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We are overwhelmed by information. Not only is the amount growing, but the *pace* of growth is ever-increasing. Buckminster Fuller, a systems theorist, noticed that until 1900 the sum of human knowledge doubled approximately every century. By the early 1950s, knowledge was doubling every 25 years. Now, with the rise of connected devices, that number will be further compressed with the data stream produced by the rise of connected 'Internet of Things' devices coming online.

At the same time, knowledge, which we build by absorbing and using information, remains essential for making decisions and taking action in all our endeavours. An increase in information is not the same as an increase in knowledge. And an increase in knowledge is not the same as an increase in actionable intelligence.

The amount of news is steadily increasing, but so is the amount of false, misleading or inaccurate information. Particularly in the age of social media, this is particularly dangerous, as misleading and false information spreads and disseminates oftentimes faster than any correction released afterwards.

In the 2016 US presidential election cycle, one incident in particular stood out. In the autumn of 2016, a number of right-leaning internet users fabricated rumours that the Democratic Party was linked to a paedophilia ring. In a country divided along partisan lines, the message fell on fruitful ground, and spread through forums such as 4chan and Reddit to a broader audience on social media. A pizza restaurant based in Washington DC, that was allegedly involved in this conspiracy, started receiving hundreds of threats from the theory's believers. In the end, it culminated in an incident in which an armed man entered the pizza parlour and shot three rounds from his AR-15-style rifle. Mercifully, no one was injured.

Fakes disguised as facts are an immense problem for society. At best, they are confusing and distracting and, at worst, they are deliberately misleading and manipulative. In this first part of the book, we will discuss how we collect data and observations that inform our opinions and decisions. We will focus on the cognitive distortions that cloud our view, make us ignore important facts and skew our beliefs about the world. Using specific examples, we will analyse the distortions and what is required to overcome them in a systematic way.

Unfortunately, our cognitive facilities are often limited by biases that make it difficult to gather the right information and use it effectively. Typically, we only notice information that confirms our existing preconceptions, and we surround ourselves with people who share our beliefs. This leads to a warped perspective that psychologists call 'confirmation bias'.[8] What we think about also informs a lot of what we see. People who think a lot about what clothes to wear also pay attention to other people's clothing choices. People who have recently read a news story about a plane crash overestimate the risk of plane crashes. We find it easiest to recall facts, objects or concepts that we have recently been reminded of. This bias is known as the 'availability heuristic'. Nobel Laureate Daniel Kahneman, who along with Amos Tversky, broke new ground in behavioural economics, calls this' WYSIATI – What You See Is All There Is.'[9]

Blind spots are tricky. Not only are we *missing information,* but we're also *not aware that we're missing it.* Our brain typically fills in the gaps by piecing together information to create a line of thought that skips over the blind spots. As a result, we believe that we've taken everything important into account in making a particular decision, even if we're missing critical pieces of the puzzle.

These cognitive flaws make us oblivious to the information we need to make smart decisions and prevent us from effectively using the information we do have. Still, there are some steps we can take to counter our cognitive limitations. In this part of the book, we will introduce strategies for uncovering your blind spots and correcting false beliefs.

Chapter One

Illuminate your blind spots

Admit what you don't know and correct your wrong beliefs

We're generally overconfident in our opinions and our impressions and judgments.

Daniel Kahneman, *Thinking, Fast and Slow*

////// BENEFITS OF THIS MENTAL TACTIC //////

Collecting and processing data is the first step in solving problems. However, the path towards building a robust and accurate 'fact base' as a basis for solid decision making is littered with pitfalls. This mental tactic helps you unmask your blind spots and calibrate the confidence you have in your beliefs.

Because of its fundamental nature, this mental tactic can be used whenever you are trying to understand and solve an analytical problem.

////// ADMIT WHAT YOU DON'T KNOW //////

When Jamie started driving cabs for a licensed taxi company in 2005, it seemed like a no-brainer. New York: the booming city of affluent professionals who need a ride everywhere, at all times of the day. In the beginning, he found himself easily making more than $200 per day. A few years later, he decided to double down on this lucrative opportunity. With his goal of financial independence in sight, he borrowed more than $250,000 to buy his own taxi medallion (licence system in the USA).

