May Contain Lies

How stories, statistics and studies exploit our biases – and what we can do about it

'Alex Edmans is such a crisp, sharp, salutary voice – and a great guide to the bullsh*t of the modern world'

Rory Stewart

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'A powerful and punchy explanation of why misinformation is a problem that affects us all – be that in finance, politics, media, business or anywhere else. Edmans offers clear ideas about how to counter this, not just in our own lives but also across society as a whole. Timely and very provocative!'
Gillian Tett, Editor-at-Large, *Financial Times*

'Alex Edmans is such a crisp, sharp, salutary voice – and a great guide to the bullshit of the modern world'
Rory Stewart, author of *Politics On the Edge*

'A masterpiece! A must-read book that is both a delight to consume and sure to improve the quality of your thinking'
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'Brilliantly researched and written [and] immensely practical in helping guide us through this thicket of (mis)information . . . I am already drawing on its insights in my everyday decision-making'
Andy Haldane, former chief economist at the Bank of England

'A passionate and dispassionate call to truth – and how to achieve it – in a world of growing disinformation in which truth and common ground are the casualties'
Will Hutton, President of the Academy of Social Sciences and author of *The State We're In*

'A fascinating account of how to navigate through lies and misleading statistics to arrive at a reasonable approximation of the truth. A valuable aid to make sense of our confusing world'
Raghuram Rajan, former governor of the Reserve Bank of India and chief economist of the International Monetary Fund

'A hard-hitting book with some great stories'
Andrew Gelman, professor of statistics and political science at Columbia University

'A clear-headed guide to the exaggerations, sloppy research and the occasional downright lies peddled by companies, universities, authors and TED Talk gurus . . . It's a timely book and, despite the nerdy statistical theories, often quite funny'
Harry Wallop, *The Times*

'A road map for how to separate myths from the real thing and come to a better understanding of the world, drawing on the approaches of academic research. [Edmans] is well placed to share what professional thinkers can teach us about examining our subjectivity to think more clearly about topics from income disparity to cancer cures'
Jonathan Moules, *Financial Times*

'Entertaining, thorough and full of current examples . . . It's excellent!'
Jason Zweig, *Wall Street Journal*

ABOUT THE AUTHOR

Alex Edmans is Professor of Finance at London Business School. His TED Talk 'What to Trust in a Post-Truth World' has been viewed 2 million times. He has also spoken at Davos and Google. In 2013, he was awarded tenure at the Wharton School and in 2021, was named MBA Professor of the Year by Poets & Quants. Edmans writes regularly for the *Wall Street Journal*, *Financial Times* and *Harvard Business Review*. His first book, *Grow the Pie*, was a *Financial Times* Book of the Year.

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ALEX EDMANS

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Introduction

The sweat was dripping down my face as I awaited my grilling in the UK House of Commons. I'd been summoned to testify in front of the Select Committee on Business.[1] This was a group of MPs who, infuriated by a couple of high-profile scandals, had launched an inquiry into how companies were being run.

In my day job as a finance professor, I'm used to being interrogated by students in lectures, journalists in interviews and executives in workshops. But being probed by MPs on live TV and having your testimony transcribed as public record is another level, so I was feeling pretty nervous. I got to the House of Commons early and sat in on the session before mine, burying my head in my notes to swot up on every question the Committee might ask.

My ears pricked up when a witness in that session mentioned some research which sounded noteworthy.[2] It apparently found that companies are more successful when there's a smaller gap between the pay of the CEO and the pay of the average worker. I was intrigued, because my own research shows that employee-friendly firms outperform their peers.[3] My studies don't focus on pay, but this new evidence appeared to complement my findings. For many years I'd been trying to convince companies of the importance of treating workers fairly, and this looked like another arrow to add to my quiver. I wanted it to be true.

If my twenty years in research have taught me anything, however, it's not to accept claims at face value. I pulled up the witness's written statement and saw they were referring to a

report by Faleye, Reis and Venkateswaran. But when I looked it up, it seemed to say the exact opposite: the *higher* the gap between CEO and worker salaries, the better the company's performance.

I was confused. Perhaps my nerves led me to misunderstand the study? After all, academic papers aren't known for their clarity. Yet their conclusion was right there on the front page and as clear as day: companies do better if they have *greater* pay gaps.

It then dawned on me what had happened. The witness statement actually quoted a half-finished draft by Faleye, Reis and Venkateswaran that was released three years before the final version.[4] I was looking at the published article, after it had gone through peer review and corrected its mistakes – leading to a completely opposite result.[5]

The witness in question was from the Trades Union Congress (TUC), which holds a strong public position against pay gaps. In 2014, it published a report declaring that 'high pay differentials damage employee morale, are detrimental to firm performance [and] contribute to inequality across the economy'. So the TUC may have jumped on this preliminary draft, without checking whether a completed version was available, because it showed exactly what it wanted.

