underweigh small probabilities when they engage in sequential experiments in which *they derive the probabilities themselves*, when they are not supplied with the odds. If you draw from an urn with a very small number of red balls and a high number of black ones, and if you do not have a clue about the relative proportions, you are likely to underestimate the number of red balls. It is only when you are supplied with their frequency—say, by telling you that 3 percent of the balls are red—that you overestimate it in your betting decision.

I've spent a lot of time wondering how we can be so myopic and shorttermist yet survive in an environment that is not entirely from Mediocristan. One day, looking at the gray beard that makes me look ten years older than I am and thinking about the pleasure I derive from exhibiting it, I realized the following. Respect for elders in many societies might be a kind of compensation for our shortterm memory. The word *senate* comes from *senatus*, "aged" in Latin; *sheikh* in Arabic means both a member of the ruling elite and "elder." Elders are repositories of complicated inductive learning that includes information about rare events. Elders can scare us with stories—which is why we become overexcited when we think of a *specific* Black Swan. I was excited to find out that this also holds true in the animal kingdom: a paper in *Science* showed that elephant matriarchs play the role of superadvisers on rare events.

We learn from repetition—at the expense of events that have not happened before. Events that are nonrepeatable are ignored before their occurrence, and overestimated after (for a while). After a Black Swan, such as September 11, 2001, people expect it to recur when in fact the odds of that happening have arguably been lowered. We like to think about *specific* and known Black Swans when in fact the very nature of randomness lies in its abstraction. As I said in the Prologue, it is the wrong definition of a god.

The economist Hyman Minsky sees the cycles of risk taking in the economy as following a pattern: stability and absence of crises encourage risk taking, complacency, and lowered awareness of the possibility of problems. Then a crisis occurs, resulting in people being shell-shocked and scared of investing their resources. Strangely, both Minsky and his school, dubbed Post-Keynesian, and his opponents, the libertarian "Austrian" economists, have the same analysis, except that the first group recommends governmental intervention to smooth out the cycle, while the second believes that civil servants should not be trusted to deal with such matters. While both schools of thought seem to fight each other, they both emphasize fundamental uncertainty and stand outside the

mainstream economic departments (though they have large followings among businessmen and nonacademics). No doubt this emphasis on fundamental uncertainty bothers the Platonifiers.

All the tests of probability I discussed in this section are important; they show how we are fooled by the rarity of Black Swans but not by the role they play in the aggregate, their *impact*. In a preliminary study, the psychologist Dan Goldstein and I subjected students at the London Business School to examples from two domains, Mediocristan and Extremistan. We selected height, weight, and Internet hits per website. The subjects were good at guessing the role of rare events in Mediocristan-style environments. But their intuitions failed when it came to variables outside Mediocristan, showing that we are effectively not skilled at intuitively gauging the impact of the improbable, such as the contribution of a blockbuster to total book sales. In one experiment they underestimated by thirty-three times the *effect* of a rare event.

Next, let us see how this lack of understanding of abstract matters affects us.

The Pull of the Sensational

Indeed, abstract statistical information does not sway us as much as the anecdote —no matter how sophisticated the person. I will give a few instances.

The Italian Toddler. In the late 1970s, a toddler fell into a well in Italy. The rescue team could not pull him out of the hole and the child stayed at the bottom of the well, helplessly crying. Understandably, the whole of Italy was concerned with his fate; the entire country hung on the frequent news updates. The child's cries produced acute pains of guilt in the powerless rescuers and reporters. His picture was prominently displayed on magazines and newspapers, and you could hardly walk in the center of Milan without being reminded of his plight.

Meanwhile, the civil war was raging in Lebanon, with an occasional hiatus in the conflict. While in the midst of their mess, the Lebanese were also absorbed in the fate of that child. The *Italian* child. Five miles away, people were dying from the war, citizens were threatened with car bombs, but the fate of the Italian child ranked high among the interests of the population in the Christian quarter of Beirut. "Look how cute that poor thing is," I was told. And the entire town expressed relief upon his eventual rescue.

As Stalin, who knew something about the business of mortality, supposedly said, “One death is a tragedy; a million is a statistic.” Statistics stay silent in us.

Terrorism kills, but the biggest killer remains the environment, responsible for close to 13 million deaths annually. But terrorism causes outrage, which makes us overestimate the likelihood of a potential terrorist attack—and react more violently to one when it happens. We feel the sting of man-made damage far more than that caused by nature.

Central Park. You are on a plane on your way to spend a long (bibulous) weekend in New York City. You are sitting next to an insurance salesman who, being a salesman, cannot stop talking. For him, *not talking* is the effortful activity. He tells you that his cousin (with whom he will celebrate the holidays) worked in a law office with someone whose brother-in-law’s business partner’s twin brother was mugged and killed in Central Park. Indeed, Central Park in glorious New York City. That was in 1989, if he remembers it well (the year is now 2007). The poor victim was only thirty-eight and had a wife and three children, one of whom had a birth defect and needed special care at Cornell Medical Center. Three children, one of whom needed special care, lost their father because of his foolish visit to Central Park.

Well, you are likely to avoid Central Park during your stay. You know you can get crime statistics from the Web or from any brochure, rather than anecdotal information from a verbally incontinent salesman. But you can’t help it. For a while, the name Central Park will conjure up the image of that that poor, undeserving man lying on the polluted grass. It will take a lot of statistical information to override your hesitation.

Motorcycle Riding. Likewise, the death of a relative in a motorcycle accident is far more likely to influence your attitude toward motorcycles than volumes of statistical analyses. You can effortlessly look up accident statistics on the Web, but they do not easily come to mind. Note that I ride my red Vespa around town, since no one in my immediate environment has recently suffered an accident—although I am aware of this problem in logic, I am incapable of acting on it.

Now, I do not disagree with those recommending the use of a narrative to get attention. Indeed, our consciousness may be linked to our ability to concoct some form of story about ourselves. It is just that narrative can be lethal when

used in the wrong places.

THE SHORTCUTS

Next I will go beyond narrative to discuss the more general attributes of thinking and reasoning behind our crippling shallowness. These defects in reasoning have been cataloged and investigated by a powerful research tradition represented by a school called the Society of Judgment and Decision Making (the only academic and professional society of which I am a member, and proudly so; its gatherings are the only ones where I do not have tension in my shoulders or anger fits). It is associated with the school of research started by Daniel Kahneman, Amos Tversky, and their friends, such as Robyn Dawes and Paul Slovic. It is mostly composed of empirical psychologists and cognitive scientists whose methodology hews strictly to running very precise, controlled experiments (physics-style) on humans and making catalogs of how people react, with minimal theorizing. They look for regularities. Note that empirical psychologists use the bell curve to gauge errors in their testing methods, but as we will see more technically in Chapter 15, this is one of the rare adequate applications of the bell curve in social science, owing to the nature of the experiments. We have seen such types of experiments earlier in this chapter with the flood in California, and with the identification of the confirmation bias in Chapter 5. These researchers have mapped our activities into (roughly) a dual mode of thinking, which they separate as "System 1" and "System 2," or the *experiential* and the *cogitative*. The distinction is straightforward.

System 1, the experiential one, is effortless, automatic, fast, opaque (we do not know that we are using it), parallel-processed, and can lend itself to errors. It is what we call "intuition," and performs these quick acts of prowess that became popular under the name *blink*, after the title of Malcolm Gladwell's bestselling book. System 1 is highly emotional, precisely because it is quick. It produces shortcuts, called "heuristics," that allow us to function rapidly and effectively. Dan Goldstein calls these heuristics "fast and frugal." Others prefer to call them "quick and dirty." Now, these shortcuts are certainly virtuous, since they are rapid, but, at times, they can lead us into some severe mistakes. This main idea generated an entire school of research called the *heuristics and biases* approach (heuristics corresponds to the study of shortcuts, biases stand for mistakes).

System 2, the cogitative one, is what we normally call *thinking*. It is what you use in a classroom, as it is effortful (even for Frenchmen), reasoned, slow, logical, serial, progressive, and self-aware (you can follow the steps in your reasoning). It makes fewer mistakes than the experiential system, and, since you know how you derived your result, you can retrace your steps and correct them in an adaptive manner.

Most of our mistakes in reasoning come from using System 1 when we are in fact thinking that we are using System 2. How? Since we react without thinking and introspection, the main property of System 1 is our lack of awareness of using it!

Recall the round-trip error, our tendency to confuse "no evidence of Black Swans" with "evidence of no Black Swans;" it shows System 1 at work. You have to make an effort (System 2) to override your first reaction. Clearly Mother Nature makes you use the fast System 1 to get out of trouble, so that you do not sit down and cogitate whether there is truly a tiger attacking you or if it is an optical illusion. You run immediately, before you become "conscious" of the presence of the tiger.

Emotions are assumed to be the weapon System 1 uses to direct us and force us to act quickly. It mediates risk avoidance far more effectively than our cognitive system. Indeed, neurobiologists who have studied the emotional system show how it often reacts to the presence of danger long before we are consciously aware of it—we experience fear and start reacting a few milliseconds before we realize that we are facing a snake.

Much of the trouble with human nature resides in our inability to use much of System 2, or to use it in a prolonged way without having to take a long beach vacation. In addition, we often just forget to use it.

Beware the Brain

Note that neurobiologists make, roughly, a similar distinction to that between System 1 and System 2, except that they operate along anatomical lines. Their distinction differentiates between parts of the brain, the *cortical* part, which we are supposed to use for thinking, and which distinguishes us from other animals, and the fast-reacting *limbic* brain, which is the center of emotions, and which we share with other mammals.

As a skeptical empiricist, I do not want to be the turkey, so I do not want to

focus solely on specific organs in the brain, since we do not observe brain functions very well. Some people try to identify what are called the neural correlates of, say, decision making, or more aggressively the neural "substrates" of, say, memory. The brain might be more complicated machinery than we think; its anatomy has fooled us repeatedly in the past. We can, however, assess regularities by running precise and thorough experiments on how people react under certain conditions, and keep a tally of what we see.

For an example that justifies skepticism about unconditional reliance on neurobiology, and vindicates the ideas of the empirical school of medicine to which Sextus belonged, let's consider the intelligence of birds. I kept reading in various texts that the cortex is where animals do their "thinking," and that the creatures with the largest cortex have the highest intelligence—we humans have the largest cortex, followed by bank executives, dolphins, and our cousins the apes. Well, it turns out that some birds, such as parrots, have a high level of intelligence, equivalent to that of dolphins, but that the intelligence of birds correlates with the size of another part of the brain, called the hyperstriatum. So neurobiology with its attribute of "hard science" can sometimes (though not always) fool you into a Platonified, reductive statement. I am amazed that the "empirics," skeptical about links between anatomy and function, had such insight—no wonder their school played a very small part in intellectual history. As a skeptical empiricist I prefer the experiments of empirical psychology to the theories-based MRI scans of neurobiologists, even if the former appear less "scientific" to the public.

How to Avert the Narrative Fallacy

I'll conclude by saying that our misunderstanding of the Black Swan can be largely attributed to our using System 1, i.e., narratives, and the sensational—as well as the emotional—which imposes on us a wrong map of the likelihood of events. On a day-to-day basis, we are not introspective enough to realize that we understand what is going on a little less than warranted from a dispassionate observation of our experiences. We also tend to forget about the notion of Black Swans immediately after one occurs—since they are too abstract for us—focusing, rather, on the precise and vivid events that easily come to our minds. We do worry about Black Swans, just the wrong ones.

Let me bring Mediocristan into this. In Mediocristan, narratives seem to work

—the past is likely to yield to our inquisition. But not in Extremistan, where you do not have repetition, and where you need to remain suspicious of the sneaky past and avoid the easy and obvious narrative.

Given that I have lived largely deprived of information, I've often felt that I inhabit a different planet than my peers, which can sometimes be extremely painful. It's like they have a virus controlling their brains that prevents them from seeing things going forward—the Black Swan around the corner.

The way to avoid the ills of the narrative fallacy is to favor experimentation over storytelling, experience over history, and clinical knowledge over theories. Certainly the newspaper cannot perform an experiment, but it can choose one report over another—there is plenty of empirical research to present and interpret from—as I am doing in this book. Being empirical does not mean running a laboratory in one's basement: it is just a mind-set that favors a certain class of knowledge over others. I do not forbid myself from using the word *cause*, but the causes I discuss are either bold speculations (presented as such) or the result of experiments, not stories.

Another approach is to predict and keep a tally of the predictions.

Finally, there may be a way to use a narrative—but for a good purpose. Only a diamond can cut a diamond; we can use our ability to convince with a story that conveys the right message—what storytellers seem to do.

So far we have discussed two internal mechanisms behind our blindness to Black Swans, the confirmation bias and the narrative fallacy. The next chapters will look into an external mechanism: a defect in the way we receive and interpret recorded events, and a defect in the way we act on them.

---

* The word *the* is written twice.

* The Parisian novelist Georges Perec tried to break away from narrative and attempted to write a book as large as the world. He had to settle for an exhaustive account of what happened on the Place Saint-Sulpice between October 18 and October 20, 1974. Even so, his account was not so exhaustive, and he ended up with a narrative.

* Such tests avoid both the narrative fallacy and much of the confirmation bias, since testers are obliged to take into account the failures as well as the successes of their experiments.

Chapter Seven

LIVING IN THE ANTECHAMBER OF HOPE

*How to avoid watercoolers—Select your brother-in-law—Yevgenia's favorite book—What deserts can and cannot deliver—On the avoidance of hope—*El desierto de los tártaros*—The virtues of slow motion*

Assume that, like Yevgenia, your activities depend on a Black Swan surprise—i.e., you are a reverse turkey. Intellectual, scientific, and artistic activities belong to the province of Extremistan, where there is a severe concentration of success, with a very small number of winners claiming a large share of the pot. This seems to apply to all professional activities I find nondull and "interesting" (I am still looking for a single counterexample, a nondull activity that belongs to Mediocristan).

Acknowledging the role of this concentration of success, and acting accordingly, causes us to be punished twice: we live in a society where the reward mechanism is based on the illusion of the regular; our hormonal reward system also needs tangible and steady results. It too thinks that the world is steady and well behaved—it falls for the confirmation error. The world has changed too fast for our genetic makeup. We are alienated from our environment.

PEER CRUELTY

Every morning you leave your cramped apartment in Manhattan's East Village to go to your laboratory at the Rockefeller University in the East Sixties. You return in the late evening, and people in your social network ask you if you had a good day, just to be polite. At the laboratory, people are more tactful. Of course you did not have a good day; you found nothing. You are not a watch repairman. Your *finding nothing* is very valuable, since it is part of the process of discovery —hey, you know where *not* to look. Other researchers, knowing your results, would avoid trying your special experiment, provided a journal is thoughtful enough to consider your "found nothing" as information and publish it.

Meanwhile your brother-in-law is a salesman for a Wall Street firm, and keeps getting large commissions—large and steady commissions. "He is doing very well," you hear, particularly from your father-in-law, with a small pensive nanosecond of silence after the utterance—which makes you realize that he just made a comparison. It was involuntary, but he made one.

Holidays can be terrible. You run into your brother-in-law at family reunions and, invariably, detect unmistakable signs of frustration on the part of your wife, who, briefly, fears that she married a loser, before remembering the logic of your profession. But she has to fight her first impulse. Her sister will not stop talking about their renovations, their new wallpaper. Your wife will be a little more silent than usual on the drive home. This sulking will be made slightly worse because the car you are driving is rented, since you cannot afford to garage a car in Manhattan. What should you do? Move to Australia and thereby make family reunions less frequent, or switch brothers-in-laws by marrying someone with a less "successful" brother?

Or should you dress like a hippie and become defiant? That may work for an artist, but not so easily for a scientist or a businessman. You are trapped.

You work on a project that does not deliver immediate or steady results; all the while, people around you work on projects that do. You are in trouble. Such is the lot of scientists, artists, and researchers lost in society rather than living in an insulated community or an artist colony.

Positive lumpy outcomes, for which we either collect big or get nothing, prevail in numerous occupations, those invested with a sense of mission, such as

doggedly pursuing (in a smelly laboratory) the elusive cure for cancer, writing a book that will change the way people view the world (while living hand to mouth), making music, or painting miniature icons on subway trains and considering it a higher form of art despite the diatribes of the antiquated "scholar" Harold Bloom.

If you are a researcher, you will have to publish inconsequential articles in "prestigious" publications so that others say hello to you once in a while when you run into them at conferences.

If you run a public corporation, things were great for you before you had shareholders, when you and your partners were the sole owners, along with savvy venture capitalists who understood uneven results and the lumpy nature of economic life. But now you have a slow-thinking thirty-year-old security analyst at a downtown Manhattan firm who "judges" your results and reads too much into them. He likes routine rewards, and the last thing you can deliver are routine rewards.