Ten years later, Jamie found himself unable to pay off his debt. As more and more passengers switched to apps such as Uber or Lyft, Jamie's daily salary dropped considerably. Even though he avoided the peak of medallion prices (in 2014 the market rate was well above a million dollars), he still shared the same fate as thousands of other taxi drivers who just didn't see the age of app services coming.[10] In June 2018, the *New York Post* reported that prices had fallen to $160,000–$250,000 each.[11]

The 'sharing economy' has flipped the world of mobility on its head. Getting into a car with an unknown person? Sleeping in a stranger's bed? Just a few years ago, this was unthinkable. Today, these models are mainstream and continue to hurt established players and businesses.

Is there a way of systematically uncovering one's blind spots and identifying wrong beliefs? That is exactly what this is about:
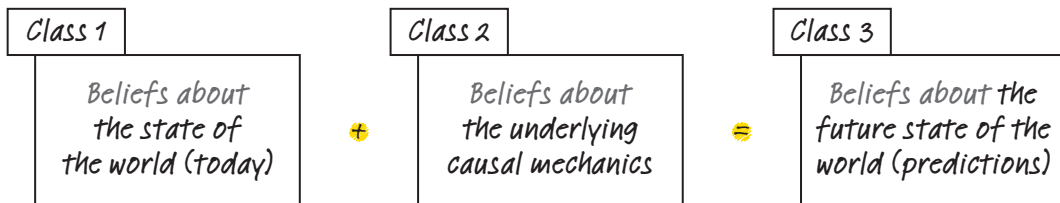
- First, how to detect true blind spots – areas devoid of information that are important for decision making.
- Second, how to spot and overcome incorrect beliefs.

Beliefs about the state and mechanics of the world

Hands-down the most important ingredient for problem solving and decision making is holding beliefs that are in accordance with fact and reality.

Our beliefs (or in the absence of beliefs, blind spots) fall into three categories (or classes):

1 **Beliefs about the current states of the world (today):** if you arrive at the airport at 7am, believing your flight departs at 8.20am when, in fact, it took off at 6.20am, you are holding wrong beliefs about the current state of the world (and were punished for it immediately by missing your plane).

2 **Beliefs about the causal mechanics of the world:** the incorrect belief that vaccinations could cause autism prevented many parents from immunising their children. Locally, this can lead to the immunisation rate falling below the threshold required to prevent communicable diseases from spreading. In some places, such as Minnesota, anti-vaccine activists managed to convince a critical number of parents not to vaccinate their children, which caused over 70 confirmed cases of measles in 2017.[12]

3 **Beliefs about future states of the world (predictions):** if you place a bet on a race horse winning, you believe in the relative strength of your favourite relative to its competition (Class 1) *and* in organised horse-racing as a reliable mechanism to accurately determine the racing times of horses (Class 2).

Class 1		Class 2		Class 3
Beliefs about the state of the world (today)	+	Beliefs about the underlying causal mechanics	⇌	Beliefs about the future state of the world (predictions)

As shown, the third class of belief is typically a function of the first two classes of beliefs (either implicitly or explicitly).

Let's revisit Jamie the taxi driver's situation. Which beliefs could have influenced his decision? He might have:

- underestimated customers' preferences for taxi-sharing services (Class 1) or the pace at which customers' preferences changed (Class 2)

- overestimated the ability of the taxi lobby to influence regulation towards maintaining the status quo (Class 1)

- overestimated the growth in city population, per-capita spending and the subsequent increase in demand of passenger miles (mix of Class 1 and Class 2).

Of course, at this point we can only speculate, but any or all of these beliefs could have prompted Jamie to predict a rosy future for the taxi industry and therefore invest in a taxi medallion.

Predictably wrong

Whenever we form beliefs about the state and mechanics of the world, uncertainty is involved in some form or another. This should not come as a surprise. We simply cannot know or process everything.