My own session went smoothly. One question had me stumped, but I told the MPs that I wasn't an expert in that topic rather than trying to make up an answer. They seemed surprised, as if no one had ever admitted to not knowing something before. In the corridor afterwards, I told the Clerk to the Select Committee about the tainted evidence in the earlier session. He seemed appalled and asked me to submit a formal memo highlighting the error. I did so, and the Committee published it.

Yet the Committee's final report on the inquiry referred to the overturned study as if it were gospel. It said: 'The TUC

states that "There is clear academic evidence that high wage disparities within companies harm productivity and company performance" ' – even though this statement was contradicted by the very researchers the TUC quoted in support. Partly due to this claim, the report recommended that every large UK company disclose its pay gap, and this eventually became law.[6]

The takeaway I'd like to draw is nothing to do with pay gaps – whether they should be published, or whether large gaps are good or bad. Even if bigger differences lead to better performance, we might care about equality more than profits. Instead, it's to stress how careful we need to be with evidence.

This episode taught me two lessons. First, you can rustle up a report to support almost any opinion you want, even if it's deeply flawed and has subsequently been debunked. A topical issue attracts dozens of studies, so you can take your pick. Phrases like 'Research shows that . . .', 'A study finds that . . .', or 'There is clear academic evidence that . . .' are commonly bandied around as proof, but they're often meaningless.

Second, sources we consider reliable, such as a government report, may still be untrustworthy. *Any* report – by policymakers, consultancies, and even academics like me – is written by humans, and humans have their biases. The Committee may have already felt that pay was too high and needed to be reined in, which is why they launched the inquiry in the first place.

This isn't just an isolated case. Newspapers publish articles highlighting the blockbuster findings of a study that doesn't even exist. Companies release research that has no actual data behind it; it just assumes its results. Universities circulate reports declaring game-changing conclusions, when their tests in fact found nothing. Yet if readers want these claims to be true, they accept them unquestioningly.

The problem extends far beyond business. Misinformation

surrounds us and affects our everyday lives – how we vote, learn a skill or improve our health. In the 2016 Brexit referendum, buses paraded the claim that European Union membership cost the UK £350 million per week. The actual figure was £250 million, or £120 million after deducting the amount the EU gives back to the UK.[7] People believe the '10,000 hours rule' that you can master any skill with 10,000 hours of practice. Yet the research it's based on was limited to violinists, didn't measure their skill, and didn't even mention 10,000 hours. In 1988, the journal *Nature* published a paper touting the effectiveness of homeopathy, a treatment using heavily diluted substances that supposedly transfer their properties to water.[8] But several other studies found no improvements, and scientific consensus is now that homeopathy is ineffective for any disease or condition.[9]

These examples show how we're all affected by research, even if we never read a single academic paper. Each time we pick up a self-help book, browse through the latest *Men's Fitness*, *Women's Health* or *Runner's World*, or open an article shared on LinkedIn, X or Facebook, we're reading about research. Whenever we listen to an expert's opinion on whether to invest in crypto, how to teach our kids to read, or why inflation is so high, we're hearing about research. And information is far broader than research – our news feeds are bombarded not only with 'New study finds that . . .' but also anecdotes like 'How daily journalling boosted my mental health', hunches such as 'Five tips to ace your job interview', and speculation like 'Why we'll colonize Mars by 2050'.[10] Blindly following this advice, you could find yourself sicker, poorer and unemployed.

In some cases, misinformation can be fatal. In March 2020, as the coronavirus pandemic was breaking out, US President Donald Trump tweeted that hydroxychloroquine might be a cure, proclaiming it 'one of the biggest game changers in the history of

medicine'. One woman noticed 'chloroquine'* on the label of her fish-tank cleaner; as she told NBC News, 'I saw it sitting on the back shelf and thought "Hey, isn't that the stuff they're talking about on TV?" '[11] She and her husband drank it, hoping it would protect them from the virus. The woman became violently sick but vomited up enough of the chemical to survive. Her husband wasn't so lucky and died just after getting to hospital.

What's striking in all the above cases is that the solution is simple – to check the facts. It seems obvious to ensure a drug is safe before swallowing it, to verify a study exists before writing about it, and to doubt the side of a bus as a source of information. And the people making the misjudgements are more than capable of checking the facts. If I share a study on LinkedIn whose findings people don't like, there's no shortage of comments from executives, investors and fellow academics pointing out how it might be flawed – exactly the kind of discerning engagement I'm hoping to prompt. But do I see the same critical thinking when I post a paper that finds their favour? Unfortunately not: they lap it up uncritically.