Many people labor in life under the impression that they are doing something right, yet they may not show solid results for a long time. They need a capacity for continuously adjourned gratification to survive a steady diet of peer cruelty without becoming demoralized. They look like idiots to their cousins, they look like idiots to their peers, they need courage to continue. No confirmation comes to them, no validation, no fawning students, no Nobel, no Shnobel. "How was your year?" brings them a small but containable spasm of pain deep inside, since almost all of their years will seem wasted to someone looking at their life from the outside. Then bang, the lumpy event comes that brings the grand vindication. Or it may never come.

Believe me, it is tough to deal with the social consequences of the appearance of continuous failure. We are social animals; hell is other people.

Where the Relevant Is the Sensational

Our intuitions are not cut out for nonlinearities. Consider our life in a primitive environment where process and result are closely connected. You are thirsty; drinking brings you adequate satisfaction. Or even in a not-so-primitive environment, when you engage in building, say, a bridge or a stone house, more work will lead to more apparent results, so your mood is propped up by visible continuous feedback.

In a primitive environment, the relevant *is* the sensational. This applies to our knowledge. When we try to collect information about the world around us, we tend to be guided by our biology, and our attention flows effortlessly toward the sensational—not the relevant so much as the sensational. Somehow the guidance system has gone wrong in the process of our coevolution with our habitat—it was transplanted into a world in which the relevant is often boring, nonsensational.

Furthermore, we think that if, say, two variables are causally linked, then a steady input in one variable should *always* yield a result in the other one. Our emotional apparatus is designed for linear causality. For instance, if you study every day, you expect to learn something in proportion to your studies. If you feel that you are not going anywhere, your emotions will cause you to become demoralized. But modern reality rarely gives us the privilege of a satisfying, linear, positive progression: you may think about a problem for a year and learn nothing; then, unless you are disheartened by the emptiness of the results and give up, something will come to you in a flash.

Researchers spent some time dealing with this notion of gratification; neurology has been enlightening us about the tension between the notions of immediate rewards and delayed ones. Would you like a massage today, or two next week? Well, the news is that the logical part of our mind, that "higher" one, which distinguishes us from animals, can override our animal instinct, which asks for immediate rewards. So we are a little better than animals, after all—but perhaps not by much. And not all of the time.

Nonlinearities

The situation can get a little more tragic—the world is more nonlinear than we think, and than scientists would like to think.

With linearities, relationships between variables are clear, crisp, and constant, therefore Platonically easy to grasp in a single sentence, such as "A 10 percent increase in money in the bank corresponds to a 10 percent increase in interest income and a 5 percent increase in obsequiousness on the part of the personal banker." If you have more money in the bank, you get more interest. Nonlinear relationships can vary; perhaps the best way to describe them is to say that they cannot be expressed verbally in a way that does justice to them. Take the relationship between pleasure and drinking water. If you are in a state of painful

thirst, then a bottle of water increases your well-being significantly. More water means more pleasure. But what if I gave you a cistern of water? Clearly your well-being becomes rapidly insensitive to further quantities. As a matter of fact, if I gave you the choice between a bottle or a cistern you would prefer the bottle —so your enjoyment *declines* with additional quantities.

These nonlinear relationships are ubiquitous in life. Linear relationships are truly the exception; we only focus on them in classrooms and textbooks because they are easier to understand. Yesterday afternoon I tried to take a fresh look around me to catalog what I could see during my day that was linear. I could not find anything, no more than someone hunting for squares or triangles could find them in the rain forest—or, as we will see in Part Three, any more than someone looking for bell-shape randomness finding it in socioeconomic phenomena.

You play tennis every day with no improvement, then suddenly you start beating the pro.

Your child does not seem to have a learning impediment, but he does not seem to want to speak. The schoolmaster pressures you to start considering "other options," namely therapy. You argue with her to no avail (she is supposed to be the "expert"). Then, suddenly, the child starts composing elaborate sentences, perhaps a bit too elaborate for his age group. I will repeat that linear progression, a Platonic idea, is not the norm.

Process over Results

We favor the sensational and the extremely visible. This affects the way we judge heroes. There is little room in our consciousness for heroes who do not deliver visible results—or those heroes who focus on process rather than results.

However, those who claim that they value process over result are not telling the whole truth, assuming of course that they are members of the human species. We often hear the semi-lie that writers do not write for glory, that artists create for the sake of art, because the activity is "its own reward." True, these activities can generate a steady flow of autosatisfaction. But this does not mean that artists do not crave some form of attention, or that they would not be better off if they got some publicity; it does not mean that writers do not wake up early Saturday morning to check if *The New York Times Book Review* has featured their work, even if it is a very long shot, or that they do not keep checking their mailbox for that long-awaited reply from *The New Yorker*. Even a philosopher the caliber of

Hume spent a few weeks sick in bed after the trashing of his masterpiece (what later became known as his version of the Black Swan problem) by some dim-thinking reviewer—whom he knew to be wrong and to have missed his whole point.

Where it gets painful is when you see one of your peers, whom you despise, heading to Stockholm for his Nobel reception.

Most people engaged in the pursuits that I call "concentrated" spend most of their time waiting for the big day that (usually) never comes.

True, this takes your mind away from the pettiness of life—the cappuccino that is too warm or too cold, the waiter too slow or too intrusive, the food too spicy or not enough, the overpriced hotel room that does not quite resemble the advertised picture—all these considerations disappear because you have your mind on much bigger and better things. But this does not mean that the person insulated from materialistic pursuits becomes impervious to other pains, those issuing from disrespect. Often these Black Swan hunters feel shame, or are made to feel shame, at not contributing. "You betrayed those who had high hopes for you," they are told, increasing their feeling of guilt. The problem of lumpy payoffs is not so much in the lack of income they entail, but the pecking order, the loss of dignity, the subtle humiliations near the watercooler.

It is my great hope someday to see science and decision makers rediscover what the ancients have always known, namely that our highest currency is respect.

Even economically, the individual Black Swan hunters are not the ones who make the bucks. The researcher Thomas Astebro has shown that returns on independent inventions (you take the cemetery into account) are far lower than those on venture capital. Some blindness to the odds or an obsession with their own positive Black Swan is necessary for entrepreneurs to function. The venture capitalist is the one who gets the shekels. The economist William Baumol calls this "a touch of madness." This may indeed apply to all concentrated businesses: when you look at the empirical record, you not only see that venture capitalists do better than entrepreneurs, but publishers do better than writers, dealers do better than artists, and science does better than scientists (about 50 percent of scientific and scholarly papers, costing months, sometimes years, of effort, are never truly read). The person involved in such gambles is paid in a currency other than material success: hope.

Human Nature, Happiness, and Lumpy Rewards

Let me distill the main idea behind what researchers call hedonic happiness.

Making $1 million in one year, but nothing in the preceding nine, does not bring the same pleasure as having the total evenly distributed over the same period, that is, $100,000 every year for ten years in a row. The same applies to the inverse order—making a bundle the first year, then nothing for the remaining period. Somehow, your pleasure system will be saturated rather quickly, and it will not carry forward the hedonic balance like a sum on a tax return. As a matter of fact, your happiness depends far more on the number of instances of positive feelings, what psychologists call "positive affect," than on their intensity when they hit. In other words, good news is good news first; *how* good matters rather little. So to have a pleasant life you should spread these small "affects" across time as evenly as possible. Plenty of mildly good news is preferable to one single lump of great news.

Sadly, it may be even worse for you to make $10 million, then lose back nine, than to making nothing at all! True, you may end up with a million (as compared to nothing), but it may be better had you got zilch. (This assumes, of course, that you care about financial rewards.)

So from a narrowly defined accounting point of view, which I may call here "hedonic calculus," it does not pay to shoot for one large win. Mother Nature destined us to derive enjoyment from a steady flow of pleasant small, but frequent, rewards. As I said, the rewards do not have to be large, just frequent—a little bit here, a little bit there. Consider that our major satisfaction for thousands of years came in the form of food and water (and something else more private), and that while we need these steadily, we quickly reach saturation.

The problem, of course, is that we do not live in an environment where results are delivered in a steady manner—Black Swans dominate much of human history. It is unfortunate that the right strategy for our current environment may not offer *internal* rewards and positive feedback.

The same property in reverse applies to our unhappiness. It is better to lump all your pain into a brief period rather than have it spread out over a longer one.

But some people find it possible to transcend the asymmetry of pains and joys, escape the hedonic deficit, set themselves outside that game—and live with hope. There is some good news, as we see next.

The Antechamber of Hope

For Yevgenia Krasnova, a person could love one book, at most a few—beyond this was a form of promiscuity. Those who talk about books as commodities are inauthentic, just as those who collect acquaintances can be superficial in their friendships. A novel you like resembles a friend. You read it and reread it, getting to know it better. Like a friend, you accept it the way it is; you do not judge it. Montaigne was asked "why" he and the writer Etienne de la Boétie were friends—the kind of question people ask you at a cocktail party as if you knew the answer, or as if there were an answer to know. It was typical of Montaigne to reply, "Parce que c'était lui, parce que c'était moi" (because it was him and because it was me). Likewise, Yevgenia claims that she likes that *one* book "because it is it and because I am me." Yevgenia once even walked out on a schoolteacher because he analyzed that book and thus violated her rule. One does not sit idle listening as people wax analytical about your friends. A very stubborn schoolchild she was.

This book she has as a friend is *Il deserto dei tartari*, by Dino Buzzati, a novel that was well known in Italy and France during her childhood, but that, strangely, nobody she knows in America had heard of. Its English title is mistranslated as *The Tartar Steppe* instead of *The Desert of the Tartars*.

Yevgenia encountered *Il deserto* when she was thirteen, in her parents' weekend country house in a small village two hundred kilometers outside Paris, where their Russian and French books multiplied without the constraints of the overfed Parisian apartment. She was so bored in the country that she could not even read. Then, one afternoon, she opened the book and was sucked into it.

Inebriated by Hope

Giovanni Drogo is a man of promise. He has just graduated from the military academy with the rank of junior officer, and active life is just starting. But things do not turn out as planned: his initial four-year assignment is a remote outpost, the Bastiani fortress, protecting the nation from the Tartars likely to invade from the border desert—not too desirable a position. The fortress is located a few days by horseback from the town; there is nothing but bareness around it—none of the social buzz that a man of his age could look forward to. Drogo thinks that his assignment in the outpost is temporary, a way for him to pay his dues before more appealing positions present themselves. Later, back in town, in his

impeccably ironed uniform and with his athletic figure, few ladies will be able to resist him.

What is Drogo to do in this hole? He discovers a loophole, a way to be transferred after only four months. He decides to use the loophole.

At the very last minute, however, Drogo takes a glance at the desert from the window of the medical office and decides to extend his stay. Something in the walls of the fort and the silent landscape ensnares him. The appeal of the fort and waiting for the attackers, the big battle with the ferocious Tartars, gradually become his only reason to exist. The entire atmosphere of the fort is one of anticipation. The other men spend their time looking at the horizon and awaiting the big event of the enemy attack. They are so focused that, on rare occasions, they can detect the most insignificant stray animal that appears at the edge of the desert and mistake it for an enemy attack.

Sure enough, Drogo spends the rest of his life extending his stay, delaying the beginning of his life in the city—thirty-five years of pure hope, spent in the grip of the idea that one day, from the remote hills that no human has ever crossed, the attackers will eventually emerge and help him rise to the occasion.

At the end of the novel we see Drogo dying in a roadside inn as the event for which he has waited all his life takes place. He has missed it.

The Sweet Trap of Anticipation

Yevgenia read *Il deserto* numerous times; she even learned Italian (and perhaps married an Italian) so she could read it in the original. Yet she never had the heart to reread the painful ending.

I presented the Black Swan as the outlier, the important event that is not expected to happen. But consider the opposite: the unexpected event that *you very badly want to happen*. Drogo is obsessed and blinded by the possibility of an unlikely event; that rare occurrence is his raison d'être. At thirteen, when she encountered the book, little did Yevgenia know that she would spend an entire life playing Giovanni Drogo in the antechamber of hope, waiting for the big event, sacrificing for it, and refusing intermediate steps, the consolation prizes.

She did not mind the sweet trap of anticipation: to her it was a life worth living; it was worth living in the cathartic simplicity of a single purpose. Indeed, "be careful what you wish for": she may have been happier before the Black

Swan of her success than after.

One of the attributes of a Black Swan is an asymmetry in consequences—either positive or negative. For Drogo the consequences were thirty-five years spent waiting in the antechamber of hope for just a few randomly distributed hours of glory—which he ended up missing.

When You Need the Bastiani Fortress

Note that there was no brother-in-law around in Drogo's social network. He was lucky to have companions in his mission. He was a member of a community at the gate of the desert intently looking together at the horizon. Drogo had the advantage of an association with peers and the avoidance of social contact with others outside the community. We are local animals, interested in our immediate neighborhood—even if people far away consider us total idiots. Those homo sapiens are abstract and remote and we do not care about them because we do not run into them in elevators or make eye contact with them. Our shallowness can sometimes work for us.

It may be a banality that we need others for many things, but we need them far more than we realize, particularly for dignity and respect. Indeed, we have very few historical records of people who have achieved anything extraordinary without such peer validation—but we have the freedom to choose our peers. If we look at the history of ideas, we see schools of thought occasionally forming, producing unusual work unpopular outside the school. You hear about the Stoics, the Academic Skeptics, the Cynics, the Pyrrhonian Skeptics, the Essenes, the Surrealists, the Dadaists, the anarchists, the hippies, the fundamentalists. A school allows someone with unusual ideas with the remote possibility of a payoff to find company and create a microcosm insulated from others. The members of the group can be ostracized together—which is better than being ostracized alone.

If you engage in a Black Swan–dependent activity, it is better to be part of a group.

EL DESIERTO DE LOS TÁRTAROS

Yevgenia met Nero Tulip in the lobby of the Hotel Danieli in Venice. He was a trader who lived between London and New York. At the time, traders from London went to Venice on Friday noon during the low season, just to talk to other traders (from London).

As Yevgenia and Nero stood engaged in an effortless conversation, she noticed that her husband was looking uncomfortably at them from the bar where he sat, trying to stay focused on the pontifications of one of his childhood friends. Yevgenia realized that she was going to see a bit more of Nero.

They met again in New York, first in a clandestine way. Her husband, being a philosophy professor, had too much time on his hands, so he started paying close attention to her schedule and became clingy. The clingier he got, the more stifled Yevgenia felt, which made him even clingier. She dumped him, called her lawyer who was by then expecting to hear from her, and saw more of Nero openly.

Nero had a stiff gait since he was recovering from a helicopter crash—he gets a little too arrogant after episodes of success and starts taking uncalculated physical risks, though he remains financially hyperconservative, even paranoid. He had spent months immobile in a London hospital, hardly able to read or write, trying to resist having to watch television, teasing the nurses, and waiting for his bones to heal. He can draw the ceiling with its fourteen cracks from memory, as well as the shabby white building across the street with its sixty-three windowpanes, all in need of professional cleaning.

Nero claimed that he was comfortable in Italian when he drank, so Yevgenia gave him a copy of *Il deserto*. Nero did not read novels—"Novels are fun to write, not read," he claimed. So he left the book by his bedside for a while.

Nero and Yevgenia were, in a sense, like night and day. Yevgenia went to bed at dawn, working on her manuscripts at night. Nero rose at dawn, like most traders, even on weekends. He then worked for an hour on his opus, *Treatise on Probability*, and never touched it again after that. He had been writing it for a decade and felt rushed to finish it only when his life was threatened. Yevgenia smoked; Nero was mindful of his health, spending at least an hour a day at the gym or in the pool. Yevgenia hung around intellectuals and bohemians; Nero often felt comfortable with street-smart traders and businessmen who had never

been to college and spoke with cripplingly severe Brooklyn accents. Yevgenia never understood how a classicist and a polyglot like Nero could socialize with people like that. What was worse, she had this French Fifth Republic overt disdain for money, unless disguised by an intellectual or cultural façade, and she could hardly bear these Brooklyn fellows with thick hairy fingers and gigantic bank accounts. Nero's post-Brooklyn friends, in turn, found her snotty. (One of the effects of prosperity has been a steady migration of streetwise people from Brooklyn to Staten Island and New Jersey.)

Nero was also elitist, unbearably so, but in a different way. He separated those who could *connect the dots*, Brooklyn-born or not, from those who could not, regardless of their levels of sophistication and learning.

A few months later, after he was done with Yevgenia (with inordinate relief) he opened *Il deserto* and was sucked into it. Yevgenia had the prescience that, like her, Nero would identify with Giovanni Drogo, the main character of *Il deserto*. He did.

Nero, in turn, bought cases of the English (bad) translation of the book and handed copies to anyone who said a polite hello to him, including his New York doorman who could hardly speak English, let alone read it. Nero was so enthusiastic while explaining the story that the doorman got interested and Nero had to order the Spanish translation for him, *El desierto de los tártaros*.

