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PREFACE

THE WORLD IS AWASH WITH BULLSHIT, AND WE'RE DROWNING IN IT.

Politicians are unconstrained by facts. Science is conducted by press release. Silicon Valley startups elevate bullshit to high art. Colleges and universities reward bullshit over analytic thought. The majority of administrative activity seems to be little more than a sophisticated exercise in the combinatorial reassembly of bullshit. Advertisers wink conspiratorially and invite us to join them in seeing through all the bullshit. We wink back—but in doing so drop our guard and fall for the second-order bullshit they are shoveling at us. Bullshit pollutes our world by misleading people about specific issues, and it undermines our ability to trust information in general. However modest, this book is our attempt to fight back.

The philosopher Harry Frankfurt recognized that the ubiquity of bullshit is a defining characteristic of our time. His classic treatise *On Bullshit* begins as follows:

One of the most salient features of our culture is that there is so much bullshit. Everyone knows this. Each of us contributes his share. But we tend to take the situation for granted [yet] we have no clear understanding of what bullshit is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory.

To eradicate bullshit, it is helpful to know precisely what it is. And here things get tricky.

First of all, "bullshit" is both a noun and a verb. Not only can I get tired of listening to your bullshit (*n.*), I can turn around and bullshit (*v.*) you myself. This is straightforward enough. To bullshit is, at a first approximation, the act of producing bullshit.

But what does the noun "bullshit" refer to anyway? As with many attempts to match philosophical concepts to everyday language, it would be a fool's errand to attempt a definition that incorporates and excludes everything it should. Instead, we will start with a few examples and then try to describe some things that would qualify as bullshit.

Most people think they're pretty good at spotting bullshit. That may be true when bullshit comes in the form of rhetoric or fancy language, what we call *old-school bullshit*. For example:

- Our collective mission is to functionalize bilateral solutions for leveraging underutilized human resource portfolio opportunities. (In other words, we are a temp agency.)

- We exist as transmissions. To embark on the myth is to become one with it. (We might call this new-age old-school bullshit.)

- Just as our forefathers before us, we look to the unending horizons of our great nation with minds fixed and hearts aflame to rekindle the dampened sparks of our collective destiny.

(Spare us. How are you going bring jobs back to the district?)

Old-school bullshit doesn't seem to be going away, but it may be overshadowed by the rise of what we call *new-school bullshit*. New-school bullshit uses the language of math and science and statistics to create the impression of rigor and accuracy. Dubious claims are given a veneer of legitimacy by glossing them with numbers, figures, statistics, and data graphics. New-school bullshit might look something like this:

- Adjusted for currency exchange rates, our top-performing global fund beat the market in seven of the past nine years.

(How exactly were returns adjusted? How many of the company's funds failed to beat the market and by how much? For that matter,

was there a single fund that beat the market in seven of nine years, or was it a different fund that beat the market in each of those seven years?)

- While short of statistical significance ($p = 0.13$), our results underscore the clinically important effect size (relative odds of survival at five years = 1.3) of our targeted oncotherapy and challenge the current therapeutic paradigm.

(What does it mean for a result to be clinically important if it is not statistically significant? Is five-year survival a relevant measure for this particular cancer, or are most patients deceased within three years? Why should we imagine that any of this “challenges the current therapeutic paradigm”?)

- The team’s convolutional neural net algorithm extracts the underlying control logic from a multiplex network composed of the human metabolome, transcriptome, and proteome.

(What is a multiplex network? Why are connections among these various -omes meaningful, and how are they measured? What does the author mean by “control logic”? How do we know there is an underlying control logic linking these systems, and if there is, how do we know that this approach can actually capture it?)

- Our systematic screening revealed that 34 percent of behaviorally challenged second graders admit to having sniffed Magic Markers at least once in the past year.

(Why does it matter? And if it does, is marker-sniffing a cause or a consequence of being “behaviorally challenged”? What fraction of nonchallenged second graders admit to sniffing Magic Markers? Perhaps that fraction is even higher!)

New-school bullshit can be particularly effective because many of us don’t feel qualified to challenge information that is presented in quantitative form. That is exactly what new-school bullshitters are

counting on. To fight back, one must learn when and how to question such statements.