One of my favourite toys growing up was Action Man. This UK character was based on the GI Joe set of military figures in the US, which were accompanied by a cartoon series. Each episode closed with a scene where a GI Joe figure taught kids a lesson – don't give your address to strangers, don't pet unfamiliar animals, do wear sun protection. The children in the cartoon exclaimed, 'Now I know!', to which the GI Joe replied, 'And knowing is half the battle.' This aimed to highlight the power of knowledge – with it, you're already halfway there.

* Chloroquine and hydroxychloroquine are different compounds, but the woman did not check this.

But there's another way to interpret that statement: the glass is half empty, not just half full. Even with knowledge, you've *only* won half the battle.[12] Knowing how to check the facts isn't enough. The people who made the above mistakes knew what to do in the cold light of day, yet their biases took over and prevented them applying their knowledge.

As a university academic for two decades, I've seen first-hand how important rigour is when producing research. At the Massachusetts Institute of Technology, where I did my Ph.D.; Wharton, the business school of the University of Pennsylvania, where I was first a professor; and London Business School, where I now teach, I've been held to gruelling standards in my own work. Journals correctly refused to publish my papers until I'd completely nailed the results, addressed alternative explanations for my findings, and toned down any claims that weren't fully supported by the data. Sometimes it took five years of toil and sweat to get a study above the bar for publication.

This isn't just my experience as a producer of research; it's also what I've seen as a gatekeeper. As the Managing Editor of a leading academic journal, the *Review of Finance*, I've been on the other side for six years. After authors submit a paper for potential publication, I send it to 'peer reviewers' (independent experts) and ask their advice on whether to accept it. I've been gratified by the extreme care with which they scrutinize a manuscript. And I've had to apply the same exacting standards myself, rejecting papers that would be highly influential if taken at their word, because their results just weren't identified precisely enough.

While one foot is firmly in academia, my second is deeply rooted in practice, advising companies, investors and policymakers based on the findings of research. So I've observed how the painstaking care with which papers are written goes out of

the window when they're read and emotion takes over. My main field is sustainable business, a field with strong opinions that polarize across political lines. Those on the left tend to believe that ethical stocks always outperform, so they'll trumpet any study which claims this. Many right-wingers retort that sustainable companies are distracted from the bottom line; some US lawmakers have banned state pension funds from investing in them. Sustainability is also a highly practical topic, so I've seen how academic rigour isn't just an academic concept but affects how CEOs run their companies, investors choose which firms to finance, and policymakers decide what laws to pass.

In 2017 I was invited to give a second TEDx talk. It was a great opportunity to reach a wide audience and my instinct was to use it to share my work – as most professors do, and as I indeed did in my first talk. Then I had a thought: what if, instead of pitching my own research, I spoke up for research in general? The whole mission of TED is to promote 'ideas worth spreading', but this mission is under threat if how far an idea spreads depends on whether people like it rather than whether it's true. And it's not just the TED/TEDx stage: anyone with a newspaper column, social media platform, or YouTube channel can broadcast what they want and claim there's data to support it.

So I spoke about how discerning we must be with evidence – how our biases can lead us to fall for something false or reject something real, and how we should judge a study by its carefulness, not its claims. I was grateful when it was elevated to a mainstage TED talk, 'What to trust in a post-truth world', because I hoped it might move the needle, even slightly, from fiction to fact.

Yet misinformation has arguably become worse. Public discourse is increasingly polarized, with opinions formed on ideology, not evidence. The most pressing issues of our time,

such as climate change, inequality and global health, are steeped in falsehoods. In the past, we knew what the reliable sources were, such as a doctor or medical textbook for health advice and an encyclopaedia for general knowledge. Now one half of Americans obtain news 'often' or 'sometimes' from social media,[13] where false stories spread further, faster and deeper than the truth because they're more attention-grabbing.[14]

And biases exist even among people who've seen the talk and should know better. Some companies invited me to present an extended version to their employees, supposedly to promote critical thinking, only to strike out a couple of 'inconvenient truths' from the slide deck – because they didn't want them to be true.

In today's post-truth world, it's more important than ever to separate myth from reality. This book is a practical guide to help you think smarter, sharper and more critically – on topics such as how to run a company and invest your money, how to improve your health and develop good habits, how to feed your child and educate a nation's children, what drives global warming or the spread of coronavirus, and which policies lawmakers should pass and voters should support. We'll overturn some widely accepted ideas, and in doing so learn simple ways to spot if a claim is supported by the evidence. We'll uncover the problems with the case study method that pervades the world's leading business schools, viral TED talks and bestselling books. We'll see how we can be fooled even by large-scale data – even if hundreds of datapoints all tell the same story.