Bleed or Blowup

Let us separate the world into two categories. Some people are like the turkey, exposed to a major blowup without being aware of it, while others play reverse turkey, prepared for big events that might surprise others. In some strategies and life situations, you gamble dollars to win a succession of pennies while appearing to be winning all the time. In others, you risk a succession of pennies to win dollars. In other words, you bet either that the Black Swan will happen or that it will never happen, two strategies that require completely different mind-sets.

We have seen that we (humans) have a marked preference for making a little bit of income at a time. Recall from Chapter 4 that in the summer of 1982, large American banks lost close to everything they had ever earned, and more.

So some matters that belong to Extremistan are extremely dangerous but do not appear to be so beforehand, since they hide and delay their risks—so suckers

think they are “safe.” It is indeed a property of Extremistan to look less risky, in the short run, than it really is.

Nero called the businesses exposed to such blowups dubious businesses, particularly since he distrusted whatever method was being used to compute the odds of a blowup. Recall from Chapter 4 that the accounting period upon which companies’ performances are evaluated is too short to reveal whether or not they are doing a great job. And, owing to the shallowness of our intuitions, we formulate our risk assessments too quickly.

I will rapidly present Nero’s idea. His premise was the following trivial point: some business bets in which one wins big but infrequently, yet loses small but frequently, are worth making if others are suckers for them and *if you have the personal and intellectual stamina*. But you need such stamina. You also need to deal with people in your entourage heaping all manner of insult on you, much of it blatant. People often accept that a financial strategy with a small chance of success is not necessarily a bad one as long as the success is large enough to justify it. For a spate of psychological reasons, however, people have difficulty carrying out such a strategy, simply because it requires a combination of belief, a capacity for delayed gratification, and the willingness to be spat upon by clients without blinking. And those who lose money for any reason start looking like guilty dogs, eliciting more scorn on the part of their entourage.

Against that background of potential blowup disguised as skills, Nero engaged in a strategy that he called “bleed.” You lose steadily, daily, for a long time, except when some event takes place for which you get paid disproportionately well. No single event can make you blow up, on the other hand—some changes in the world can produce extraordinarily large profits that pay back such bleed for years, sometimes decades, sometimes even centuries.

Of all the people he knew, Nero was the least genetically designed for such a strategy. His brain disagreed so heavily with his body that he found himself in a state of continuous warfare. It was his body that was his problem, which accumulated physical fatigue from the neurobiological effect of exposure to the small continuous losses, Chinese-water-torture-style, throughout the day. Nero discovered that the losses went to his emotional brain, bypassing his higher cortical structures and slowly affecting his hippocampus and weakening his memory. The hippocampus is the structure where memory is supposedly controlled. It is the most plastic part of the brain; it is also the part that is assumed to absorb all the damage from repeated insults like the chronic stress

we experience daily from small doses of negative feelings—as opposed to the invigorating "good stress" of the tiger popping up occasionally in your living room. You can rationalize all you want; the hippocampus takes the insult of chronic stress seriously, incurring irreversible atrophy. Contrary to popular belief, these small, seemingly harmless stressors do not strengthen you; they can amputate part of your self.

It was the exposure to a high level of information that poisoned Nero's life. He could sustain the pain if he saw only weekly performance numbers, instead of updates every minute. He did better emotionally with his own portfolio than with those of clients, since he was not obligated to monitor it continuously.

If his neurobiological system was a victim of the confirmation bias, reacting to the short term and the visible, he could trick his brain to escape its vicious effect by focusing only on the longer haul. He refused to look at any printout of his track record that was shorter than ten years. Nero came of age, intellectually speaking, with the stock market crash of 1987, in which he derived monstrous returns on what small equity he controlled. This episode would forever make his track record valuable, taken as a whole. In close to twenty years of trading, Nero had only four good years. For him, one was more than enough. All he needed was one good year per century.

Investors were no problem for him—they needed his trading as insurance and paid him well. He just had to exhibit a mild degree of contempt toward those he wanted to shed, which did not take much effort on his part. This effort was not contrived: Nero did not think much of them and let his body language express it freely, all the while maintaining an unfashionably high level of courtesy. He made sure, after a long string of losses, that they did not think he was apologetic—indeed, paradoxically, they became more supportive that way. Humans will believe anything you say provided you do not exhibit the smallest shadow of diffidence; like animals, they can detect the smallest crack in your confidence before you express it. The trick is to be as smooth as possible in personal manners. It is much easier to signal self-confidence if you are exceedingly polite and friendly; you can control people without having to offend their sensitivity. The problem with business people, Nero realized, is that if you act like a loser they will treat you as a loser—you set the yardstick yourself. There is no absolute measure of good or bad. It is not what you are telling people, it is how you are saying it.

But you need to remain understated and maintain an Olympian calm in front

of others.

When he worked as a trader for an investment bank, Nero had to face the typical employee-evaluation form. The form was supposed to keep track of "performance," supposedly as a check against employees slacking off. Nero found the evaluation absurd because it did not so much judge the quality of a trader's performance as encourage him to game the system by working for short-term profits at the expense of possible blowups—like banks that give foolish loans that have a small probability of blowing up, because the loan officer is shooting for his next quarterly evaluation. So one day early in his career, Nero sat down and listened very calmly to the evaluation of his "supervisor." When Nero was handed the evaluation form he tore it into small pieces in front of him. He did this very slowly, accentuating the contrast between the nature of the act and the tranquillity with which he tore the paper. The boss watched him blank with fear, eyes popping out of his head. Nero focused on his undramatic, slow-motion act, elated by both the feeling of standing up for his beliefs and the aesthetics of its execution. The combination of elegance and dignity was exhilarating. He knew that he would either be fired or left alone. He was left alone.

Chapter Eight

GIACOMO CASANOVA'S UNFAILING LUCK: THE PROBLEM OF SILENT EVIDENCE

The Diagoras problem—How Black Swans make their way out of history books—Methods to help you avoid drowning—The drowned do not usually vote—We should all be stockbrokers—Do silent witnesses count?—Casanova's étoile—New York is "so invincible"

Another fallacy in the way we understand events is that of silent evidence. History hides both Black Swans and its Black Swan–generating ability from us.

THE STORY OF THE DROWNED WORSHIPPERS

More than two thousand years ago, the Roman orator, belletrist, thinker, Stoic, manipulator-politician, and (usually) virtuous gentleman, Marcus Tullius Cicero, presented the following story. One Diagoras, a nonbeliever in the gods, was shown painted tablets bearing the portraits of some worshippers who prayed, then survived a subsequent shipwreck. The implication was that praying protects you from drowning. Diagoras asked, "Where were the pictures of those who prayed, then drowned?"

The drowned worshippers, being dead, would have a lot of trouble advertising their experiences from the bottom of the sea. This can fool the casual observer into believing in miracles.

We call this the problem of silent evidence. The idea is simple, yet potent and universal. While most thinkers try to put to shame those who came *before* them, Cicero puts to shame almost all empirical thinkers who came *after* him, until very recently.

Later on, both my hero of heroes, the essayist Michel de Montaigne and the empirical Francis Bacon, mentioned the point in their works, applying it to the formation of false beliefs. "And such is the way of all superstition, whether in astrology, dreams, omens, divine judgments, or the like," wrote Bacon in his *Novum Organum*. The problem, of course, is that unless they are drilled into us systematically, or integrated into our way of thinking, these great observations are rapidly forgotten.

Silent evidence pervades everything connected to the notion of *history*. By history, I don't just mean those learned-but-dull books in the history section (with Renaissance paintings on their cover to attract buyers). History, I will repeat, is *any succession of events* seen with the effect of *posteriority*.

This bias extends to the ascription of factors in the success of ideas and religions, to the illusion of skill in many professions, to success in artistic occupations, to the nature versus nurture debate, to mistakes in using evidence in the court of law, to illusions about the "logic" of history—and of course, most severely, in our perception of the nature of extreme events.

You are in a classroom listening to someone self-important, dignified, and ponderous (but dull), wearing a tweed jacket (white shirt, polka-dot tie), pontificating for two hours on the theories of history. You are too paralyzed by

boredom to understand what on earth he is talking about, but you hear the names of big guns: Hegel, Fichte, Marx, Proudhon, Plato, Herodotus, Ibn Khaldoun, Toynbee, Spengler, Michelet, Carr, Bloch, Fukuyama, Schmukuyama, Trukuyama. He seems deep and knowledgeable, making sure that no attention lapse will make you forget that his approach is "post-Marxist," "postdialectical," or post-something, whatever that means. Then you realize that a large part of what he is saying reposes on a simple optical illusion! But this will not make a difference: he is so invested in it that if you questioned his method he would react by throwing even more names at you.

It is so easy to avoid looking at the cemetery while concocting historical theories. But this is not just a problem with history. It is a problem with the way we construct samples and gather evidence *in every domain*. We shall call this distortion a bias, i.e., the difference between what you see and what is there. By *bias* I mean a systematic error consistently showing a more positive, or negative, effect from the phenomenon, like a scale that unfailingly shows you a few pounds heavier or lighter than your true weight, or a video camera that adds a few sizes to your waistline. This bias has been rediscovered here and there throughout the past century across disciplines, often to be rapidly forgotten (like Cicero's insight). As drowned worshippers do not write histories of their experiences (it is better to be alive for that), so it is with the losers in history, whether people or ideas. Remarkably, historians and other scholars in the humanities who need to understand silent evidence the most do not seem to have a name for it (and I looked hard). As for journalists, fuhgedaboudit! They are industrial producers of the distortion.

The term *bias* also indicates the condition's potentially quantifiable nature: you may be able to calculate the distortion, and to correct for it by taking into account both the dead and the living, instead of only the living.

Silent evidence is what events use to conceal their own randomness, particularly the Black Swan type of randomness.

Sir Francis Bacon is an interesting and endearing fellow in many respects.

He harbored a deep-seated, skeptical, nonacademic, antidogmatic, and obsessively empirical nature, which, to someone skeptical, nonacademic, antidogmatic, and obsessively empirical, like this author, is a quality almost impossible to find in the thinking business. (Anyone can be skeptical; any scientist can be overly empirical—it is the rigor coming from the combination of skepticism and empiricism that's hard to come by.) The problem is that his

empiricism wanted us to confirm, not disconfirm; thus he introduced the problem of confirmation, that beastly corroboration that generates the Black Swan.

THE CEMETERY OF LETTERS

The Phoenicians, we are often reminded, produced no literature, although they allegedly invented the alphabet. Commentators discuss their philistinism from the basis of this absence of a written legacy, asserting that by race or culture, they were more interested in commerce than in the arts. Accordingly, the Phoenician invention of the alphabet served the lower purpose of commercial record keeping rather than the more noble purpose of literary production. (I remember finding on the shelves of a country house I once rented a mildewed history book by Will and Ariel Durant describing the Phoenicians as the "merchant race." I was tempted to throw it in the fireplace.) Well, it now seems that the Phoenicians wrote quite a bit, but using a perishable brand of papyrus that did not stand the biodegradative assaults of time. Manuscripts had a high rate of extinction before copyists and authors switched to parchment in the second or third century. Those not copied during that period simply disappeared.

The neglect of silent evidence is endemic to the way we study comparative talent, particularly in activities that are plagued with winner-take-all attributes. We may enjoy what we see, but there is no point reading too much into success stories because we do not see the full picture.

Recall the *winner-take-all* effect from Chapter 3: notice the large number of people who call themselves writers but are (only "temporarily") operating the shiny cappuccino machines at Starbucks. The inequity in this field is larger than, say, medicine, since we rarely see medical doctors serving hamburgers. I can thus infer that I can largely gauge the performance of the latter profession's entire population from what sample is visible to me. Likewise with plumbers, taxi drivers, prostitutes, and those in professions devoid of superstar effects. Let us go beyond the discussion on Extremistan and Mediocristan in Chapter 3. The consequence of the superstar dynamic is that what we call "literary heritage" or "literary treasures" is a minute proportion of what has been produced cumulatively. This is the first point. How it invalidates the identification of talent can be derived immediately from it: say you attribute the success of the nineteenth-century novelist Honoré de Balzac to his superior "realism," "insights," "sensitivity," "treatment of characters," "ability to keep the reader riveted," and so on. These may be deemed "superior" qualities that lead to superior performance *if, and only if,* those who lack what we call talent also lack these qualities. But what if there are dozens of comparable literary masterpieces

that happened to perish? And, following my logic, if there are indeed many perished manuscripts with similar attributes, then, I regret to say, your idol Balzac was just the beneficiary of disproportionate luck compared to his peers. Furthermore, you may be committing an injustice to others by favoring him.

My point, I will repeat, is not that Balzac is untalented, but that he is less *uniquely* talented than we think. Just consider the thousands of writers now completely vanished from consciousness: their record does not enter into analyses. We do not see the tons of rejected manuscripts because these writers have never been published. *The New Yorker* alone rejects close to a hundred manuscripts a day, so imagine the number of geniuses that we will never hear about. In a country like France, where more people write books while, sadly, fewer people read them, respectable literary publishers accept one in ten thousand manuscripts they receive from firsttime authors. Consider the number of actors who have never passed an audition but would have done very well had they had that lucky break in life.

The next time you visit a Frenchman of comfortable means, you will likely spot the stern books from the collection *Bibliothèque de la Pléiade*, which their owner will never, almost never, read, mostly on account of their uncomfortable size and weight. Membership in the *Pléiade* means membership in the literary canon. The tomes are expensive; they have the distinctive smell of ultrathin India paper, compressing the equivalent of fifteen hundred pages into the size of a drugstore paperback. They are supposed to help you maximize the number of masterpieces per Parisian square foot. The publisher Gallimard has been extremely selective in electing writers into the *Pléiade* collection–only a few authors, such as the aesthete and adventurer André Malraux, have made it in while still alive. Dickens, Dostoyevsky, Hugo, and Stendhal are in, along with Mallarmé, Sartre, Camus, and … Balzac. Yet if you follow Balzac's own ideas, which I will examine next, you would accept that there is no ultimate justification for such an official corpus.

Balzac outlined the entire business of silent evidence in his novel *Lost Illusions*. Lucien de Rubempré (alias of Lucien Chardon), the penurious provincial genius, "goes up" to Paris to start a literary career. We are told that he is talented—actually *he* is told that he is talented by the semiaristocratic set in Angoulême. But it is difficult to figure out whether this is due to his good looks or to the literary quality of his works—or even whether literary quality is visible, or, as Balzac seems to wonder, if it has much to do with anything. Success is

presented cynically, as the product of wile and promotion or the lucky surge of interest for reasons completely external to the works themselves. Lucien discovers the existence of the immense cemetery inhabited by what Balzac calls "nightingales."

> Lucien was told that this designation "nightingale" was given by bookstores to those works residing on the shelves in the solitary depths of their shops.

Balzac presents to us the sorry state of contemporary literature when Lucien's manuscript is rejected by a publisher who has never read it; later on, when Lucien's reputation has developed, the very same manuscript is accepted by another publisher who did not read it either! The work itself was a secondary consideration.

In another example of silent evidence, the book's characters keep bemoaning that things are no longer as they were *before*, implying that literary fairness prevailed in more ancient times—as if there was no cemetery before. They fail to take into account the nightingales among the ancients' work! Notice that close to two centuries ago people had an idealized opinion of their own past, just as we have an idealized opinion of today's past.

I mentioned earlier that to understand successes and analyze what *caused* them, we need to study the traits present in failures. It is to a more general version of this point that I turn next.

How to Become a Millionaire in Ten Steps

Numerous studies of millionaires aimed at figuring out the skills required for hotshotness follow the following methodology. They take a population of hotshots, those with big titles and big jobs, and study their attributes. They look at what those big guns have in common: courage, risk taking, optimism, and so on, and infer that these traits, most notably risk taking, help you to become successful. You would also probably get the same impression if you read CEOs' ghostwritten autobiographies or attended their presentations to fawning MBA students.

Now take a look at the cemetery. It is quite difficult to do so because people who fail do not seem to write memoirs, and, if they did, those business publishers I know would not even consider giving them the courtesy of a returned phone call (as to returned e-mail, fuhgedit). Readers would not pay

$26.95 for a story of failure, even if you convinced them that it had more useful tricks than a story of success.* The entire notion of biography is grounded in the arbitrary ascription of a causal relation between specified traits and subsequent events. Now consider the cemetery. The graveyard of failed persons will be full of people who shared the following traits: courage, risk taking, optimism, et cetera. Just like the population of millionaires. There may be some differences in skills, but what truly separates the two is for the most part a single factor: luck. Plain luck.