However, some of our cognitive limitations are structural (and hence predictable). They fool us again and again in similar ways, and distort our thinking. These limitations are known as cognitive biases and have attracted a growing community of scientists working in fields such as behavioural economics and neuroscience.

For example, it can be shown experimentally that we tend to:

- be influenced by the first bit of information we acquire about a certain topic and are unlikely to move away from it – the 'anchoring effect'

- update our beliefs insufficiently when presented with new evidence – the 'belief revision effect'

- completely neglect probability when making a decision under uncertainty.

We will take a more comprehensive look at some of the most important cognitive biases in the next chapter.[13]

Admitting to being wrong isn't fashionable

Not only are we biased in multiple ways, we are also subject to strong social norms that are difficult to overcome and change our views. Admitting to not knowing an answer or to being wrong is socially stigmatised. If a CIO quotes incorrect figures during quarterly performance reports, you can be sure they will be called to account. So-called strong leaders are often

perceived as strong simply because they refuse to voice natural human uncertainty. They are required to know the way and take bold leaps forward.[14]

It is typically not humility that is criticised, but an assumed mental attitude or capability. For example, saying "I don't know" might either be taken as "I'm not *able* to know" which could indicate cognitive limitations, or as "I don't *want* to know," which suggests a lack of motivation to find out.

////// DIFFERENT TYPES OF IGNORANCE //////

It helps to classify the different types of ignorance in order to spot them quickly. The following matrix separates truthfulness of belief and perceived level of confidence.

- **Truthfulness of belief:** is something you believe *objectively* true? Or is it false?

- **Level of confidence:** are you *highly confident* that you are holding a truthful belief, or is your confidence level *low*? For instance, do you know *for sure* that your co-worker will be promoted because his superior just confided it to you? Or is your belief just a wild guess based on speculations about your colleague's performance?

Level of confidence

	High	Low
True	"See? I was 100% sure all along"	"Turns out I was right –how lucky"
False	"Oops, I was so sure"	"Well, it was just a wild guess anyway"

Belief is …

As you navigate the world around you and make hundreds of decisions every day, you will find yourself most frequently in the top-left quadrant. To take a profane example: you can be pretty sure that the coffee-maker will not explode when you turn it on in the morning.

But be aware of the bottom-left quadrant, the hallmark of overconfidence. As the prices of residential homes continued to increase throughout the 1990s and the early 2000s, few people were aware of the risk of a slowdown (let alone crash). Yet that's exactly what happened, and it triggered a domino-effect of defaults and foreclosures, which took a heavy hit on banks and then the economy as a whole. Exposure to only one trend direction, namely upwards, made many investors complacent and overconfident.

Overconfidence is also at play when it comes to evaluating our own skills, which is known as the 'Dunning-Kruger effect'.[15] Those who are lower skilled often rate their skill level as very high, which means that they are essentially lacking the capability to correctly judge their performance. While there is some correlation between a person's estimation of their own skills and their actual competency, it is smaller than one might suppose: the top 25% of test-takers are underconfident in how well they did at a given test, while the bottom 25% of test-takers are overconfident.

What if we haven't formed a belief yet, possibly because we aren't aware of the existence of something? For example, you might not have gathered knowledge about the risks of Artificial Intelligence, simply due to a lack of awareness. The matrix below can be informative.

Let's start with the top-left quadrant, the 'known knowns'.[16] These are typically relatively straightforward situations that are both deterministic and display clear causal relationships. Problems and solutions in this field are typically undisputed. For example, take the example of a flat tyre on your car. Not only is it clear what the problem is (you will notice its deflation), but often the cause is visible as well (a nail or a rip). In addition, the problem *solution* is mostly undisputed: change your tyre.

Let's move on to the bottom-left quadrant, the 'known unknowns'. Typical examples for problems in this category are textbook questions. Hence, when you encounter them, expertise is the best remedy. Before reading the maths textbook chapter on integration you don't know how to integrate the formula, but after you work through it, it's easy to figure out the answer. On the surface, problems in this category can seem daunting and complicated, with multiple possible 'right' answers. But if you look past the fine details, you'll see that the type of problem has been solved before.