But knowledge is *only* half the battle. Having knowledge isn't enough: we need to know *when* to use it and *how* to use it. Why do we leave our learnings at the door and rush to accept a statement at face value? Without highlighting the biases that cause us to forget our knowledge, a book that simply passes on

knowledge is incomplete. It's like teaching a first-aider how to perform CPR but not how to spot if someone needs it.

Sun Tzu's *The Art of War* stresses that you should 'know your enemy' before drawing up battle plans. So we'll start in Part I ('The Biases') by learning about our enemy. We'll take a deep dive into two psychological biases – confirmation bias and black-and-white thinking – that are the two biggest culprits in causing us to misinterpret information.

In Part II ('The Problems'), we'll study the consequences of these biases. They lead us to climb the Ladder of Misinference shown below:

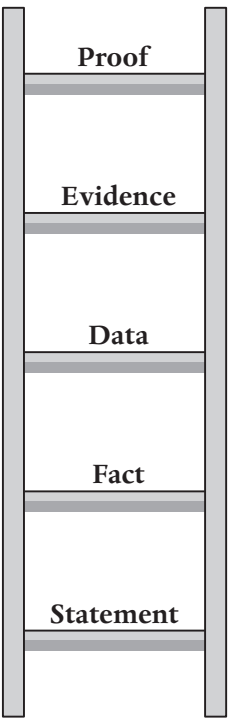

Figure 1. The Ladder of Misinference

We *accept a statement as fact*, even if it's not *accurate* – the information behind it may be unreliable and may even be misquoted in the first place. We *accept a fact as data*, even if it's not *representative* but a hand-picked example – an exception that doesn't prove the rule. We *accept data as evidence*, even if it's not *conclusive* and many other interpretations exist. We *accept evidence as proof*, even if it's not *universal* and doesn't apply in other settings.

Importantly, checking the facts only saves us from the first misstep up the ladder. Even if the facts are correct, we may interpret them erroneously, by over-extrapolating from a single anecdote or ignoring alternative explanations. The word 'lie' is typically reserved for an outright falsehood made deliberately, and to accuse someone of lying or call them a liar is a serious allegation. But we need to take a broader view of what a lie can involve so that we can guard against its many manifestations.

'Lie' is simply the opposite of 'truth'. Someone can lie to us by hiding contradictory information, not gathering it in the first place, or drawing invalid conclusions from valid data. The Select Committee's claim that 'The TUC states that . . .' is strictly correct – but it's still a lie, as it suggests the TUC's statement was true when the Committee knew it had been debunked. Lies also have many causes – some are wilful and self-interested; others are a careless or accidental result of someone's biases; and yet more arise from well-intentioned but excessive enthusiasm to further a cause they deem worthy.

This wider definition of 'lie' highlights how regulation can't save us from being deceived – it can only make someone state the facts truthfully; it can't stop him claiming invalid implications from them. It's up to us to protect ourselves. Even if a report has been signed off by the government, a paper has been published by a scientific journal, or a book has been

endorsed by a Nobel Laureate, they should all carry the same health warning: 'May contain lies'.

Part II thus provides a practical guide to help us discern whether a statement really is fact, a fact truly is data, data genuinely is evidence, and evidence actually is proof. These tips are simple and non-technical, and can be applied even if you're time-pressed and don't have the capacity to dig into the weeds of a study.

To distinguish between truth and lies, and gain a deeper understanding of the world around us, we need to do more than just interpret statements, facts, data and evidence correctly. Part III ('The Solutions') goes beyond the ladder. It moves past evaluating single studies to learning scientific consensus, and assessing other sources of information such as books, newspaper articles, and even our friends and colleagues. From learning how to think critically as individuals, we'll explore how to create smart-thinking organizations that harness our colleagues' diversity of thought, overcome groupthink and embrace challenge. We'll finally examine how to build intelligent societies through teaching critical thinking to our children, taking the politics out of issues such as climate change, and playing our part in the information we share and ignore.

The Appendix provides a checklist of questions to evaluate statements, facts, data and evidence, applying the learnings of Part II. At the start, we might literally go through every question. Over time, the way of thinking that the book develops – challenging what we'd like to believe, listening open-mindedly to what we don't and staying alert to our biases – should become ingrained so we no longer need to follow a script. A novice tennis player thinks, 'First I split-step, then I turn my body so it's square to the net, then I take a

backswing and follow through over my opposite shoulder,' but after a while it becomes second nature.