You do not need a lot of empiricism to figure this out: a simple thought experiment suffices. The fund-management industry claims that some people are extremely skilled, since year after year they have outperformed the market. They will identify these "geniuses" and convince you of their abilities. My approach has been to manufacture cohorts of purely random investors and, by simple computer simulation, show how it would be impossible to not have these geniuses produced *just by luck*. Every year you fire the losers, leaving only the winners, and thus end up with long-term steady winners. Since you do not observe the cemetery of failed investors, you will think that it is a good business, and that some operators are considerably better than others. Of course an explanation will be readily provided for the success of the lucky survivors: "He eats tofu," "She works late; just the other day I called her office at eight P.M. …" Or of course, "She is naturally lazy. People with that type of laziness can see things clearly." By the mechanism of retrospective determinism we will find the "cause"—actually, we need to see the cause. I call these simulations of hypothetical cohorts, often done by computer, an engine of computational epistemology. Your thought experiments can be run on a computer. You just simulate an alternative world, plain random, and verify that it looks similar to the one in which we live. Not getting lucky billionaires in these experiments would be the exception.*

Recall the distinction between Mediocristan and Extremistan in Chapter 3. I said that taking a "scalable" profession is not a good idea, simply because there are far too few winners in these professions. Well, these professions produce a large cemetery: the pool of starving actors is larger than the one of starving accountants, even if you assume that, on average, they earn the same income.

A HEALTH CLUB FOR RATS

The second, and more vicious, variety of the problem of silent evidence is as follows. When I was in my early twenties and still read the newspaper, and thought that steadily reading the newspapers was something useful to me, I came across an article discussing the mounting threat of the Russian Mafia in the United States and its displacement of the traditional Louie and Tony in some neighborhoods of Brooklyn. The article explained their toughness and brutality as a result of their being hardened by their Gulag experiences. The Gulag was a network of labor camps in Siberia where criminals and dissidents were routinely deported. Sending people to Siberia was one of the purification methods initially used by the czarist regimes and later continued and perfected by the Soviets. Many deportees did not survive these labor camps.

Hardened by the Gulag? The sentence jumped out at me as both profoundly flawed (and a reasonable inference). It took me a while to figure out the nonsense in it since it was protected by cosmetic wrapping; the following thought experiment will give the intuition. Assume that you're able to find a large, assorted population of rats: fat, thin, sickly, strong, well-proportioned, et cetera. (You can easily get them from the kitchens of fancy New York restaurants.) With these thousands of rats, you build a heterogeneous cohort, one that is well representative of the general New York rat population. You bring them to my laboratory on East Fifty-ninth Street in New York City and we put the entire collection in a large vat. We subject the rats to increasingly higher levels of radiation (since this is supposed to be a thought experiment, I am told that there is no cruelty in the process). At every level of radiation, those that are naturally stronger (and this is the key) will survive; the dead will drop out of your sample. We will progressively have a stronger and stronger collection of rats. Note the following central fact: every single rat, including the strong ones, will be *weaker* after the radiation than before.

An observer endowed with analytical abilities, who probably got excellent grades in college, would be led to believe that treatment in my laboratory is an excellent health-club replacement, and one that could be generalized to all mammals (think of the potential commercial success). His logic would run as follows: Hey, these rats are stronger than the rest of the rat population. What do they seem to have in common? They all came from that Black Swan guy Taleb's workshop. Not many people will have the temptation to go look at the dead rats.

Next we pull the following trick on *The New York Times:* we let these surviving rats loose in New York City and inform the chief rodent correspondent of the newsworthy disruption in the pecking order in the New York rat population. He will write a lengthy (and analytical) article on the social dynamics of New York rats that includes the following passage: "Those rats are now bullies in the rat population. They literally run the show. *Strengthened* by their experience in the laboratory of the reclusive (but friendly) statistician/philosopher/trader Dr. Taleb, they …"

Vicious Bias

There is a vicious attribute to the bias: it can hide best when its impact is largest. Owing to the invisibility of the dead rats, the more lethal the risks, the less visible they will be, since the severely victimized are likely to be eliminated from the evidence. The more injurious the treatment, the larger the difference between the surviving rats and the rest, and the more fooled you will be about the *strengthening* effect. One of the two following ingredients is necessary for this difference between the true effect (weakening) and the observed one (strengthening): a) a degree of inequality in strength, or diversity, in the base cohort, or b) unevenness, or diversity, somewhere in the treatment. Diversity here has to do with the degree of uncertainty inherent in the process.

More Hidden Applications

We can keep going with this argument; it has such universality that once we get the bug it is hard to look at reality with the same eyes again. Clearly it robs our observations of their realistic power. I will enumerate a few more cases to illustrate the weaknesses of our inferential machinery.

The stability of species. Take the number of species that we now consider extinct. For a long time scientists took the number of such species as that implied from an analysis of the extant fossils. But this number ignores the silent cemetery of species that came and left without leaving traces in the form of fossils; the fossils that we have managed to find correspond to a smaller proportion of all species that came and disappeared. This implies that our biodiversity was far greater than it seemed at first examination. A more worrisome consequence is that the rate of extinction of species may be far greater than we think—close to 99.5 percent of species that transited through

earth are now extinct, a number that scientists have kept raising through time. Life is a great deal more fragile than we have allowed for. But this does not mean we (humans) should feel guilty for extinctions around us; nor does it mean that we should act to stop them—species were coming and going before we started messing up the environment. There is no need to feel moral responsibility for every endangered species.

Does crime pay? Newspapers report on the criminals who get caught. There is no section in *The New York Times* recording the stories of those who committed crimes but have not been caught. So it is with cases of tax evasion, government bribes, prostitution rings, poisoning of wealthy spouses (with substances that do not have a name and cannot be detected), and drug trafficking.

In addition, our representation of the standard criminal might be based on the properties of those less intelligent ones who were caught.

Once we seep ourselves into the notion of silent evidence, so many things around us that were previously hidden start manifesting themselves. Having spent a couple of decades in this mind-set, I am convinced (but cannot prove) that training and education can help us avoid its pitfalls.

The Evolution of the Swimmer's Body

What do the popular expressions "a swimmer's body" and "beginner's luck" have in common? What do they seem to share with the concept of history?

There is a belief among gamblers that beginners are almost always lucky. "It gets worse later, but gamblers are always lucky when they start out," you hear. This statement is actually empirically true: researchers confirm that gamblers have lucky beginnings (the same applies to stock market speculators). Does this mean that each one of us should become a gambler for a while, take advantage of lady luck's friendliness to beginners, then stop?

The answer is no. The same optical illusion prevails: those who start gambling will be either lucky or unlucky (given that the casino has the advantage, a slightly greater number will be unlucky). The lucky ones, with the feeling of having been selected by destiny, will continue gambling; the others, discouraged, will stop and will not show up in the sample. They will probably take up, depending on their temperaments, bird-watching, Scrabble, piracy, or other pastimes. Those who continue gambling will remember having been lucky as beginners. The dropouts, by definition, will no longer be part of the surviving

gamblers' community. This explains beginner's luck.

There is an analogy with what is called in common parlance a "swimmer's body," which led to a mistake I shamefully made a few years ago (in spite of my specialty in this bias, I did not notice that I was being fooled). When asking around about the comparative physical elegance of athletes, I was often told that runners looked anorexic, cyclists bottom-heavy, and weight lifters insecure and a little primitive. I inferred that I should spend some time inhaling chlorine in the New York University pool to get those "elongated muscles." Now suspend the causality. Assume that a person's genetic variance allows for a certain type of body shape. Those born with a natural tendency to develop a swimmer's body become better swimmers. These are the ones you see in your sample splashing up and down at the pools. But they would have looked pretty much the same if they lifted weights. It is a fact that a given muscle grows almost the same way whether you take steroids or climb walls at the local gym.

WHAT YOU SEE AND WHAT YOU DON'T SEE

Katrina, the devastating hurricane that hit New Orleans in 2005, got plenty of politicizing politicians on television. These legislators, moved by the images of devastation and the pictures of angry victims made homeless, made promises of "rebuilding." It was so noble on their part to do something humanitarian, to rise above our abject selfishness.

Did they promise to do so with their own money? No. It was with public money. Consider that such funds will be taken away from somewhere else, as in the saying "You take from Peter to give to Paul." That *somewhere else* will be less mediatized. It may be privately funded cancer research, or the next efforts to curb diabetes. Few seem to pay attention to the victims of cancer lying lonely in a state of untelevised depression. Not only do these cancer patients not vote (they will be dead by the next ballot), but they do not manifest themselves to our emotional system. More of them die every day than were killed by Hurricane Katrina; they are the ones who need us the most—not just our financial help, but our attention and kindness. And they may be the ones from whom the money will be taken—indirectly, perhaps even directly. Money (public or private) taken away from research might be responsible for killing them—in a crime that may remain silent.

A ramification of the idea concerns our decision making under a cloud of possibilities. We see the obvious and visible consequences, not the invisible and less obvious ones. Yet those unseen consequences can be—nay, generally are—more meaningful.

Frédéric Bastiat was a nineteenth-century humanist of a strange variety, one of those rare independent thinkers—independent to the point of being unknown in his own country, France, since his ideas ran counter to French political orthodoxy (he joins another of my favorite thinkers, Pierre Bayle, in being unknown at home and in his own language). But he has a large number of followers in America.

In his essay "What We See and What We Don't See," Bastiat offered the following idea: we can see what governments do, and therefore sing their praises—but we do not see the alternative. But there is an alternative; it is less obvious and remains unseen.

Recall the confirmation fallacy: governments are great at telling you what

they did, but not what they did not do. In fact, they engage in what could be labeled as phony "philanthropy," the activity of helping people in a visible and sensational way without taking into account the unseen cemetery of invisible consequences. Bastiat inspired libertarians by attacking the usual arguments that showed the benefits of governments. But his ideas can be generalized to apply to both the Right and the Left.

Bastiat goes a bit deeper. If both the positive and the negative consequences of an action fell on its author, our learning would be fast. But often an action's positive consequences benefit only its author, since they are visible, while the negative consequences, being invisible, apply to others, with a net cost to society. Consider job-protection measures: you notice those whose jobs are made safe and ascribe social benefits to such protections. You do not notice the effect on those who cannot find a job as a result, since the measure will reduce job openings. In some cases, as with the cancer patients who may be punished by Katrina, the positive consequences of an action will immediately benefit the politicians and phony humanitarians, while the negative ones take a long time to appear—they may never become noticeable. One can even blame the press for directing charitable contributions toward those who may need them the least.

Let us apply this reasoning to September 11, 2001. Around twenty-five hundred people were directly killed by bin Laden's group in the Twin Towers of the World Trade Center. Their families benefited from the support of all manner of agencies and charities, as they should. But, according to researchers, during the remaining three months of the year, close to one thousand people died as silent victims of the terrorists. How? Those who were afraid of flying and switched to driving ran an increased risk of death. There was evidence of an increase of casualties on the road during that period; the road is considerably more lethal than the skies. These families got no support—they did not even know that their loved ones were also the victims of bin Laden.

In addition to Bastiat, I have a weakness for Ralph Nader (the activist and consumer advocate, certainly not the politician and political thinker). He may be the American citizen who saved the highest number of lives by exposing the safety record of car companies. But, in his political campaign a few years ago, even he forgot to trumpet the tens of thousands of lives saved by his seat belt laws. It is much easier to sell "Look what I did for you" than "Look what I avoided for you."

Recall from the Prologue the story of the hypothetical legislator whose actions

might have avoided the attack of September 11. How many such people are walking the street without the upright gait of the phony hero?

Have the guts to consider the silent consequences when standing in front of the next snake-oil humanitarian.

Doctors

Our neglect of silent evidence kills people daily. Assume that a drug saves many people from a potentially dangerous ailment, but runs the risk of killing a few, with a net benefit to society. Would a doctor prescribe it? He has no incentive to do so. The lawyers of the person hurt by the side effects will go after the doctor like attack dogs, while the lives saved by the drug might not be accounted for anywhere.

A life saved is a statistic; a person hurt is an anecdote. Statistics are invisible; anecdotes are salient. Likewise, the risk of a Black Swan is invisible.*

Giacomo Casanova, a.k.a. Jacques, Chevalier de Seingalt. Some readers might be surprised that the legendary seducer did not look quite like James Bond.

THE TEFLON-STYLE PROTECTION OF GIACOMO CASANOVA

This brings us to gravest of all manifestations of silent evidence, the illusion of stability. The bias lowers our perception of the risks we incurred in the past, particularly for those of us who were lucky to have survived them. Your life came under a serious threat but, having survived it, you retrospectively underestimate how risky the situation actually was.

The adventurer Giacomo Casanova, later self-styled Jacques, Chevalier de Seingalt, the wannabe intellectual and legendary seducer of women, seems to have had a Teflon-style trait that would cause envy on the part of the most resilient of Mafia dons: misfortune did not stick to him. Casanova, while known for his seductions, viewed himself as some sort of a scholar. He aimed at literary fame with his twelve-volume *History of My Life*, written in bad (charmingly bad) French. In addition to the extremely useful lessons on how to become a seducer, the *History* provides an engrossing account of a succession of reversals of fortune. Casanova felt that every time he got into difficulties, his lucky star, his *étoile*, would pull him out of trouble. After things got bad for him, they somehow recovered by some invisible hand, and he was led to believe that it was his intrinsic property to recover from hardships by running every time into a new opportunity. He would somehow meet someone in extremis who offered him a financial transaction, a new patron that he had not betrayed in the past, or someone generous enough and with a weak enough memory to forget past betrayals. Could Casanova have been selected by destiny to bounce back from all hardships?

Not necessarily. Consider the following: of all the colorful adventurers who have lived on our planet, many were occasionally crushed, and a few did bounce back repeatedly. It is those who survive who will tend to believe that they are indestructible; they will have a long and interesting enough experience to write books about it. Until, of course …

Actually, adventurers who feel singled out by destiny abound, simply because there are plenty of adventurers, and we do not hear the stories of those down on their luck. As I started writing this chapter, I recalled a conversation with a woman about her flamboyant fiancé, the son of a civil servant, who managed through a few financial transactions to catapult himself into the life of a character in a novel, with handmade shoes, Cuban cigars, collectible cars, and so on. The French have a word for this, *flambeur*, which means a mixture of

extravagant bon vivant, wild speculator, and risk taker, all the while bearing considerable personal charm; a word that does not seem to be available in Anglo-Saxon cultures. The fiancé was spending his money very quickly, and as we were having the conversation about his fate (she was going to marry him, after all), she explained to me that he was undergoing slightly difficult times, but that there was no need to worry since he always came back with a vengeance. That was a few years ago. Out of curiosity, I have just tracked him down (trying to do so tactfully): he has not recovered (yet) from his latest blow of fortune. He also dropped out of the scene and is no longer to be found among other *flambeurs*.

How does this relate to the dynamics of history? Consider what is generally called the resilience of New York City. For seemingly transcendental reasons, every time it gets close to the brink of disaster, the city manages to pull back and recover. Some people truly believe that this is an internal property of New York City. The following quote is from a *New York Times* article:

> Which is why New York still needs Samuel M. E. An economist who turns 77 today, Mr. E. studied New York City through half a century of booms and busts. … "We have a record of going through tough times and coming back stronger than ever," he said.

Now run the idea in reverse: think of cities as little Giacomo Casanovas, or as rats in my laboratory. As we put the thousands of rats through a very dangerous process, let's put a collection of cities in a simulator of history: Rome, Athens, Carthage, Byzantium, Tyre, Catal Hyuk (located in modern-day Turkey, it is one of the first known human settlements), Jericho, Peoria, and, of course, New York City. Some cities will survive the harsh conditions of the simulator. As to others, we know that history might not be too kind. I am sure that Carthage, Tyre, and Jericho had their local, no less eloquent, Samuel M. E., saying, "Our enemies have tried to destroy us many times; but we always came back more resilient than before. We are now invincible."

This bias causes the survivor to be an unqualified witness of the process. Unsettling? The fact that you survived is a condition that may weaken your interpretation of the properties of the survival, including the shallow notion of "cause."

You can do a lot with the above statement. Replace the retired economist Samuel E. with a CEO discussing his corporation's ability to recover from past problems. How about the touted "resilience of the financial system"? How about a general who has had a good run?

The reader can now see why I use Casanova's unfailing luck as a generalized framework for the analysis of history, all histories. I generate artificial histories featuring, say, millions of Giacomo Casanovas, and observe the difference between the attributes of the successful Casanovas (because you generate them, you know their exact properties) and those an observer of the result would obtain. From that perspective, it is not a good idea to be a Casanova.

"I Am a Risk Taker"

Consider the restaurant business in a competitive place like New York City. One has indeed to be foolish to open one, owing to the enormous risks involved and the harrying quantity of work to get anywhere in the business, not counting the finicky fashion-minded clients. The cemetery of failed restaurants is very silent: walk around Midtown Manhattan and you will see these warm patron-filled restaurants with limos waiting outside for the diners to come out with their second, trophy, spouses. The owner is overworked but happy to have all these important people patronize his eatery. Does this mean that it makes sense to open a restaurant in such a competitive neighborhood? Certainly not, yet people do it out of the foolish risk-taking trait that pushes us to jump into such adventures blinded by the outcome.