The third category in the bottom right are the real blind spots. These 'unknown unknowns' are arguably the trickiest ones. By its very definition, we don't know what we don't know. Hence, there can't be any specific advice on what to do with the items in this category, because they are simply unknown. However, there are creative ways of surfacing them. Using some of the approaches featured below will help you imagine the unimagined, and move unknown unknowns from the bottom-right to the bottom-left.

DETECTING BLIND SPOTS AND AVOIDING FALSE BELIEFS

1. Understand how your mind works

There are three mental enemies that make overcoming blind spots and changing incorrect beliefs particularly challenging. We have already touched on some of them above. Our mind has the tendency to:

- automatically look out for evidence *confirming* our preconceptions
- fill white spots with *well-sounding* (i.e. plausible and believable) stories
- be better at finding fault with what's in front of our eyes than finding out what's *missing*.

Let's talk about the first one. It is called 'selective cognition'. We tend to gather evidence that confirms our existing values and beliefs rather than evidence that challenges it. To overcome this, you need to be aware of what values you believe to be true and what beliefs about the world you hold. This is true for both your own perception and the media sources you chose to consume, but also the (social) media sources themselves.

Second, our mind masks white spots with well-sounding stories. And it does so not only before we make a decision, but also after it. In one fascinating experiment, scientists set up a tasting booth for tea and jam, and passers-by were asked which combination they pre-ferred after tasting. But after they made their decision, the participants were asked to sample again and verbally explain what led them to the choice they made. Unbeknown to them, by that time, the researchers had switched the contents of the jars, which now contained the exact *opposite* of what the test subjects chose. No more than a third of all participants noticed the switch.[17] Our mind quickly fills in the gaps, even if it doesn't quite match with our experience.

Finally, it is much easier to find fault with what is readily in front of our eyes, what is *known,* than it is to identify what is *missing.* This happens to your authors all the time, for example, when reviewing documents or presentations. Figuring out what is *missing* (what argument or assumption *should* be there but isn't) is an order of magnitude more difficult than *correcting* what is incorrect (for example, a false statement or illogical assumption).

2. Try to make the best possible argument for the other side

It is easy to fall in love with our own perspectives and world views. We create positions that suit us and then defend them. We get attached to them.

However, it is generally good practice to *make the best possible argument for the other side.* Give them the benefit of the doubt: let them (or yourself) make the best and most convincing argument for *why you are wrong.* The more you are engaged in trying to build *their case,* the more you are not only finding holes in your system of beliefs, but also enhancing your empathy for the other side. Daniel Dennett, a well-known thinker who explores the philosophy of mind and consciousness, wrote: "You should attempt to re-express your target's position so clearly, vividly, and fairly, that your target says, 'Thanks, I wish I'd thought of putting it that way.'"[18]

3. Be humble

Nurturing humility is one of the most effective ways of keeping overconfidence in check. Richard Feynman, the great physicist and educator, once said: "I'm smart enough to know I'm dumb."[19] Humility is about adjusting one's attitude towards admitting that one could be wrong, actively asking for advice, and finding ways to double-check beliefs and judgements.

4. Attach probabilities to your beliefs and regularly calibrate them

Instead of just comparing the instances in which you were right with the ones in which you thought you were, you can be more specific. One way to practise everyday humility when dealing with beliefs is to attach probabilities to them.

In the Appendix, we provide you with a proven confidence calibration method and showcase an example.

5. Place bets on your beliefs

There's a saying that talk is cheap – and in our social media-driven world, we're talking more than ever. It's easy to make unsupported claims or wild guesses about the world we live in when nothing is at stake. But what if we hold ourselves to higher standards, putting consequences in place to encourage us to think critically and probingly about our opinions?