While this book aims to be practical, it also seeks to be realistic. It's impossible to overcome our biases in every situation and correctly evaluate every piece of information; the range of ways we can be deceived may seem overwhelming. Our goal is not to become perfect, only better. A baseball player who improves his batting average from 0.280 to 0.320 will leap from a Major League starter to a Hall of Famer, even though he's still well below 1.000. Critical thinking is a polar star – you might never get there, but it guides you.

Now more than ever, we have easy access to scientific research by the world's leading minds, yet it's drowned out by fallacies, fabrications and falsehoods. Knowing what to trust and what to doubt will help us make shrewder decisions, comprehend better how the world works, and spread knowledge rather than unwittingly sharing misinformation. This in turn allows us and our families to lead healthy and fulfilling lives, the businesses we work for and invest in to solve the world's biggest problems, and the nations we're citizens of to prosper and thrive. By recognizing our own biases, we can view a contrary perspective as something to learn from rather than fight, build bridges across ideological divides to find common ground, and evolve from simplistic thinking to seeing the world in all its magnificence.

PART I

The Biases

1.

Confirmation Bias

Belle Gibson was a happy young Australian. An avid skateboarder with a bright smile, she had the rest of her life to look forward to.

But in 2009, Belle suffered a stroke. Tests to find the cause uncovered devastating news: Belle had an advanced brain tumour and only four months to live. She wouldn't even see her twenty-first birthday.[1]

Yet Belle was determined. She'd been a fighter her whole life. At just six years old, she had to cook for her brother who had autism, and care for her mother who had multiple sclerosis; her father was out of the picture. So Belle did the only thing she knew: she fought. But chemotherapy and radiotherapy only made her sicker, and after two months there wasn't the slightest sign of remission.

With conventional treatments totally powerless, Belle's battling instinct spurred her to fight another way – using natural methods. Weak from the chemotherapy, she forced herself to exercise. She started meditation. She ditched meat for fruit and vegetables.

And, miraculously, she made a complete recovery.

Belle's story went viral. It was shared, tweeted and blogged about, and reached millions. It showed the benefits of shunning traditional medicine for diet, exercise and sheer grit. Having discovered the secret of how to cure cancer, she now devoted her life to telling others. In August 2013, Belle launched *The Whole*

Pantry app, 'a motivating and supportive resource filled with delicious recipes, wellness guides and lifestyle support'. It hit number one in Apple's App Store in the first month, as 200,000 people rushed to download the path to better health.

As 2013 drew to a close, *The Whole Pantry* was named Apple's Best Food and Drink App and was a runner-up for App of the Year. It was so successful that Apple flew Belle to its headquarters to work on a secret project, which, upon arrival, she learned was the Apple Watch – they wanted to develop *The Whole Pantry* into one of its first apps. When the watch was released, Belle's creation took centre stage, appearing alongside Strava on the Featured Apps page.

Belle wanted to reach those in need through traditional media also. The following year, she published a cookbook, also titled *The Whole Pantry*, with the subtitle 'Over 80 Original Gluten-, Refined-sugar- and Dairy-free Recipes to Nourish Your Body and Mind'. It was more than just a recipe book; it was a self-help manual that stressed the importance of taking charge of your life. It described how Belle 'began a journey of self-education that resulted in her getting back to basics, as she set out to heal herself through nutrition and lifestyle changes'. In her own words, 'I was empowering myself to save my own life through nutrition, patience, determination and love.'[2]

In just eighteen months, the app and the book netted Belle A$420,000.[3] Yet her motivation was never to make money, but to help others. From day one, she'd pledged to donate a large chunk of her royalties to charity. Due to her success, this amounted to A$300,000.

By 2015, Belle was on the top of the world. She was a best-selling author, a successful businesswoman and a generous philanthropist. Completely cured of cancer, Belle radiated wellness, emboldening others to choose clean eating and good

habits over drugs and chemicals in the pursuit of a happier, healthier life.

But Belle's story was a lie. Belle never had cancer. People believed her without ever checking the facts.

This is a classic example of *confirmation bias*. We accept a claim uncritically if it confirms what we'd like to be true. The public trusted Belle's account so eagerly, and then spread it so widely, because it struck a chord with our beliefs and values. Belle inspired us to believe you can have anything – even a second chance at life when you're at death's door – if you want it hard enough. Ever since we were kids, we've been told, 'You can do anything you set your mind to,' and Belle was proof.

This bias had serious consequences. Several cancer patients stopped chemotherapy, hoping to emulate Belle. A believer named Kylie explained in a BBC documentary: '[Belle] was saying what she was doing was curing her cancer, it was making it better . . . I had her there to look at, I had her on my phone, she was in magazines, she was on the news, so I trusted her.' Those afflicted by other chronic illnesses, not just cancer, hoped that Belle's formula might work for them also, so they too became disciples.