Clearly there is an element of the surviving Casanovas in us, that of the risk-taking genes, which encourages us to take blind risks, unaware of the variability in the possible outcomes. We inherited the taste for uncalculated risk taking. Should we encourage such behavior?

In fact, economic growth comes from such risk taking. But some fool might argue the following: if someone followed reasoning such as mine, we would not have had the spectacular growth we experienced in the past. This is exactly like someone playing Russian roulette and finding it a good idea because he survived and pocketed the money.

We are often told that we humans have an optimistic bent, and that *it is supposed to be good for us*. This argument appears to justify general risk taking as a positive enterprise, and one that is glorified in the common culture. Hey, look, our ancestors took the challenges—while you, NNT, are encouraging us to do nothing (I am not).

We have enough evidence to confirm that, indeed, we humans are an extremely lucky species, and that we got the genes of the risk takers. The foolish

risk takers, that is. In fact, the Casanovas who survived.

Once again, I am not dismissing the idea of risk taking, having been involved in it myself. I am only critical of the encouragement of *uninformed* risk taking. The überpsychologist Danny Kahneman has given us evidence that we generally take risks not out of bravado but out of ignorance and blindness to probability! The next few chapters will show in more depth how we tend to dismiss outliers and adverse outcomes when projecting the future. But I insist on the following: *that we got here by accident does not mean that we should continue to take the same risks*. We are mature enough a race to realize this point, enjoy our blessings, and try to preserve, by becoming more conservative, what we got by luck. We have been playing Russian roulette; now let's stop and get a real job.

I have two further points to make on this subject. First, justification of overoptimism on grounds that "it brought us here" arises from a far more serious mistake about human nature: the belief that we are built to understand nature and our own nature and that our decisions are, and have been, the result of our own choices. I beg to disagree. So many instincts drive us.

Second, a little more worrisome than the first point: evolutionary fitness is something that is continuously touted and aggrandized by the crowd who takes it as gospel. The more unfamiliar someone is with the wild Black Swan–generating randomness, the more he or she believes in the optimal working of evolution. Silent evidence is not present in their theories. Evolution is a series of flukes, some good, many bad. You only see the good. But, in the short term, it is not obvious which traits are really good for you, particularly if you are in the Black Swan–generating environment of Extremistan. This is like looking at rich gamblers coming out of the casino and claiming that a taste for gambling is good for the species because gambling makes you rich! Risk taking made many species head for extinction!

This idea that we are here, that this is the best of all possible worlds, and *that evolution did a great job* seems rather bogus in the light of the silent-evidence effect. The fools, the Casanovas, and the blind risk takers are often the ones who win in the short term. Worse, in a Black Swan environment, where one single but rare event can come shake up a species after a very long run of "fitness," the foolish risk takers can also win in the long term! I will revisit this idea in Part Three, where I show how Extremistan worsens the silent-evidence effect.

But there is another manifestation that merits a mention.

I AM A BLACK SWAN: THE ANTHROPIC BIAS

I want to stay closer to earth and avoid bringing higher-up metaphysical or cosmological arguments into this discussion—there are so many significant dangers to worry about down here on planet earth and it would be a good idea to postpone the metaphysical philosophizing for later. But it would be useful to take a peek (not more) at what is called the anthropic cosmological argument, as it points out the gravity of our misunderstanding of historical stability.

A recent wave of philosophers and physicists (and people combining the two categories) has been examining *the self-sampling assumption*, which is a generalization of the principle of the Casanova bias to our own existence.

Consider our own fates. Some people reason that the odds of any of us being in existence are so low that our being here cannot be attributed to an accident of fate. Think of the odds of the parameters being exactly where they need to be to induce our existence (any deviation from the optimal calibration would have made our world explode, collapse, or simply not come into existence). It is often said that the world seems to have been built to the specifications that would make our existence possible. According to such an argument, it could not come from luck.

However, *our presence in the sample* completely vitiates the computation of the odds. Again, the story of Casanova can make the point quite simple—much simpler than in its usual formulation. Think again of all the possible worlds as little Casanovas following their own fates. The one who is still kicking (by accident) will feel that, given that he cannot be so lucky, there had to be some transcendental force guiding him and supervising his destiny: “Hey, otherwise the odds would be too low to get here just by luck.” For someone who observes *all* adventurers, the odds of finding a Casanova are not low at all: there are so many adventurers, and someone is bound to win the lottery ticket.

The problem here with the universe and the human race is that *we are the surviving Casanovas*. When you start with many adventurous Casanovas, there is bound to be a survivor, and guess what: if you are here talking about it, you are likely to be that particular one (notice the “condition”: you survived to talk about it). So we can no longer naïvely compute odds without considering that the condition that we are in existence imposes restrictions on the process that led us here.

Assume that history delivers either “bleak” (i.e., unfavorable) or “rosy” (i.e., favorable) scenarios. The bleak scenarios lead to extinction. Clearly, if I am now writing these lines, it is certainly because history delivered a “rosy” scenario, one that allowed me to be here, a historical route in which my forebears avoided massacre by the many invaders who roamed the Levant. Add to that beneficial scenarios free of meteorite collisions, nuclear war, and other large-scale terminal epidemics. But I do not have to look at humanity as a whole. Whenever I probe into my own biography I am alarmed at how tenuous my life has been so far. Once when I returned to Lebanon during the war, at the age of eighteen, I felt episodes of extraordinary fatigue and cold chills in spite of the summer heat. It was typhoid fever. Had it not been for the discovery of antibiotics, only a few decades earlier, I would not be here today. I was also later “cured” of another severe disease that would have left me for dead, thanks to a treatment that depends on another recent medical technology. As a human being alive here in the age of the Internet, capable of writing and reaching an audience, I have also benefited from society’s luck and the remarkable absence of recent large-scale war. In addition, I am the result of the rise of the human race, itself an accidental event.

My being here is a consequential low-probability occurrence, and I tend to forget it.

Let us return to the touted recipes for becoming a millionaire in ten steps. A successful person will try to convince you that his achievements could not possibly be accidental, just as a gambler who wins at roulette seven times in a row will explain to you that the odds against such a streak are one in several million, so you either have to believe some transcendental intervention is in play or accept his skills and insight in picking the winning numbers. But if you take into account the quantity of gamblers out there, and the number of gambling sessions (several million episodes in total), then it becomes obvious that such strokes of luck are bound to happen. And if you are talking about them, they have happened to you.

The *reference point argument* is as follows: do not compute odds from the vantage point of the winning gambler (or the lucky Casanova, or the endlessly bouncing back New York City, or the invincible Carthage), but from all those who started in the cohort. Consider once again the example of the gambler. If you look at the population of beginning gamblers taken as a whole, you can be close to certain that one of them (but you do not know in advance which one)

will show stellar results just by luck. So, from the *reference point* of the beginning cohort, this is not a big deal. But from the reference point of the winner (and, who does not, and this is key, take the losers into account), a long string of wins will appear to be too extraordinary an occurrence to be explained by luck. Note that a "history" is just a series of numbers through time. The numbers can represent degrees of wealth, fitness, weight, anything.

The Cosmetic Because

This in itself greatly weakens the notion of "because" that is often propounded by scientists, and almost always misused by historians. We have to accept the fuzziness of the familiar "because" no matter how queasy it makes us feel (and it does makes us queasy to remove the analgesic illusion of causality). I repeat that we are explanation-seeking animals who tend to think that everything has an identifiable cause and grab the most apparent one as *the* explanation. Yet there may not be a visible *because;* to the contrary, frequently there is nothing, not even a spectrum of possible explanations. But silent evidence masks this fact. Whenever our survival is in play, the very notion of *because* is severely weakened. The condition of survival drowns all possible explanations. The Aristotelian "because" is not there to account for a solid link between two items, but rather, as we saw in Chapter 6, to cater to our hidden weakness for imparting explanations.

Apply this reasoning to the following question: Why didn't the bubonic plague kill more people? People will supply quantities of cosmetic explanations involving theories about the intensity of the plague and "scientific models" of epidemics. Now, try the weakened causality argument that I have just emphasized in this chapter: had the bubonic plague killed more people, the observers (us) would not be here to observe. So it may not necessarily be the property of diseases to spare us humans. Whenever your survival is in play, don't immediately look for causes and effects. The main identifiable reason for our survival of such diseases might simply be inaccessible to us: we are here since, Casanova-style, the "rosy" scenario played out, and if it seems too hard to understand it is because we are too brainwashed by notions of causality and we think that it is smarter to say *because* than to accept randomness.

My biggest problem with the educational system lies precisely in that it forces students to squeeze explanations out of subject matters and *shames* them for

withholding judgment, for uttering the "I don't know." Why did the Cold War end? Why did the Persians lose the battle of Salamis? Why did Hannibal get his behind kicked? Why did Casanova bounce back from hardship? In each of these examples, we are taking a condition, survival, and looking for the explanations, instead of flipping the argument on its head and stating that *conditional on such survival*, one cannot read *that* much into the process, and should learn instead to invoke some measure of randomness (randomness, in practice, is what we don't know; to invoke randomness is to plead ignorance). It is not just your college professor who gives you bad habits. I showed in Chapter 6 how newspapers need to stuff their texts with causal links to make you enjoy the narratives. But have the integrity to deliver your "because" very sparingly; try to limit it to situations where the "because" is derived from experiments, not backward-looking history.

Note here that I am not saying causes do not exist; do not use this argument to avoid trying to learn from history. All I am saying is that it is *not so simple;* be suspicious of the "because" and handle it with care—particularly in situations where you suspect silent evidence.

We have seen several varieties of the silent evidence that cause deformations in our perception of empirical reality, making it appear more explainable (and more stable) than it actually is. In addition to the confirmation error and the narrative fallacy, the manifestations of silent evidence further distort the role and importance of Black Swans. In fact, they cause a gross overestimation at times (say, with literary success), and underestimation at others (the stability of history; the stability of our human species).

I said earlier that our perceptual system may not react to what does not lie in front of our eyes, or what does not arouse our emotional attention. We are made to be superficial, to heed what we see and not heed what does not vividly come to mind. We wage a double war against silent evidence. The unconscious part of our inferential mechanism (and there is one) will ignore the cemetery, even if we are intellectually aware of the need to take it into account. Out of sight, out of mind: we harbor a natural, even physical, scorn of the abstract.

This will be further illustrated in the next chapter.

---

* The best noncharlatanic finance book I know is called *What I Learned Losing a Million Dollars*, by D. Paul and B. Moynihan. The authors had to self-publish the book.

* Doctors are rightfully and vigorously skeptical of anecdotal results, and require that studies of drug efficacy probe into the cemetery of silent evidence. However, the same doctors fall for the bias elsewhere! Where? In their personal lives, or in their investment activities. At the cost of being repetitive, I have to once again state my amazement at the aspect of human nature that allows us to mix the most rigorous skepticism and the most acute gullibility.

* Silent evidence can actually bias matters to look less stable and riskier than they actually are. Take cancer. We are in the habit of counting survival rates from diagnosed cancer cases—which should overestimate the danger from cancer. Many people develop cancer that remains undiagnosed, and go on to live a long and comfortable life, then die of something else, either because their cancer was not lethal or because it went into spontaneous remission. Not counting these cases biases the risks upward.

Chapter Nine

THE LUDIC FALLACY, OR THE UNCERTAINTY OF THE NERD

Lunch at Lake Como (west)—The military as philosophers—Plato's randomness

FAT TONY

"Fat Tony" is one of Nero's friends who irritates Yevgenia Krasnova beyond measure. We should perhaps more thoughtfully style him "Horizontally-challenged Tony," since he is not as objectively overweight as his nickname indicates; it is just that his body shape makes whatever he wears seem ill-fitted. He wears only tailored suits, many of them cut for him in Rome, but they look as if he bought them from a Web catalog. He has thick hands, hairy fingers, wears a gold wrist chain, and reeks of licorice candies that he devours in industrial quantities as a substitute for an old smoking habit. He doesn't usually mind people calling him Fat Tony, but he much prefers to be called just Tony. Nero calls him, more politely, "Brooklyn Tony," because of his accent and his Brooklyn way of thinking, though Tony is one of the prosperous Brooklyn people who moved to New Jersey twenty years ago.

Tony is a successful nonnerd with a happy disposition. He leads a gregarious existence. His sole visible problem seems to be his weight and the corresponding nagging by his family, remote cousins, and friends, who keep warning him about that premature heart attack. Nothing seems to work; Tony often goes to a fat farm in Arizona to *not* eat, lose a few pounds, then gain almost all of them back in his first-class seat on the flight back. It is remarkable how his self-control and personal discipline, otherwise admirable, fail to apply to his waistline.

He started as a clerk in the back office of a New York bank in the early 1980s, in the letter-of-credit department. He pushed papers and did some grunt work. Later he grew into giving small business loans and figured out the game of how you can get financing from the monster banks, how their bureaucracies operate, and what they like to see on paper. All the while an employee, he started acquiring property in bankruptcy proceedings, buying it from financial institutions. His big insight is that bank employees who sell you a house that's not theirs just don't care as much as the owners; Tony knew very rapidly how to talk to them and maneuver. Later, he also learned to buy and sell gas stations with money borrowed from small neighborhood bankers.

Tony has this remarkable habit of trying to make a buck effortlessly, just for entertainment, without straining, without office work, without meeting, just by melding his deals into his private life. Tony's motto is "Finding who the sucker is." Obviously, they are often the banks: "The clerks don't care about nothing." Finding these suckers is second nature to him. If you took walks around the

block with Tony you would feel considerably more informed about the texture of the world just “tawking” to him.

Tony is remarkably gifted at getting unlisted phone numbers, first-class seats on airlines for no additional money, or your car in a garage that is officially full, either through connections or his forceful charm.

Non-Brooklyn John

I found the perfect non-Brooklyn in someone I will call Dr. John. He is a former engineer currently working as an actuary for an insurance company. He is thin, wiry, and wears glasses and a dark suit. He lives in New Jersey not far from Fat Tony but certainly they rarely run into each other. Tony never takes the train, and, actually, never commutes (he drives a Cadillac, and sometimes his wife’s Italian convertible, and jokes that he is more visible than the rest of the car). Dr. John is a master of the schedule; he is as predictable as a clock. He quietly and efficiently reads the newspaper on the train to Manhattan, then neatly folds it for the lunchtime continuation. While Tony makes restaurant owners rich (they beam when they see him coming and exchange noisy hugs with him), John meticulously packs his sandwich every morning, fruit salad in a plastic container. As for his clothing, he also wears a suit that looks like it came from a Web catalog, except that it is quite likely that it actually did.

Dr. John is a painstaking, reasoned, and gentle fellow. He takes his work seriously, so seriously that, unlike Tony, you can see a line in the sand between his working time and his leisure activities. He has a PhD in electrical engineering from the University of Texas at Austin. Since he knows both computers and statistics, he was hired by an insurance company to do computer simulations; he enjoys the business. Much of what he does consists of running computer programs for “risk management.”

I know that it is rare for Fat Tony and Dr. John to breathe the same air, let alone find themselves at the same bar, so consider this a pure thought exercise. I will ask each of them a question and compare their answers.

NNT (that is, me): Assume that a coin is fair, i.e., has an equal probability of coming up heads or tails when flipped. I flip it ninety-nine times and get heads each time. What are the odds of my getting tails on my next throw?

Dr. John: Trivial question. One half, of course, since you are assuming 50 percent odds for each and independence between draws.

NNT: What do you say, Tony?

Fat Tony: I'd say no more than 1 percent, of course.

NNT: Why so? I gave you the initial assumption of a fair coin, meaning that it was 50 percent either way.

Fat Tony: You are either full of crap or a pure sucker to buy that "50 pehcent" business. The coin gotta be loaded. It can't be a fair game. (Translation: It is far more likely that your assumptions about the fairness are wrong than the coin delivering ninety-nine heads in ninety-nine throws.)

NNT: But Dr. John said 50 percent.

Fat Tony (whispering in my ear): I know these guys with the nerd examples from the bank days. They think way too slow. And they are too commoditized. You can take them for a ride.

Now, of the two of them, which would you favor for the position of mayor of New York City (or Ulan Bator, Mongolia)? Dr. John thinks entirely within the box, the box that was given to him; Fat Tony, almost entirely outside the box.

To set the terminology straight, what I call "a nerd" here doesn't have to look sloppy, unaesthetic, and sallow, and wear glasses and a portable computer on his belt as if it were an ostensible weapon. A nerd is simply someone who thinks exceedingly inside the box.

