principle have led to the unfettered dissemination of accurate information. In practice, however, the internet in general and social media in particular often facilitate the spread of conspiracy theories and other falsehoods, which either directly or indirectly question the credibility of science.

One of the great strengths of *Distrust* is Smith's use of vivid, important, and often amusing real-world examples. In Part I, Smith's examples range from magic tricks and UFOs to recent conspiracy theories. Public belief in paranormal phenomena, when paired with dismissals by scientists, feeds doubt about the competence and forthrightness of scientists, while conspiracy theories often directly attack scientific credibility. While Smith's reliance on such examples is highly illuminating, there are places where examples and attendant data are presented too uncritically. For example, Smith cites a figure suggesting that roughly 4% of Americans believe that the US government is run by lizard people (53).

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However, others have noted that this, and similar figures, ought not be taken at face value, as they likely, at least partially, reflect mischievousness on the part of survey participants (Hartman 2021). Smith likewise cites recent data suggesting that attitudes toward COVID-19 conspiracy theories are largely politicized, being especially widely believed by Republicans (53–54). Here, the discussion would be enriched by engagement with recent work that suggests that endorsement of conspiracy theories and other misinformation often serve an expressive function, rather than indicating sincere belief (Hannon and de Ridder 2021; Schaffner and Luks 2018).

Whereas conspiracy theories and other forms of misinformation represent a largely external threat to science's credibility, further threats originate from closer to home. In Parts II and III, Smith turns to these endogenous threats. As Smith recounts, in illuminating and often entertaining detail, the practices of data torturing and data mining lead to scientific findings that can be neither reproduced nor replicated. Data torturing is the exploitation of various tricks to make findings reach the threshold of statistical significance. The data torturer might, for instance, partition a sample into various subgroups, such that statistically significant results can be found for some subgroups. Alternatively, or additionally, the data torturer might halt a study precisely when a statistically significant result has been found. Notably, such practices have often seemed legitimate to researchers.

Data mining, on the other hand, involves combing through massive quantities of data to find correlations. While some such correlations may reflect important facts about the causal structure of the world—and may thus be predictive—many reflect mere chance. Importantly, data mining is facilitated by novel computational technologies that allow for the rapid and cheap collection and processing of data. As Smith illustrates, rich quantities of data, and the technology to sort through it, often makes for embarrassing science.

Especially when taken together, Smith's chapters on data torturing and data mining paint a bleak picture of much of contemporary science and some of the methods on which it relies. These practices can facilitate the misrepresentation of spurious correlations as revealing the causal structure of the world. If the resultant findings are trusted, and especially if they are put into practice, inevitable disappointments will discourage trust in science and those who produce it (166).

Arguably, the picture of contemporary science, which one might take away from Parts II and III of *Distrust,* is *too* bleak. While unconstrained data torturing and data mining can have serious negative consequences, the consequences can be, and often are, mitigated by other factors. As Smith notes elsewhere (2020), the misleading conclusions likely to arise from merely data mining a sample of data can be at least partly corrected for by testing resulting models against out-of-sample data. Similarly, although data torturing can extract false "confessions," the influence of these can be mitigated by subsequent tests and analyses. Even if individual scientific findings cannot be taken at face value, the broader scientific process arguably can be trusted to ultimately sort between legitimate and bogus findings. The crucial caveat is that the professional incentives of science often do more to reward torturers and unwary miners than those attempting to double-check others' results. The misuse of data is arguably solvable by institutional changes in science, but it is not yet solved.

In Part IV, Smith turns to the perils of excessive confidence in the capacities of artificial intelligence. As Smith emphasizes through a potted history of failed predictions as to the achievement of genuine artificial intelligence, predicting the capacities of computational systems is a dangerous game. For one thing, excessive optimism concerning artificial intelligence is likely to lead to disappointment and a loss of trust in optimistic predictions. However, Smith's own discussion of the shortcomings of artificial intelligence is arguably oversimplified. Smith recounts some amusing interactions with OpenAI's GPT-3, including several where Smith asks GPT-3 whether it is "safe to walk downstairs backwards if I close my eyes" (208). Over several trials, the language model provided Smith with absurd and contradictory answers, some of which assured him that walking downstairs in this way is safe. According to Smith's diagnosis, GPT-3 struggles with such questions because it exists in the "Math World," not the world occupied by humans (208). But this diagnosis, and its concrete implications for the capacities of AI, is too quick. As an exercise, I gave the same prompt, along with several others Smith describes, to Microsoft's Bing chatbot, which utilizes OpenAI's GPT-4. The answers were not only consistent but also the chatbot implored me not to take the dangerous actions I appeared to be contemplating. Surprisingly, however, the chatbot made some simple mathematical errors in response to some of my questions.

The Bing chatbot thus answered a question about the real world reasonably well, though it struggled with basic mathematics. The upshot is that large language models are arguably both more useful and more dangerous than Smith's analysis suggests. *More useful* because recent models can provide correct information and helpful advice for a range of tasks, including practical tasks. *More dangerous* because such successes encourage credulity toward the bad information and bad advice that the models sometimes offer.

Part V of *Distrust* turns more directly to the crisis of declining public trust in science and what can be done about it. Smith notes that practices of data torturing and data mining, as well as outright fraud, have led to a proliferation of scientific results that cannot be reproduced or replicated. What is worse, poorly evidenced scientific results often enjoy outsized prominence and continuing influence precisely because they are more surprising and novel than better-evidenced results. Here, there is an interesting parallel between the exogenous and endogenous threats to the credibility of science, as both misinformation and poorly conducted science benefit from the human preference for novelty. Notably, insofar as Part V highlights the widespread awareness of the problems posed by poor scientific practices, as well as efforts to mitigate these, this portion of the book goes some way toward offering a more optimistic picture of the credibility of science than one might take away from Parts II and III.

One lesson, driven home by the events of recent years, is that competently addressing the complex challenges facing humanity requires the input of scientific experts. For this input to be given proper weight, the credibility of science must be preserved. Smith's *Distrust* is a strikingly readable exploration of several interrelated threats to the credibility of science. Along the way, Smith usefully debunks several misleading scientific claims, including many made in the context of the COVID-19 pandemic, which will likely be of practical significance to readers. The

book can serve as both a guide to helping readers better spot bogus scientific claims and a warning as to the individual and institutional failings that threaten the credibility of science.

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References

Hannon, M., and J. de Ridder. 2021. The point of political belief. In *Routledge Handbook of Political Epistemology*, ed. M. Hannon and J. de Ridder, 156–166. Routledge.

Hartman, R. 2021. Did 4% of Americans really drink bleach last year? *Harvard Business Review,* April 20. https://hbr.org/2021/04/did-4-of-americans-really-drink-bleach-last-year.

Schaffner, B.F., and S. Luks. 2018. Misinformation or expressive responding? *Public Opinion Quarterly* 82 (1): 135–147. https://doi.org/10.1093/poq/nfx042.

Smith, G. 2020. Data mining fool's gold. *Journal of Information Technology* 35 (3): 182–194. https://doi.org/10.1177/0268396220915600.