Sadly, they only became sicker. Belle's followers spurned their doctors' scientifically proven medicines, replacing them with the musings of a blogger. One died within a few months of refusing chemotherapy, prompting her daughter's devastated friend to turn whistleblower to two journalists at *The Age* newspaper in Australia, who broke the story.[4] Hundreds more might have died had Belle not been exposed. After Kylie learned the truth, she restarted chemotherapy and went into remission. The facts saved her life.

We can understand why critically ill patients were easy

targets for Belle. If traditional medicine isn't working, you'll seek out alternative cures. But confirmation bias doesn't just prey on the desperation of the sick – an entire cottage industry has sprung up where authors and influencers peddle advice based on emotion, not evidence. Adverts for trading courses promise that we can escape the nine to five and live the life we want, accompanied by the gold standard of social media proof – a photo of the guru cruising in a Ferrari waving a wad of cash. Reality TV stars spread the conspiracy that 5G causes coronavirus, playing into popular mistrust about technology.[5] At the end of 2022, #luckygirlsyndrome amassed 150 million TikTok views within a month. Videos with this hashtag claimed that telling yourself you'll be lucky makes it so – leading some people to blame themselves when things go wrong.

You might think that only the foolish fall for a TikToker's tales. But the temptation to believe alluring claims is so strong that even the rich and famous succumb. Founded in 2003 by Elizabeth Holmes, the medical start-up Theranos claimed it could perform hundreds of tests, including the diagnosis of several life-threatening diseases, from a finger-prick of blood. Investors injected over $700 million, including media mogul Rupert Murdoch, Oracle founder Larry Ellison and former US Secretary of State George Shultz. They'd all reached the top through a lifetime of scrutiny and scepticism – separating the few promising ideas from the hundreds that were pie-in-the-sky. For a small, portable machine to run two hundred simultaneous tests from a few drops of blood was stretching scientific plausibility, so it was essential to put Holmes's claims under the microscope.

Yet many took them at face value, likely because they wanted them to be true. Holmes's story was captivating: a young, charismatic visionary who dropped out of university to

pursue her dream and triumph in a male-dominated world. Just as seductive was Theranos's investment thesis – that its shareholders would not only make money but help save lives. One asked for Theranos's audited accounts, wasn't given any, but invested anyway. Another admitted she didn't visit any of Theranos's testing centres or consult any experts, yet still handed over $100 million.[6] In 2015, *TIME* magazine named Holmes one of the world's '100 Most Influential People', and the World Economic Forum inducted her as a Young Global Leader. That October, Theranos was exposed as a sham, and Holmes was convicted of fraud six years later.

Why truth is not enough

You might think the moral of the Belle Gibson and Elizabeth Holmes stories is to always check the facts. But checking the facts is not enough. Confirmation bias is so pernicious that it doesn't just cause us to accept falsehoods. Even if the facts are true, it can lead us to interpret them incorrectly.

Take the case of Bruce Lisker. On the morning of 10 March 1983, seventeen-year-old Bruce swung by the home of his adoptive parents in Sherman Oaks, Los Angeles, to borrow a tool to repair his car. When no one answered the door, he ran to the backyard and looked through the living-room window to see if anyone was in. He glimpsed his sixty-six-year-old mother, Dorka, lying on the floor. Panicking, Bruce darted to the kitchen and removed the panes of glass to climb in, a technique he'd previously mastered to sneak into the house after curfew. He found Dorka unconscious with her head smashed in, her right ear nearly severed, and two steak knives lodged in her back. Bruce pulled them out and called 911. The

paramedics came and rushed Dorka to hospital, but she died that afternoon.

The first detective to arrive at the scene was Andrew Monsue, who immediately suspected Bruce. He'd dealt with Bruce before and considered him 'an in-your-face little punk'. Bruce first tried cocaine and LSD aged thirteen, stealing from his parents to support his habit. He had a heated relationship with his mother, which often escalated into screaming matches. In June 1982, he was arrested for throwing a screwdriver at a motorist who'd cut him up and convicted of vandalism.

Monsue instantly decided Bruce was guilty. His theory was that Bruce rifled through Dorka's purse to steal money for drugs. When Dorka caught him, he struck her head with his Little League baseball trophy, followed up with his father's exercise bar, and plunged in the knives. Monsue then interpreted all the evidence he came across as being consistent with this hunch. There were blood spatters on Bruce's shoes and shirt cuffs, which he concluded came from hitting Dorka with a blunt object. Monsue discovered bloody footprints, which, at Bruce's trial, he testified 'resembled quite closely' Bruce's shoes. Soon after Bruce arrived in the county jail to await trial, career criminal Robert Hughes claimed that Bruce confessed to him. In November 1985, Bruce was convicted of murder and sentenced to sixteen years to life.