Have you ever wondered why so many of these straight-A students end up going nowhere in life while someone who lagged behind is now getting the shekels, buying the diamonds, and getting his phone calls returned? Or even getting the Nobel Prize in a real discipline (say, medicine)? Some of this may have something to do with luck in outcomes, but there is this sterile and obscurantist quality that is often associated with classroom knowledge that may get in the way of understanding what's going on in real life. In an IQ test, as well as in any academic setting (including sports), Dr. John would vastly outperform Fat Tony. But Fat Tony would outperform Dr. John in any other possible ecological, real-life situation. In fact, Tony, in spite of his lack of culture, has an enormous curiosity about the texture of reality, and his own erudition—to me, he is more scientific in the literal, though not in the social, sense than Dr. John.

We will get deep, very deep, into the difference between the answers of Fat Tony and Dr. John; this is probably the most vexing problem I know about the connections between two varieties of knowledge, what we dub Platonic and a-Platonic. Simply, people like Dr. John can cause Black Swans outside Mediocristan—their minds are closed. While the problem is very general, one of its nastiest illusions is what I call the ludic fallacy—the attributes of the uncertainty we face in real life have little connection to the sterilized ones we encounter in exams and games.

So I close Part One with the following story.

LUNCH AT LAKE COMO

One spring day a few years ago, I was surprised to receive an invitation from a think tank sponsored by the United States Defense Department to a brainstorming session on risk that was to take place in Las Vegas the following fall. The person who invited me announced on the phone, “We’ll have lunch on a terrace overlooking Lake Como,” which put me in a state of severe distress. Las Vegas (along with its sibling the emirate of Dubai) is perhaps one place I’d never wish to visit before I die. Lunch at “fake Como” would be torture. But I’m glad I went.

The think tank had gathered a nonpolitical collection of people they called doers and scholars (and practitioners like me who do not accept the distinction) involved in uncertainty in a variety of disciplines. And they symbolically picked a major casino as a venue.

The symposium was a closed-doors, synod-style assembly of people who would never have mixed otherwise. My first surprise was to discover that the military people there thought, behaved, and acted like philosophers—far more so than the philosophers we will see splitting hairs in their weekly colloquium in Part Three. They thought out of the box, like traders, except much better and without fear of introspection. An assistant secretary of defense was among us, but had I not known his profession I would have thought he was a practitioner of skeptical empiricism. Even an engineering investigator who had examined the cause of a space shuttle explosion was thoughtful and open-minded. I came out of the meeting realizing that only military people deal with randomness with genuine, introspective intellectual honesty—unlike academics and corporate executives using other people’s money. This does not show in war movies, where they are usually portrayed as war-hungry autocrats. The people in front of me were not the people who initiate wars. Indeed, for many, the successful defense policy is the one that manages to eliminate potential dangers without war, such as the strategy of bankrupting the Russians through the escalation in defense spending. When I expressed my amazement to Laurence, another finance person who was sitting next to me, he told me that the military collected more genuine intellects and risk thinkers than most if not all other professions. Defense people wanted to understand the epistemology of risk.

In the group was a gentleman who ran a group of professional gamblers and who was banned from most casinos. He had come to share his wisdom with us.

He sat not far from a stuffy professor of political science, dry like a bone and, as is characteristic of "big names," careful about his reputation, who said nothing out of the box, and who did not smile once. During the sessions, I tried to imagine the hotshot with a rat dropped down his back, putting him in a state of wriggling panic. He was perhaps good at writing Platonic models of something called game theory, but when Laurence and I went after him on his improper use of financial metaphors, he lost all his arrogance.

Now, when you think of the major risks casinos face, gambling situations come to mind. In a casino, one would think, the risks include lucky gamblers blowing up the house with a series of large wins and cheaters taking away money through devious methods. It is not just the general public that would believe so, but the casino management as well. Consequently, the casino had a high-tech surveillance system tracking cheaters, card counters, and other people who try to derive an advantage over them.

Each of the participants gave his presentation and listened to those of the others. I came to discuss Black Swans, and I intended to tell them that the only thing I know is that we know precious little about them, but that it was their property to sneak up on us, and that attempts at Platonifying them led to additional misunderstandings. Military people can understand such things, and the idea became recently prevalent in military circles with the expression *unknown unknown* (as opposed to the *known unknown)*. But I had prepared my talk (on five restaurant napkins, some stained) and was ready to discuss a new phrase I coined for the occasion: the *ludic fallacy*. I intended to tell them that I should not be speaking at a casino because it had nothing to do with uncertainty.

The Uncertainty of the Nerd

What is the *ludic* fallacy? *Ludic* comes from *ludus*, Latin for games.

I was hoping that the representatives of the casino would speak before me so I could start harassing them by showing (politely) that a casino was precisely the venue *not* to pick for such a discussion, since the class of risks casinos encounter are very insignificant *outside* of the building, and their study not readily transferable. My idea is that gambling was *sterilized* and domesticated uncertainty. In the casino you know the rules, you can calculate the odds, and the type of uncertainty we encounter there, we will see later, is *mild*, belonging to Mediocristan. My prepared statement was this: "The casino is the only human

venture I know where the probabilities are known, Gaussian (i.e., bell-curve), and almost computable." You cannot expect the casino to pay out a million times your bet, or to change the rules abruptly on you during the game—there are never days in which "36 black" is designed to pop up 95 percent of the time.*

In real life you do not know the odds; you need to discover them, and the sources of uncertainty are not defined. Economists, who do not consider what was discovered by noneconomists worthwhile, draw an artificial distinction between Knightian risks (which you can compute) and Knightian uncertainty (which you cannot compute), after one Frank Knight, who rediscovered the notion of unknown uncertainty and did a lot of thinking but perhaps never took risks, or perhaps lived in the vicinity of a casino. Had he taken economic or financial risks he would have realized that these "computable" risks are largely absent from real life! They are laboratory contraptions!

Yet we automatically, spontaneously associate chance with these Platonified games. I find it infuriating to listen to people who, upon being informed that I specialize in problems of chance, immediately shower me with references to dice. Two illustrators for a paperback edition of one of my books spontaneously and independently added a die to the cover and below every chapter, throwing me into a state of rage. The editor, familiar with my thinking, warned them to "avoid the ludic fallacy," as if it were a well-known intellectual violation. Amusingly, they both reacted with an "Ah, sorry, we didn't know."

Those who spend too much time with their noses glued to maps will tend to mistake the map for the territory. Go buy a recent history of probability and probabilistic thinking; you will be showered with names of alleged "probability thinkers" who all base their ideas on these sterilized constructs. I recently looked at what college students are taught under the subject of chance and came out horrified; they were brainwashed with this ludic fallacy and the outlandish bell curve. The same is true of people doing PhD's in the field of probability theory. I'm reminded of a recent book by a thoughtful mathematician, Amir Aczel, called *Chance*. Excellent book perhaps, but like all other modern books it is grounded in the ludic fallacy. Furthermore, assuming chance has anything to do with mathematics, what little mathematization we can do in the real world does not assume the mild randomness represented by the bell curve, but rather scalable wild randomness. What can be mathematized is usually not Gaussian, but Mandelbrotian.

Now, go read any of the classical thinkers who had something practical to say

about the subject of chance, such as Cicero, and you find something different: a notion of probability that remains fuzzy throughout, as it needs to be, since such fuzziness is the very nature of uncertainty. Probability is a liberal art; it is a child of skepticism, not a tool for people with calculators on their belts to satisfy their desire to produce fancy calculations and certainties. Before Western thinking drowned in its "scientific" mentality, what is arrogantly called the Enlightenment, people prompted their brain to think—not compute. In a beautiful treatise now vanished from our consciousness, *Dissertation on the Search for Truth*, published in 1673, the polemist Simon Foucher exposed our psychological predilection for certainties. He teaches us the art of doubting, how to position ourselves between doubting and believing. He writes: "One needs to exit doubt in order to produce science—but few people heed the importance of not exiting from it prematurely. … It is a fact that one usually exits doubt without realizing it." He warns us further: "We are dogma-prone from our mother's wombs."

By the confirmation error discussed in Chapter 5, we use the example of games, which probability theory was successful at tracking, and claim that this is a general case. Furthermore, just as we tend to underestimate the role of luck in life in general, we tend to *overestimate* it in games of chance.

"This building is inside the Platonic fold; life stands outside of it," I wanted to shout.

Gambling with the Wrong Dice

I was in for quite a surprise when I learned that the building too was outside the Platonic fold.

The casino's risk management, aside from setting its gambling policies, was geared toward reducing the losses resulting from cheaters. One does not need heavy training in probability theory to understand that the casino was sufficiently diversified across the different tables to not have to worry about taking a hit from an extremely lucky gambler (the diversification argument that leads to the bell curve, as we will see in Chapter 15). All they had to do was control the "whales," the high rollers flown in at the casino's expense from Manila or Hong Kong; whales can swing several million dollars in a gambling bout. Absent cheating, the performance of most individual gamblers would be the equivalent of a drop in the bucket, making the aggregate very stable.

I promised not to discuss any of the details of the casino's sophisticated surveillance system; all I am allowed to say is that I felt transported into a James Bond movie—I wondered if the casino was an imitation of the movies or if it was the other way around. Yet, in spite of such sophistication, their risks had nothing to do with what can be anticipated knowing that the business is a casino. For it turned out that the four largest losses incurred or narrowly avoided by the casino fell completely outside their sophisticated models.

First, they lost around $100 million when an irreplaceable performer in their main show was maimed by a tiger (the show, *Siegfried and Roy*, had been a major Las Vegas attraction). The tiger had been reared by the performer and even slept in his bedroom; until then, nobody suspected that the powerful animal would turn against its master. In scenario analyses, the casino had even conceived of the animal jumping into the crowd, but nobody came near to the idea of insuring against what happened.

Second, a disgruntled contractor was hurt during the construction of a hotel annex. He was so offended by the settlement offered him that he made an attempt to dynamite the casino. His plan was to put explosives around the pillars in the basement. The attempt was, of course, thwarted (otherwise, to use the arguments in Chapter 8, we would not have been there), but I shivered at the thought of possibly sitting above a pile of dynamite.

Third, casinos must file a special form with the Internal Revenue Service documenting a gambler's profit if it exceeds a given amount. The employee who was supposed to mail the forms hid them, instead, for completely unexplainable reasons, in boxes under his desk. This went on for years without anyone noticing that something was wrong. The employee's refraining from sending the documents was truly impossible to predict. Tax violations (and negligence) being serious offences, the casino faced the near loss of a gambling license or the onerous financial costs of a suspension. Clearly they ended up paying a monstrous fine (an undisclosed amount), which was the luckiest way out of the problem.

Fourth, there was a spate of other dangerous scenes, such as the kidnapping of the casino owner's daughter, which caused him, in order to secure cash for the ransom, to violate gambling laws by dipping into the casino coffers.

Conclusion: A back-of-the-envelope calculation shows that the dollar value of these Black Swans, the off-model hits and potential hits I've just outlined, swamp the on-model risks by a factor of close to 1,000 to 1. The casino spent

hundreds of millions of dollars on gambling theory and high-tech surveillance while the bulk of their risks came from outside their models.

All this, and yet the rest of the world still learns about uncertainty and probability from gambling examples.

WRAPPING UP PART ONE

The Cosmetic Rises to the Surface

All of the topics in Part One are actually only one. You can think about a subject for a long time, to the point of being possessed by it. Somehow you have a lot of ideas, but they do not seem explicitly connected; the logic linking them remains concealed from you. Yet you know deep down that all these are *the same* idea. Meanwhile, what Nietzsche calls *bildungsphilisters*,* or learned philistines, blue collars of the thinking business, tell you that you are spread out between fields; you reply that these disciplines are artificial and arbitrary, to no avail. Then you tell them that you are a limousine driver, and they leave you alone—you feel better because you do not identify with them, and thus you no longer need to be amputated to fit into the Procrustean bed of the disciplines. Finally, a little push and you see that it was all one single problem.

One evening I found myself at a cocktail party in Munich at the apartment of a former art historian who had more art books in its library than I thought existed. I stood drinking excellent Riesling in the spontaneously formed English-speaking corner of the apartment, in the hope of getting to a state where I would be able to start speaking my brand of fake German. One of the most insightful thinkers I know, the computer entrepreneur Yossi Vardi, prompted me to summarize "my idea" while standing on one leg. It was not too convenient to stand on one leg after a few glasses of perfumed Riesling, so I failed in my improvisation. The next day I experienced staircase wit. I jumped out of bed with the following idea: *the cosmetic and the Platonic rise naturally to the surface*. This is a simple extension of the problem of knowledge. It is simply that one side of Eco's library, the one we never see, has the property of being ignored. This is also the problem of silent evidence. It is why we do not see Black Swans: we worry about those that happened, not those that may happen but did not. It is why we Platonify, liking known schemas and well-organized knowledge—to the point of blindness to reality. It is why we fall for the problem of induction, why we *confirm*. It is why those who "study" and fare well in school have a tendency to be suckers for the ludic fallacy.

And it is why we have Black Swans and never learn from their occurrence, because the ones that did not happen were too abstract. Thanks to Vardi, I now belonged to the club of single-idea people.

We love the tangible, the confirmation, the palpable, the real, the visible, the concrete, the known, the seen, the vivid, the visual, the social, the embedded, the emotionally laden, the salient, the stereotypical, the moving, the theatrical, the romanced, the cosmetic, the official, the scholarly-sounding verbiage (b******t), the pompous Gaussian economist, the mathematicized crap, the pomp, the Académie Française, Harvard Business School, the Nobel Prize, dark business suits with white shirts and Ferragamo ties, the moving discourse, and the lurid. Most of all we favor *the narrated*.

Alas, we are not manufactured, in our current edition of the human race, to understand abstract matters—we need context. Randomness and uncertainty are abstractions. We respect what has happened, ignoring what *could have* happened. In other words, we are naturally shallow and superficial—and we do not know it. This is not a psychological problem; it comes from the main property of information. The dark side of the moon is harder to see; beaming light on it costs energy. In the same way, beaming light on the unseen is costly in both computational and mental effort.

Distance from Primates

There have been in history many distinctions between higher and lower forms of humans. For the Greeks, there were the Greeks and the barbarians, those people of the north who uttered amorphous sentences similar, to the Attic ear, to an animal's shrieks. For the English, a higher form of life was the gentleman's—contrary to today's definition, a gentleman's life was practiced through idleness and a code of behavior that included, along with a set of manners, the avoidance of work beyond the necessities of comfortable subsistence. For New Yorkers, there are those with a Manhattan zip code and those with such a thing as a Brooklyn or, worse, Queens address. For the earlier Nietzsche, there was the Apollonian compared to the Dionysian; for the better-known Nietzsche, there was the Übermensch, something his readers interpret however it suits them. For a modern stoic, a higher individual subscribes to a dignified system of virtue that determines elegance in one's behavior and the ability to separate results from efforts. All of these distinctions aim at lengthening the distance between us and our relatives among other primates. (I keep insisting that, when it comes to decision making, the distance between us and these hairy cousins is far shorter than we think.)

I propose that if you want a simple step to a higher form of life, as distant from the animal as you can get, then you may have to denarrate, that is, shut down the television set, minimize time spent reading newspapers, ignore the blogs. Train your reasoning abilities to control your decisions; nudge System 1 (the heuristic or experiential system) out of the important ones. Train yourself to spot *the difference between the sensational and the empirical*. This insulation from the toxicity of the world will have an additional benefit: it will improve your well-being. Also, bear in mind how shallow we are with probability, the mother of all abstract notions. You do not have to do much more in order to gain a deeper understanding of things around you. Above all, learn to avoid "tunneling."

A bridge here to what is to come. The Platonic blindness I illustrated with the casino story has another manifestation: focusing. To be able to focus is a great virtue if you are a watch repairman, a brain surgeon, or a chess player. But the last thing you need to do when you deal with uncertainty is to "focus" (you should tell uncertainty to focus, not us). This "focus" makes you a sucker; it translates into prediction problems, as we will see in the next section. Prediction, not narration, is the real test of our understanding of the world.

---

* My colleague Mark Spitznagel found a martial version of the ludic fallacy: organized competitive fighting trains the athlete to focus on the game and, in order not to dissipate his concentration, to ignore the possibility of what is not specifically allowed by the rules, such as kicks to the groin, a surprise knife, et cetera. So those who win the gold medal might be precisely those who will be most vulnerable in real life. Likewise, you see people with huge muscles (in black T-shirts) who can impress you in the artificial environment of the gym but are unable to lift a stone.

* What Nietzsche means by this term are the dogma-prone newspaper readers and opera lovers who have cosmetic exposure to culture and shallow depth. I extend the term here to the philistine hiding in academia who lacks in erudition out of lack of curiosity and is closely centered on his ideas.

When I ask people to name three recently implemented technologies that most impact our world today, they usually propose the computer, the Internet, and the laser. All three were unplanned, unpredicted, and unappreciated upon their discovery, and remained unappreciated well after their initial use. They were consequential. They were Black Swans. Of course, we have this retrospective illusion of their partaking in some master plan. You can create your own lists with similar results, whether you use political events, wars, or intellectual epidemics.