One easy way to do this is to get into the habit of placing bets on our beliefs and predictions. If an expensive dinner or a hundred bucks depends on our accuracy, we might think more carefully about our answers. Alex Taborrok, a professor at George Mason University, put it neatly when he called bets "a tax on bullshit".[20]

6. Adopt a sceptic's mindset

Collins Dictionary's entry of the year 2017 was 'fake news'. Used as a weapon to attack unfavourable reports and the media at large, it spread quickly.

It's clear that we as problem solvers need to be on our guard against fake news. But first, we need to learn how to recognise it.

Claims should be analysed on two levels:

1 Is the claim *in itself* plausible?

2 Is the *source* trustworthy and not conflicted?

Let's start with the first point. We tend to use our intuitive knowledge of the world to assess how plausible a claim is. The better a claim fits with what we already believe of the world, the more plausible it is. The less it does, the more evidence it requires. In the words of Carl Sagan: "Extraordinary claims deserve extraordinary evidence."[21]

Now on to the second point. Can we trust the *source* of the information?

After research found links between sugar consumption and heart health, the sugar lobby in the USA (back then called the Sugar Research Foundation) ended the study and never published the results. Instead, one of the foundation's top executives, John Hickson, secretly paid two influential Harvard scientists to publish a paper shifting the blame to saturated fat.[22] This example shows how important it is to understand what *motivates* your source to put out a certain piece of information. Why go through the effort to say or publish something? What is the motivation of your source? Where does their funding come from? Even more importantly, who benefits from it?

Motivations don't need to be that nefarious: take publication bias in science. It is well documented that scientists tend to publish only articles that show significant positive results.[23] In other words, the outcome of a study determines to some extent its likelihood of publication. This behaviour is completely rational from both the scientist's and the journal's point of view, but leads to a disturbed balance of scientific findings and hence a distorted 'scientific consensus' on important scientific matters.

In addition to the motivation, ask yourself if the source is *able* to deliver a true statement. Is it *capable* of doing the research and analysis necessary to arrive at trustworthy information? Just as you might not trust a drunk person to give you accurate directions when asking for the way, you might not want to go to a spiritual healer with little classical medical education when you've broken your leg.

7. Tap into other people's minds

As we have argued above, we tend to favour one interpretation too early in the process of problem solving and don't change our beliefs when faced with counter-evidence. We accept stories and narrative explanations, but disregard observations that call for alternative interpretations. The solution for this inherent bias is simple: tap into other people's minds for help.

Chances are you deal with other people in your job on a daily basis. Most likely, they will not have the same blind spots as you, as everyone's life path is different. By designating different roles for them to play, you can use their analytical focus deliberately to check beliefs. Here are two specific 'hats' that worked well in team settings:

- **The devil's advocate:** this is a particularly critical team member who, first and foremost, points out the problems and risks of an approach. They do not necessarily disbelieve the proposition, but are focused on testing its validity. They find new evidence that you might not know and might not be motivated to seek out in the first place. A similar exercise is establishing what the CIA and government contractors have termed 'red teams' or 'red cells'. These are independent groups that purposely challenge incumbent opinions or viewpoints in order to detect flaws, blind spots or other shortcomings. The CIA created them in the aftermath of the 9/11 attacks and they have proved to be an influential asset.[24]

- **The fact-checker:** they bring to light hidden assumptions in statements, and double-check facts. As opposed to the devil's advocate, the fact-checker does not necessarily take a position contrary to yours. Their role is simply to dig deeper, surface implicit premises, compare statements with evidence and inject facts into the conversation.

Don't expect people to play these roles organically. Particularly in hierarchical settings, there are few incentives to raise critical points. It is better to deliberately nominate people to fill these roles. You may also think about rotating roles frequently, say for each team meeting. This will not only benefit your job at hand, but also allow those who play the roles to become more attentive, critical thinkers.

////////////// THE BOTTOM LINE //////////////

Humans don't have a built-in mechanism to detect false beliefs, or to be good at acknowledging what we don't know. Instead, we typically look for evidence to confirm our biases, and make up satisfying stories to fill in the gaps. To be a good problem solver, it is paramount to regularly review your belief system, calibrate confidence levels and actively practise humility.