Prison was dangerous for a skinny, five-foot-six kid, so Bruce kept to himself, studying computer programming and dabbling in poetry. He wrote a poem about Monsue:

> *An idiot simpleton who jumped to conclusions;*
> *Unable to reason, 'If not the boy, who then?'*[7]

In 2003, after being denied parole multiple times, Bruce filed

a complaint against Monsue with the Los Angeles Police Department. Internal Affairs officer Jim Gavin pored through the case files and was surprised to find that Monsue had never ordered a forensic analysis of the footprints, simply going on his hunch that they 'resembled quite closely' Bruce's shoes. Gavin asked forensic scientist Ronald Raquel to examine them. Raquel found prints from two different shoes outside the house, one with a herringbone pattern that couldn't have come from Bruce's tennis shoes. Crucially, this herringbone footprint matched one in the bathroom as well as a bruise on Dorka's head. It also transpired that Hughes had a history of claiming to overhear confessions by other inmates, and had testified against Bruce to reduce his own sentence. In 2009, after twenty-six years in jail for a crime he didn't commit, Bruce was finally freed.

There was no problem with the facts. It's true there was blood on Bruce's shoes and shirt; it's true there were footprints near Dorka's body; it's true that Hughes claimed that Bruce confessed. But truth is not enough. To see why, let's look at one of the most fundamental techniques in statistics. It's called Bayesian inference, and a simplified version is below.

Does *Information* support *Hypothesis?*

Depends on

Is *Information* consistent with *Hypothesis?*

vs

Is *Information* consistent with *Alternative Hypotheses?*

(plus another term)

The *scientific method* involves starting with a *hypothesis* about the world – diet cures cancer, or a suspect is guilty – which we then test by gathering information. A correctly designed test enquires: Does the information *support* the hypothesis? In other words, does the information increase our belief that the hypothesis is true?

But instead we ask: Is the information *consistent with* the hypothesis? 'Support' and 'consistent with' seem like pretty much the same thing – they're even synonyms on Thesaurus.com[8] – but there's a key difference. Even if information is consistent with a hypothesis, it may not support it because of a crucial third question: Is the information consistent with *alternative hypotheses*? Yet, due to confirmation bias, we forget this question and never stop to consider alternative hypotheses, because we're so eager to accept our preferred one.

What matters is not just the facts, but how we interpret them. The blood on Bruce Lisker's shoes was a fact, but Monsue was blind to the alternative hypothesis that it got there from Bruce tending to his mother. The footprints could have been Bruce's, but they could have also been left by someone else. Hughes's claims could have been because Bruce genuinely confessed, or because Hughes was trying to bargain for a shorter sentence. But if we've already formed our conclusion, we interpret any evidence as being consistent with it and it alone.

Bruce is far from an isolated case. US prisoners have spent a total of 30,000 years behind bars for crimes of which they were later exonerated.[9] Criminology professors Kim Rossmo and Joycelyn Pollock investigated what went wrong in fifty of the most serious overturned convictions.[10] There were a number of factors, such as media pressure, unreliable witnesses and flawed forensics, but none of them cropped up in more than

half the cases. The clear leader, occurring 74% of the time, was confirmation bias.

We ignore alternative hypotheses in many everyday settings, not just crime. Professors like me would love to believe that education increases income, and stress how people with degrees earn more than those without. However, smarter kids are more likely to go to university, and it could be ability, not education, that boosts their earnings. Motivational speakers reel out testimonials from devotees whose lives were changed after attending their seminars – but those willing to shell out hundreds of dollars and drive for six hours to hear a talk are likely taking other steps to better themselves. Those actions could be causing the turnaround, not the guru's five-point plan.

In all these cases, it's not hard to think of rival theories with a clear head. Yet we don't always have a clear head – we accept our preferred explanation without pausing to consider whether something else could be behind the data. As Francis Bacon, one of the pioneers of the scientific method, noted: 'The human understanding when it has once adopted an opinion . . . draws all things else to support and agree with it.'

Everything we've seen so far is one form of confirmation bias, which we'll call *naïve acceptance* – believing claims we like, without checking the facts or asking if there are alternative explanations. But confirmation bias comes in many different guises.[11] We'll now explore a second.