You would expect our record of prediction to be horrible: the world is far, far more complicated than we think, which is not a problem, except when most of us don't know it. We tend to "tunnel" while looking into the future, making it business as usual, Black Swan–free, when in fact there is nothing usual about the future. It is not a Platonic category!

We have seen how good we are at narrating backward, at inventing stories that convince us that we understand the past. For many people, knowledge has the remarkable power of producing confidence instead of measurable aptitude. Another problem: the focus on the (inconsequential) regular, the Platonification that makes the forecasting "inside the box."

I find it scandalous that in spite of the empirical record we continue to project into the future as if we were good at it, using tools and methods that exclude rare events. Prediction is firmly institutionalized in our world. We are suckers for those who help us navigate uncertainty, whether the fortune-teller or the "well-published" (dull) academics or civil servants using phony mathematics.

From Yogi Berra to Henri Poincaré

The great baseball coach Yogi Berra has a saying, “It is tough to make predictions, especially about the future.” While he did not produce the writings that would allow him to be considered a philosopher, in spite of his wisdom and intellectual abilities, Berra can claim to know something about randomness. He was a practitioner of uncertainty, and, as a baseball player and coach, regularly faced random outcomes, and had to face their results deep into his bones.

In fact, Yogi Berra is not the only thinker who thought about how much of the future lies beyond our abilities. Many less popular, less pithy, but not less competent thinkers than he have examined our inherent limitations in this regard, from the philosophers Jacques Hadamard and Henri Poincaré (commonly described as mathematicians), to the philosopher Friedrich von Hayek (commonly described, alas, as an economist), to the philosopher Karl Popper (commonly known as a philosopher). We can safely call this the Berra-Hadamard-Poincaré-Hayek-Popper conjecture, which puts structural, built-in limits to the enterprise of predicting.

“The future ain’t what it used to be,” Berra later said.* He seems to have been right: the gains in our ability to model (and predict) the world may be dwarfed by the increases in its complexity—implying a greater and greater role for the unpredicted. The larger the role of the Black Swan, the harder it will be for us to predict. Sorry.

Before going into the limits of prediction, we will discuss our track record in forecasting and the relation between gains in knowledge and the offsetting gains in confidence.

---

* Note that these sayings attributed to Yogi Berra might be apocryphal—it was the physicist Niels Bohr who came up with the first one, and plenty of others came up with the second. These sayings remain, however, quintessential Berraisms.

Chapter Ten

THE SCANDAL OF PREDICTION

Welcome to Sydney—How many lovers did she have?—How to be an economist, wear a nice suit, and make friends—Not right, just "almost" right—Shallow rivers can have deep spots

One March evening, a few men and women were standing on the esplanade overlooking the bay outside the Sydney Opera House. It was close to the end of the summer in Sydney, but the men were wearing jackets despite the warm weather. The women were more thermally comfortable than the men, but they had to suffer the impaired mobility of high heels.

They all had come to pay the price of sophistication. Soon they would listen for several hours to a collection of oversize men and women singing endlessly in Russian. Many of the opera-bound people looked like they worked for the local office of J. P. Morgan, or some other financial institution where employees experience differential wealth from the rest of the local population, with concomitant pressures on them to live by a sophisticated script (wine and opera). But I was not there to take a peek at the neosophisticates. I had come to look at the Sydney Opera House, a building that adorns every Australian tourist brochure. Indeed, it is striking, though it looks like the sort of building architects create in order to impress other architects.

That evening walk in the very pleasant part of Sydney called the Rocks was a pilgrimage. While Australians were under the illusion that they had built a monument to distinguish their skyline, what they had really done was to construct a monument to our failure to predict, to plan, and to come to grips with our *unknowledge* of the future—our systematic underestimation of what the future has in store.

The Australians had actually built a symbol of the epistemic arrogance of the human race. The story is as follows. The Sydney Opera House was supposed to open in early 1963 at a cost of AU$ 7 million. It finally opened its doors more

than ten years later, and, although it was a less ambitious version than initially envisioned, it ended up costing around AU$ 104 million. While there are far worse cases of planning failures (namely the Soviet Union), or failures to forecast (all important historical events), the Sydney Opera House provides an aesthetic (at least in principle) illustration of the difficulties. This opera-house story is the mildest of all the distortions we will discuss in this section (it was only money, and it did not cause the spilling of innocent blood). But it is nevertheless emblematic.

This chapter has two topics. First, we are demonstrably arrogant about what we think we know. We certainly know a lot, but we have a built-in tendency to think that we know a little bit more than we actually do, enough of *that little bit* to occasionally get into serious trouble. We shall see how you can verify, even measure, such arrogance in your own living room.

Second, we will look at the implications of this arrogance for all the activities involving prediction.

Why on earth do we predict so much? Worse, even, and more interesting: Why don’t we talk about our record in predicting? Why don’t we see how we (almost) always miss the big events? I call this the scandal of prediction.

ON THE VAGUENESS OF CATHERINE'S LOVER COUNT

Let us examine what I call *epistemic arrogance*, literally, our hubris concerning the limits of our knowledge. *Epistēmē* is a Greek word that refers to knowledge; giving a Greek name to an abstract concept makes it sound important. True, our knowledge does grow, but it is threatened by greater increases in confidence, which make our increase in knowledge at the same time an increase in confusion, ignorance, and conceit.

Take a room full of people. Randomly pick a number. The number could correspond to anything: the proportion of psychopathic stockbrokers in western Ukraine, the sales of this book during the months with *r* in them, the average IQ of business-book editors (or business writers), the number of lovers of Catherine II of Russia, et cetera. Ask each person in the room to independently estimate a range of possible values for that number set in such a way that they believe that they have a 98 percent chance of being right, and less than 2 percent chance of being wrong. In other words, whatever they are guessing has about a 2 percent chance to fall outside their range. For example:

"I am 98 percent confident that the population of Rajastan is between 15 and 23 million."

"I am 98 percent confident that Catherine II of Russia had between 34 and 63 lovers."

You can make inferences about human nature by counting how many people in your sample guessed wrong; it is not expected to be too much higher than two out of a hundred participants. Note that the subjects (your victims) are free to set their range as wide as they want: you are not trying to gauge their knowledge but rather *their evaluation of their own knowledge*.

Now, the results. Like many things in life, the discovery was unplanned, serendipitous, surprising, and took a while to digest. Legend has it that Albert and Raiffa, the researchers who noticed it, were actually looking for something quite different, and more boring: how humans figure out probabilities in their decision making when uncertainty is involved (what the learned call *calibrating)*. The researchers came out befuddled. The 2 percent error rate turned out to be close to 45 percent in the population being tested! It is quite telling that the first sample consisted of Harvard Business School students, a breed not particularly renowned for their humility or introspective orientation. MBAs are

particularly nasty in this regard, which might explain their business success. Later studies document more humility, or rather a smaller degree of arrogance, in other populations. Janitors and cabdrivers are rather humble. Politicians and corporate executives, alas … I'll leave them for later.

Are we twenty-two times too comfortable with what we know? It seems so.

This experiment has been replicated dozens of times, across populations, professions, and cultures, and just about every empirical psychologist and decision theorist has tried it on his class to show his students the big problem of humankind: we are simply not wise enough to be trusted with knowledge. The intended 2 percent error rate usually turns out to be between 15 percent and 30 percent, depending on the population and the subject matter.

I have tested myself and, sure enough, failed, even while consciously trying to be humble by carefully setting a wide range—and yet such underestimation happens to be, as we will see, the core of my professional activities. This bias seems present in all cultures, even those that favor humility—there may be no consequential difference between downtown Kuala Lumpur and the ancient settlement of Amioun, (currently) Lebanon. Yesterday afternoon, I gave a workshop in London, and had been mentally writing on my way to the venue because the cabdriver had an above-average ability to "find traffic." I decided to make a quick experiment during my talk.

I asked the participants to take a stab at a range for the number of books in Umberto Eco's library, which, as we know from the introduction to Part One, contains 30,000 volumes. Of the sixty attendees, not a single one made the range wide enough to include the actual number (the 2 percent error rate became 100 percent). This case may be an aberration, but the distortion is exacerbated with quantities that are out of the ordinary. Interestingly, the crowd erred on the very high and the very low sides: some set their ranges at 2,000 to 4,000; others at 300,000 to 600,000.

True, someone warned about the nature of the test can play it safe and set the range between zero and infinity; but this would no longer be "calibrating"—that person would not be conveying any information, and could not produce an informed decision in such a manner. In this case it is more honorable to just say, "I don't want to play the game; I have no clue."

It is not uncommon to find counterexamples, people who overshoot in the opposite direction and actually overestimate their error rate: you may have a cousin particularly careful in what he says, or you may remember that college

biology professor who exhibited pathological humility; the tendency that I am discussing here applies to the average of the population, not to every single individual. There are sufficient variations around the average to warrant occasional counterexamples. Such people are in the minority—and, sadly, since they do not easily achieve prominence, they do not seem to play too influential a role in society.

Epistemic arrogance bears a double effect: we overestimate what we know, and underestimate uncertainty, by compressing the range of possible uncertain states (i.e., by reducing the space of the unknown).

The applications of this distortion extend beyond the mere pursuit of knowledge: just look into the lives of the people around you. Literally any decision pertaining to the future is likely to be infected by it. Our human race is affected by a chronic underestimation of the possibility of the future straying from the course initially envisioned (in addition to other biases that sometimes exert a compounding effect). To take an obvious example, think about how many people divorce. Almost all of them are acquainted with the statistic that between one-third and one-half of all marriages fail, something the parties involved did not forecast while tying the knot. Of course, "not us," because "we get along so well" (as if others tying the knot got along poorly).

I remind the reader that I am not testing how much people know, but assessing *the difference between what people actually know and how much they think they know*. I am reminded of a measure my mother concocted, as a joke, when I decided to become a businessman. Being ironic about my (perceived) confidence, though not necessarily unconvinced of my abilities, she found a way for me to make a killing. How? Someone who could figure out how to buy me at the price I am truly worth and sell me at what I think I am worth would be able to pocket a huge difference. Though I keep trying to convince her of my internal humility and insecurity concealed under a confident exterior; though I keep telling her that I am an introspector—she remains skeptical. Introspector shmintrospector, she still jokes at the time of this writing that I am a little ahead of myself.

The simple test above suggests the presence of an ingrained tendency in humans to underestimate outliers—or Black Swans. Left to our own devices, we tend to think that what happens every decade in fact only happens once every century, and, furthermore, that we know what's going on.

This miscalculation problem is a little more subtle. In truth, outliers are not as sensitive to underestimation since they are fragile to estimation errors, which can go in both directions. As we saw in Chapter 6, there are conditions under which people overestimate the unusual or some specific unusual event (say when sensational images come to their minds)—which, we have seen, is how insurance companies thrive. So my general point is that these events are very fragile to *miscalculation*, with a general severe underestimation mixed with an occasional severe overestimation.

The errors get worse with the degree of remoteness to the event. So far, we have only considered a 2 percent error rate in the game we saw earlier, but if you look at, say, situations where the odds are one in a hundred, one in a thousand, or one in a million, then the errors become monstrous. The longer the odds, the larger the epistemic arrogance.

Note here one particularity of our intuitive judgment: even if we lived in Mediocristan, in which large events are rare (and, mostly, inconsequential), we would still underestimate extremes—we would think that they are even rarer. We underestimate our error rate even with Gaussian variables. Our intuitions are sub-Mediocristani. But we do not live in Mediocristan. The numbers we are likely to estimate on a daily basis belong largely in Extremistan, i.e., they are run by concentration and subjected to Black Swans.

Guessing and Predicting

There is no effective difference between my guessing a variable that is not random, but for which my information is partial or deficient, such as the number of lovers who transited through the bed of Catherine II of Russia, and predicting a random one, like tomorrow's unemployment rate or next year's stock market. In this sense, guessing (what I don't know, but what someone else may know) and predicting (what has not taken place yet) are the same thing.

To further appreciate the connection between guessing and predicting, assume

that instead of trying to gauge the number of lovers of Catherine of Russia, you are estimating the less interesting but, for some, more important question of the population growth for the next century, the stockmarket returns, the social-security deficit, the price of oil, the results of your great-uncle's estate sale, or the environmental conditions of Brazil two decades from now. Or, if you are the publisher of Yevgenia Krasnova's book, you may need to produce an estimate of the possible future sales. We are now getting into dangerous waters: just consider that most professionals who make forecasts are also afflicted with the mental impediment discussed above. Furthermore, people who make forecasts professionally are often *more* affected by such impediments than those who don't.

INFORMATION IS BAD FOR KNOWLEDGE

You may wonder how learning, education, and experience affect epistemic arrogance—how educated people might score on the above test, as compared with the rest of the population (using Mikhail the cabdriver as a benchmark). You will be surprised by the answer: it depends on the profession. I will first look at the advantages of the "informed" over the rest of us in the humbling business of prediction.

I recall visiting a friend at a New York investment bank and seeing a frenetic hotshot "master of the universe" type walking around with a set of wireless headphones wrapped around his ears and a microphone jutting out of the right side that prevented me from focusing on his lips during my twenty-second conversation with him. I asked my friend the purpose of that contraption. "He likes to keep in touch with London," I was told. When you are employed, hence dependent on other people's judgment, looking busy can help you claim responsibility for the results in a random environment. The appearance of busyness reinforces the perception of causality, of the link between results and one's role in them. This of course applies even more to the CEOs of large companies who need to trumpet a link between their "presence" and "leadership" and the results of the company. I am not aware of any studies that probe the usefulness of their time being invested in conversations and the absorption of small-time information—nor have too many writers had the guts to question how large the CEO's role is in a corporation's success.

Let us discuss one main effect of information: impediment to knowledge.

Aristotle Onassis, perhaps the first mediatized tycoon, was principally famous for being rich—and for exhibiting it. An ethnic Greek refugee from southern Turkey, he went to Argentina, made a lump of cash by importing Turkish tobacco, then became a shipping magnate. He was reviled when he married Jacqueline Kennedy, the widow of the American president John F. Kennedy, which drove the heartbroken opera singer Maria Callas to immure herself in a Paris apartment to await death.

If you study Onassis's life, which I spent part of my early adulthood doing, you would notice an interesting regularity: "work," in the conventional sense, was not his thing. He did not even bother to have a desk, let alone an office. He was not just a dealmaker, which does not necessitate having an office, but he also ran a shipping empire, which requires day-to-day monitoring. Yet his main

tool was a notebook, which contained all the information he needed. Onassis spent his life trying to socialize with the rich and famous, and to pursue (and collect) women. He generally woke up at noon. If he needed legal advice, he would summon his lawyers to some nightclub in Paris at two A.M. He was said to have an irresistible charm, which helped him take advantage of people.

Let us go beyond the anecdote. There may be a "fooled by randomness" effect here, of making a causal link between Onassis's success and his modus operandi. I may never know if Onassis was skilled or lucky, though I am convinced that his charm opened doors for him, but I can subject his modus to a rigorous examination by looking at empirical research on the link between information and understanding. So this statement, *additional knowledge of the minutiae of daily business can be useless, even actually toxic*, is indirectly but quite effectively testable.

Show two groups of people a blurry image of a fire hydrant, blurry enough for them not to recognize what it is. For one group, increase the resolution slowly, in ten steps. For the second, do it faster, in five steps. Stop at a point where both groups have been presented an identical image and ask each of them to identify what they see. The members of the group that saw fewer intermediate steps are likely to recognize the hydrant much faster. Moral? The more information you give someone, the more hypotheses they will formulate along the way, and the worse off they will be. They see more random noise and mistake it for information.

The problem is that our ideas are sticky: once we produce a theory, we are not likely to change our minds—so those who delay developing their theories are better off. When you develop your opinions on the basis of weak evidence, you will have difficulty interpreting subsequent information that contradicts these opinions, even if this new information is obviously more accurate. Two mechanisms are at play here: the confirmation bias that we saw in Chapter 5, and belief perseverance, the tendency not to reverse opinions you already have. Remember that we treat ideas like possessions, and it will be hard for us to part with them.

The fire hydrant experiment was first done in the sixties, and replicated several times since. I have also studied this effect using the mathematics of information: the more detailed knowledge one gets of empirical reality, the more one will see the noise (i.e., the anecdote) and mistake it for actual information. Remember that we are swayed by the sensational. Listening to the news on the

radio every hour is far worse for you than reading a weekly magazine, because the longer interval allows information to be filtered a bit.

In 1965, Stuart Oskamp supplied clinical psychologists with successive files, each containing an increasing amount of information about patients; the psychologists' diagnostic abilities did not grow with the additional supply of information. They just got more confident in their original diagnosis. Granted, one may not expect too much of psychologists of the 1965 variety, but these findings seem to hold across disciplines.