WE HAVE DEVOTED OUR careers to teaching students how to think logically and quantitatively about data. This book emerged from a course we teach at the University of Washington, also titled “Calling Bullshit.” We hope it will show you that you do not need to be a professional statistician or econometrician or data scientist to think critically about quantitative arguments, nor do you need extensive data sets and weeks of effort to see through bullshit. It is often sufficient to apply basic logical reasoning to a problem and, where needed, augment that with information readily discovered via search engine.

We have civic motives for wanting to help people spot and refute bullshit. It is not a matter of left- or right-wing ideology; people on both sides of the aisle have proven themselves skilled at creating and spreading misinformation. Rather (at the risk of grandiosity), we believe that adequate bullshit detection is essential for the survival of liberal democracy. Democracy has always relied on a critically thinking electorate, but never has this been more important than in the current age of fake news and international interference in the electoral process via propaganda disseminated over social media. In a December 2016 *New York Times* op-ed, Mark Galeotti summarized the best defense against this form of information warfare:

Instead of trying to combat each leak directly, the United States government should teach the public to tell when they are being manipulated. Via schools and nongovernmental organizations and public service campaigns, Americans should be taught the basic skills necessary to be savvy media consumers, from how to fact-check news articles to how pictures can lie.

As academics with decades of experience teaching data science, statistics, and related subjects at a public university, we know how to teach this sort of thinking. We believe that it can be done without taking sides, politically. You may not agree with us about the optimal size of the federal government, about what constitutes an acceptable degree of government involvement in our private lives, or how the

country should conduct itself on the world stage—but we’re good with that. We simply want to help people of all political perspectives resist bullshit, because we feel that a democracy is healthiest when voters can see through the bullshit coming from all sides.

We are not setting up a platform from which we can call bullshit on things that we don’t like. For that reason, the examples in this book are seldom the most egregious ones we know, let alone the instances that anger us the most. Rather, our examples are chosen to serve a pedagogical purpose, drawing out particular pitfalls and highlighting appropriate strategies for responding. We hope you’ll read, think, and go call bullshit yourself.

OVER A CENTURY AGO, the philosopher John Alexander Smith addressed the entering class at Oxford as follows:

Nothing that you will learn in the course of your studies will be of the slightest possible use to you [thereafter], save only this, that if you work hard and intelligently you should be able to detect when a man is talking rot, and that, in my view, is the main, if not the sole, purpose of education.

For all of its successes, we feel that higher education in STEM disciplines—science, technology, engineering, and medicine—has dropped the ball in this regard. We generally do a good job teaching mechanics: students learn how to manipulate matrices, transfect cells, run genomic scans, and implement machine learning algorithms. But this focus on facts and skills comes at the expense of training and practice in the art of critical thinking. In the humanities and the social sciences, students are taught to smash conflicting ideas up against one another and grapple with discordant arguments. In STEM fields, students seldom are given paradoxes that they need to resolve, conflicting forms of evidence that they must reconcile, or fallacious claims that they need to critique. As a result, college graduates tend to be well prepared to challenge verbal arguments and identify logical fallacies but surprisingly acquiescent in the face of quantitative claims. Of course, the same holds true for secondary education. If STEM education incorporated the interrogatory teaching practices already com-

mon in the humanities, schools could shape a generation of students prepared to call bullshit on statistical statements and artificial intelligence analyses just as comfortably as current students can on political, ethical, artistic, and philosophical claims.

For a number of reasons, we draw heavily on examples from research in science and medicine in the chapters that follow. We love science and this is where our expertise lies. Science relies on the kinds of quantitative arguments we address in this book. Of all human institutions, science seems as though it ought to be free from bullshit—but it isn't. We believe that public understanding of science is critical for an informed electorate, and we want to identify the many obstacles that interfere with that understanding.

But we want to stress that nothing we say undermines science as a successful, institutionalized means to understand the physical world. For all our complaints, for all the biases we identify, for all the problems and all the bullshit that creeps in, at the end of the day *science works*. With science on our side, we fly in airplanes, talk on video-phones, transplant organs, eradicate infectious diseases, and apprehend phenomena ranging from the early moments after the Big Bang to the molecular basis of life.

New forms of information technology have changed the way we communicate in both science and society. As access has improved, information overload has worsened. We hope this book will help you face the onslaught and separate fact from fiction.

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