The danger of denial

20 April 2010 was poised to be a special day for Deepwater Horizon, BP's star drilling rig. Seven months earlier, Deepwater Horizon had dug the deepest well in history, but it was now

embroiled in its toughest challenge yet – creating an oil well in the Macondo reservoir in the Gulf of Mexico. The project was six weeks behind schedule and $58 million over budget, due to weak formations in the ocean rock that required careful drilling.

That day would be a dual celebration. BP executives were on board to celebrate Deepwater Horizon's stellar safety record of seven years without a single lost-time incident. And the well would finally be complete, netting BP a bounty of 50 million barrels of oil worth $5 billion.

The one remaining step before the rig could be withdrawn was to secure the well. To check it's safe to do so, you need to run a 'negative pressure test'. This ensures that the steel casing around the wellbore (the hole you've just drilled) can withstand the pressure drop that occurs when the rig is removed and drilling mud* is replaced with seawater. You open the top of the drilling pipe, bleed the pressure to zero, close it, and check if pressure builds or fluid leaks into the well.

In the first test, the engineers couldn't get the pressure below 266 pounds per square inch during the bleed; after closing the pipe, it jumped back up to 1,262. The second attempt did get a zero reading, but it rebounded to 773 afterwards. If that seemed like progress, the third try went backwards – again the pressure went to zero, but then skyrocketed to 1,400. It needed it to stay at zero to pass the test. To put it into perspective, the pressure of a football is approximately 12; for a steam train it's around 250. It wasn't even close.

But 'fail' wasn't the answer the engineers wanted. Deepwater Horizon had an unblemished seven-year record, so in

* Drilling mud is added as you dig to suspend the drilled-off rock so it floats to the surface, lubricate the drill bit, and – having twice the density of seawater – create pressure to prevent the well collapsing from the outside in.

their eyes the test couldn't possibly have been right. Rather than admitting to problems with the well, they decided there must be problems with the test. With huge pressure not to delay the project further, the engineers came up with an alternative explanation for the negative result.

They blamed a 'bladder effect', where heavy mud in the riser (a pipe from the seabed to the water level) exerts pressure on the bladder-like valve that seals the top of the drilling pipe, and the valve then transfers this pressure to the pipe itself. This gave them the excuse to run the test another way – not on the drilling pipe but on the 'kill line', another tube from the seabed to the water surface. They got the zero reading they craved, allowing them to call the test a pass – and sealing the well's fate.

Later that evening, shortly after the executives congratulated the Deepwater Horizon crew on their safety record, gas burst into the casing and travelled up the riser. When it reached the air, it exploded, killing eleven workers and injuring seventeen. Within thirty-six hours, the rig sank. 5 million barrels of oil spilled into the sea, damaging 8 US national parks, endangering 400 species and ruining 1,000 miles of coastline. Local residents and clean-up workers contracted cancer,[12] heart disease[13] and long-term respiratory conditions[14] from breathing in toxic dust and fumes. To this day it remains the worst ever oil spill in the US.

What happened with Deepwater Horizon is a second form of confirmation bias: *blinkered scepticism*. While naïve acceptance involves believing claims that we like and ignoring alternative explanations, blinkered scepticism involves rejecting claims that we dislike and inventing alternative explanations. Such fabrication is known as *motivated reasoning* – grasping at rival theories, no matter how far-fetched, to justify our initial conviction and dismiss the evidence. The US government's official report on the disaster concluded 'there is no such thing

as a "bladder effect" that could account for 'pressures the rig crew was observing'.[15] The report's chief counsel put it more bluntly: 'Every industry expert the investigative team met with dismissed the so-called bladder effect as a fiction.'[16]

Blinkered scepticism can apply even if we can't come up with an alternative explanation: we simply dismiss an inconvenient truth without any justification whatsoever. Silicon Valley Bank was the go-to financial institution for many Californian start-ups and saw its deposits triple between 2019 and 2021. They piled this spare cash into US Treasury Bonds – safe as houses in normal times, but their internal models predicted serious losses if interest rates rose. Rather than heeding this warning, their executives changed the models' assumptions so that they predicted minimal risks. As a former employee told the *Washington Post*, 'if they see a model they don't like, they scrap it'.[17]

SVB collapsed in March 2023, the victim of the very interest rate hikes their own models warned about. It was the second largest bank failure in US history, and it was entirely avoidable. Just like Deepwater Horizon, the company saw the iceberg straight ahead – but the bankers put on their blinkers and crashed right into it.

The evidence for confirmation bias

Why do we react so angrily to claims we don't like? Neuroscientists Jonas Kaplan, Sarah Gimbel and Sam Harris showed how confirmation bias is wired into our brain.[18] They took students with liberal political views and hooked them up to an fMRI* scanner. The researchers read out a political statement

* Functional magnetic resonance imaging.