Finally, in another telling experiment, the psychologist Paul Slovic asked bookmakers to select from eighty-eight variables in past horse races those that they found useful in computing the odds. These variables included all manner of statistical information about past performances. The bookmakers were given the ten most useful variables, then asked to predict the outcome of races. Then they were given ten more and asked to predict again. The increase in the information set did not lead to an increase in their accuracy; their confidence in their choices, on the other hand, went up markedly. Information proved to be toxic. I've struggled much of my life with the common middlebrow belief that "more is better"—more is sometimes, but not always, better. This toxicity of knowledge will show in our investigation of the so-called expert.

So far we have not questioned the authority of the professionals involved but rather their ability to gauge the boundaries of their own knowledge. Epistemic arrogance does not preclude skills. A plumber will almost always know more about plumbing than a stubborn essayist and mathematical trader. A hernia surgeon will rarely know less about hernias than a belly dancer. But their probabilities, on the other hand, will be off—and, this is the disturbing point, you may know much more on that score than the expert. No matter what anyone tells you, it is a good idea to question *the error rate* of an expert's procedure. Do not question his procedure, only his confidence. (As someone who was burned by the medical establishment, I learned to be cautious, and I urge everyone to be: if you walk into a doctor's office with a symptom, do not listen to his odds of its *not* being cancer.)

I will separate the two cases as follows. The mild case: *arrogance in the presence of (some) competence*, and the severe case: *arrogance mixed with incompetence (the empty suit)*. There are some professions in which you know more than the experts, who are, alas, people for whose opinions you are paying —instead of them paying you to listen to them. Which ones?

What Moves and What Does Not Move

There is a very rich literature on the so-called expert problem, running empirical testing on experts to verify their record. But it seems to be confusing at first. On one hand, we are shown by a class of expert-busting researchers such as Paul Meehl and Robyn Dawes that the "expert" is the closest thing to a fraud, performing no better than a computer using a single metric, their intuition getting in the way and blinding them. (As an example of a computer using a single metric, the ratio of liquid assets to debt fares better than the majority of credit analysts.) On the other hand, there is abundant literature showing that many people can beat computers thanks to their intuition. Which one is correct?

There must be some disciplines with true experts. Let us ask the following questions: Would you rather have your upcoming brain surgery performed by a newspaper's science reporter or by a certified brain surgeon? On the other hand, would you prefer to listen to an economic forecast by someone with a PhD in finance from some "prominent" institution such as the Wharton School, or by a

newspaper's business writer? While the answer to the first question is empirically obvious, the answer to the second one isn't at all. We can already see the difference between "know-how" and "know-what." The Greeks made a distinction between *technē* and *epistēmē*. The empirical school of medicine of Menodotus of Nicomedia and Heraclites of Tarentum wanted its practitioners to stay closest to *technē* (i.e., "craft"), and away from *epistēmē* (i.e., "knowledge," "science").

The psychologist James Shanteau undertook the task of finding out which disciplines have experts and which have none. Note the confirmation problem here: if you want to prove that there are no experts, then you will be able to find *a* profession in which experts are useless. And you can prove the opposite just as well. But there is a regularity: there are professions where experts play a role, and others where there is no evidence of skills. Which are which?

Experts who tend to be experts: livestock judges, astronomers, test pilots, soil judges, chess masters, physicists, mathematicians (when they deal with mathematical problems, not empirical ones), accountants, grain inspectors, photo interpreters, insurance analysts (dealing with bell curve–style statistics).

Experts who tend to be … not experts: stockbrokers, clinical psychologists, psychiatrists, college admissions officers, court judges, councilors, personnel selectors, intelligence analysts (the CIA's record, in spite of its costs, is pitiful), unless one takes into account some great dose of invisible prevention. I would add these results from my own examination of the literature: economists, financial forecasters, finance professors, political scientists, "risk experts," Bank for International Settlements staff, august members of the International Association of Financial Engineers, and personal financial advisers.

Simply, *things that move*, and therefore require knowledge, do not usually have experts, while things that don't move seem to have some experts. In other words, professions that deal with the future and base their studies on the nonrepeatable past have an expert problem (with the exception of the weather and businesses involving short-term physical processes, not socioeconomic ones). I am not saying that no one who deals with the future provides any valuable information (as I pointed out earlier, newspapers can predict theater opening hours rather well), but rather that those who provide no tangible added value are generally dealing with the future.

Another way to see it is that things that move are often Black Swan–prone. Experts are narrowly focused persons who need to "tunnel." In situations where

tunneling is safe, because Black Swans are not consequential, the expert will do well.

Robert Trivers, an evolutionary psychologist and a man of supernormal insights, has another answer (he became one of the most influential evolutionary thinkers since Darwin with ideas he developed while trying to go to law school). He links it to self-deception. In fields where we have ancestral traditions, such as pillaging, we are very good at predicting outcomes by gauging the balance of power. Humans and chimps can immediately sense which side has the upper hand, and make a cost-benefit analysis about whether to attack and take the goods and the mates. Once you start raiding, you put yourself into a delusional mind-set that makes you ignore additional information—it is best to avoid wavering during battle. On the other hand, unlike raids, large-scale wars are not something present in human heritage—we are new to them—so we tend to misestimate their duration and overestimate our relative power. Recall the underestimation of the duration of the Lebanese war. Those who fought in the Great War thought it would be a mere cakewalk. So it was with the Vietnam conflict, so it is with the Iraq war, and just about every modern conflict.

You cannot ignore self-delusion. The problem with experts is that they do not know what they do not know. Lack of knowledge and delusion about the quality of your knowledge come together—the same process that makes you know less also makes you satisfied with your knowledge.

Next, instead of the range of forecasts, we will concern ourselves with the accuracy of forecasts, i.e., the ability to predict the number itself.

How to Have the Last Laugh

We can also learn about prediction errors from trading activities. We quants have ample data about economic and financial forecasts—from general data about large economic variables to the forecasts and market calls of the television "experts" or "authorities." The abundance of such data and the ability to process it on a computer make the subject invaluable for an empiricist. If I had been a journalist, or, God forbid, a historian, I would have had a far more difficult time testing the predictive effectiveness of these verbal discussions. You cannot process verbal commentaries with a computer—at least not so easily. Furthermore, many economists naïvely make the mistake of producing a lot of forecasts concerning many variables, giving us a database of economists and

variables, which enables us to see whether some economists are better than others (there is no consequential difference) or if there are certain variables for which they are more competent (alas, none that are meaningful).

I was in a seat to observe from very close our ability to predict. In my full-time trader days, a couple of times a week, at 8:30 A.M., my screen would flash some economic number released by the Department of Commerce, or Treasury, or Trade, or some such honorable institution. I never had a clue about what these numbers meant and never saw any need to invest energy in finding out. So I would not have cared the least about them except that people got all excited and talked quite a bit about what these figures were going to mean, pouring verbal sauce around the forecasts. Among such numbers you have the Consumer Price Index (CPI), Nonfarm Payrolls (changes in the number of employed individuals), the Index of Leading Economic Indicators, Sales of Durable Goods (dubbed "doable girls" by traders), the Gross Domestic Product (the most important one), and many more that generate different levels of excitement depending on their presence in the discourse.

The data vendors allow you to take a peek at forecasts by "leading economists," people (in suits) who work for the venerable institutions, such as J. P. Morgan Chase or Morgan Stanley. You can watch these economists talk, theorizing eloquently and convincingly. Most of them earn seven figures and they rank as stars, with teams of researchers crunching numbers and projections. But the stars are foolish enough to publish their projected numbers, right there, for posterity to observe and assess their degree of competence.

Worse yet, many financial institutions produce booklets every year-end called "Outlook for 200X," reading into the following year. Of course they do not check how their previous forecasts fared *after* they were formulated. The public might have been even more foolish in buying the arguments without requiring the following simple tests—easy though they are, very few of them have been done. One elementary empirical test is to compare these star economists to a hypothetical cabdriver (the equivalent of Mikhail from Chapter 1): you create a synthetic agent, someone who takes the most recent number as the best predictor of the next, while assuming that he does not know anything. Then all you have to do is compare the error rates of the hotshot economists and your synthetic agent. The problem is that when you are swayed by stories you forget about the necessity of such testing.

Events Are Outlandish

The problem with prediction is a little more subtle. It comes mainly from the fact that we are living in Extremistan, not Mediocristan. Our predictors may be good at predicting the ordinary, but not the irregular, and this is where they ultimately fail. All you need to do is miss one interest-rates move, from 6 percent to 1 percent in a longer-term projection (what happened between 2000 and 2001) to have all your subsequent forecasts rendered completely ineffectual in correcting your cumulative track record. What matters is not how often you are right, but how large your cumulative errors are.

And these cumulative errors depend largely on the big surprises, the big opportunities. Not only do economic, financial, and political predictors miss them, but they are quite ashamed to say anything outlandish to their clients—and yet *events, it turns out, are almost always outlandish*. Furthermore, as we will see in the next section, economic forecasters tend to fall closer to one another than to the resulting outcome. Nobody wants to be off the wall.

Since my testing has been informal, for commercial and entertainment purposes, for my own consumption and not formatted for publishing, I will use the more formal results of other researchers who did the dog work of dealing with the tedium of the publishing process. I am surprised that so little introspection has been done to check on the usefulness of these professions. There are a few—but not many—formal tests in three domains: security analysis, political science, and economics. We will no doubt have more in a few years. Or perhaps not—the authors of such papers might become stigmatized by his colleagues. Out of close to a million papers published in politics, finance, and economics, there have been only a small number of checks on the predictive quality of such knowledge.

Herding Like Cattle

A few researchers have examined the work and attitude of security analysts, with amazing results, particularly when one considers the epistemic arrogance of these operators. In a study comparing them with weather forecasters, Tadeusz Tyszka and Piotr Zielonka document that the analysts are worse at predicting, while having a greater faith in their own skills. Somehow, the analysts' self-evaluation did not decrease their error margin after their failures to forecast.

Last June I bemoaned the dearth of such published studies to Jean-Philippe

Bouchaud, whom I was visiting in Paris. He is a boyish man who looks half my age though he is only slightly younger than I, a matter that I half jokingly attribute to the beauty of physics. Actually he is not exactly a physicist but one of those quantitative scientists who apply methods of statistical physics to economic variables, a field that was started by Benoît Mandelbrot in the late 1950s. This community does not use Mediocristan mathematics, so they seem to care about the truth. They are completely outside the economics and business-school finance establishment, and survive in physics and mathematics departments or, very often, in trading houses (traders rarely hire economists for their own consumption, but rather to provide stories for their less sophisticated clients). Some of them also operate in sociology with the same hostility on the part of the "natives." Unlike economists who wear suits and spin theories, they use empirical methods to observe the data and do not use the bell curve.

He surprised me with a research paper that a summer intern had just finished under his supervision and that had just been accepted for publication; it scrutinized two thousand predictions by security analysts. What it showed was that these brokerage-house analysts predicted *nothing*—a naïve forecast made by someone who takes the figures from one period as predictors of the next would not do markedly worse. Yet analysts are informed about companies' orders, forthcoming contracts, and planned expenditures, so this advanced knowledge *should* help them do considerably better than a naïve forecaster looking at the past data without further information. Worse yet, the forecasters' errors were significantly larger than the average difference between individual forecasts, which indicates herding. Normally, forecasts should be as far from one another as they are from the predicted number. But to understand how they manage to stay in business, and why they don't develop severe nervous breakdowns (with weight loss, erratic behavior, or acute alcoholism), we must look at the work of the psychologist Philip Tetlock.

I Was "Almost" Right

Tetlock studied the business of political and economic "experts." He asked various specialists to judge the likelihood of a number of political, economic, and military events occurring within a specified time frame (about five years ahead). The outcomes represented a total number of around twenty-seven thousand predictions, involving close to three hundred specialists. Economists represented about a quarter of his sample. The study revealed that experts' error

rates were clearly many times what they had estimated. His study exposed an expert problem: there was no difference in results whether one had a PhD or an undergraduate degree. Well-published professors had no advantage over journalists. The only regularity Tetlock found was the negative effect of reputation on prediction: those who had a big reputation were worse predictors than those who had none.

But Tetlock's focus was not so much to show the real competence of experts (although the study was quite convincing with respect to that) as to investigate why the experts did not realize that they were not so good at their own business, in other words, how they spun their stories. There seemed to be a logic to such incompetence, mostly in the form of belief defense, or the protection of self-esteem. He therefore dug further into the mechanisms by which his subjects generated ex post explanations.

I will leave aside how one's ideological commitments influence one's perception and address the more general aspects of this blind spot toward one's own predictions.

You tell yourself that you were playing a different game. Let's say you failed to predict the weakening and precipitous fall of the Soviet Union (which no social scientist saw coming). It is easy to claim that you were excellent at understanding the political workings of the Soviet Union, but that these Russians, being exceedingly Russian, were skilled at hiding from you crucial economic elements. Had you been in possession of such economic intelligence, you would certainly have been able to predict the demise of the Soviet regime. It is not your skills that are to blame. The same might apply to you if you had forecast the landslide victory for Al Gore over George W. Bush. You were not aware that the economy was in such dire straits; indeed, this fact seemed to be concealed from everyone. Hey, you are not an economist, and the game turned out to be about economics.

You invoke the outlier. Something happened that was outside the system, outside the scope of your science. Given that it was not predictable, you are not to blame. It was a Black Swan and you are not supposed to predict Black Swans. Black Swans, NNT tells us, are fundamentally unpredictable (but then I think that NNT would ask you, Why rely on predictions?). Such events are "exogenous," coming from outside your science. Or maybe it was an event of very, very low probability, a thousand-year flood, and we were unlucky to be exposed to it. But next time, it will not happen. This focus on the narrow game

and linking one's performance to a given script is how the nerds explain the failures of mathematical methods in society. The model was right, it worked well, but the game turned out to be a different one than anticipated.

The "almost right" defense. Retrospectively, with the benefit of a revision of values and an informational framework, it is easy to feel that it was a close call. Tetlock writes, "Observers of the former Soviet Union who, in 1988, thought the Communist Party could not be driven from power by 1993 or 1998 were especially likely to believe that Kremlin hardliners almost overthrew Gorbachev in the 1991 coup attempt, and they would have if the conspirators had been more resolute and less inebriated, or if key military officers had obeyed orders to kill civilians challenging martial law or if Yeltsin had not acted so bravely."

I will go now into more general defects uncovered by this example. These "experts" were lopsided: on the occasions when they were right, they attributed it to their own depth of understanding and expertise; when wrong, it was either the situation that was to blame, since it was unusual, or, worse, they did not recognize that they were wrong and spun stories around it. They found it difficult to accept that their grasp was a little short. But this attribute is universal to all our activities: there is something in us designed to protect our self-esteem.

We humans are the victims of an asymmetry in the perception of random events. We attribute our successes to our skills, and our failures to external events outside our control, namely to randomness. We feel responsible for the good stuff, but not for the bad. This causes us to think that we are better than others at whatever we do for a living. Ninety-four percent of Swedes believe that their driving skills put them in the top 50 percent of Swedish drivers; 84 percent of Frenchmen feel that their lovemaking abilities put them in the top half of French lovers.

The other effect of this asymmetry is that we feel a little unique, unlike others, for whom we do not perceive such an asymmetry. I have mentioned the unrealistic expectations about the future on the part of people in the process of tying the knot. Also consider the number of families who tunnel on their future, locking themselves into hard-to-flip real estate thinking they are going to live there permanently, not realizing that the general track record for sedentary living is dire. Don't they see those well-dressed real-estate agents driving around in fancy two-door German cars? We are very nomadic, far more than we plan to be, and forcibly so. Consider how many people who have abruptly lost their job deemed it likely to occur, even a few days before. Or consider how many drug

addicts entered the game willing to stay in it so long.

There is another lesson from Tetlock's experiment. He found what I mentioned earlier, that many university stars, or "contributors to top journals," are no better than the average *New York Times* reader or journalist in detecting changes in the world around them. These sometimes overspecialized experts failed tests in their own specialties.

The hedgehog and the fox. Tetlock distinguishes between two types of predictors, the hedgehog and the fox, according to a distinction promoted by the essayist Isaiah Berlin. As in Aesop's fable, the hedgehog knows one thing, the fox knows many things—these are the adaptable types you need in daily life. Many of the prediction failures come from hedgehogs who are mentally married to a single big Black Swan event, a big bet that is not likely to play out. The hedgehog is someone focusing on a single, improbable, and consequential event, falling for the narrative fallacy that makes us so blinded by one single outcome that we cannot imagine others.

Hedgehogs, because of the narrative fallacy, are easier for us to understand—their ideas work in sound bites. Their category is overrepresented among famous people; ergo famous people are on average worse at forecasting than the rest of the predictors.

I have avoided the press for a long time because whenever journalists hear my Black Swan story, they ask me to give them a list of future impacting events. They want me to be *predictive* of these Black Swans. Strangely, my book *Fooled by Randomness*, published a week before September 11, 2001, had a discussion of the possibility of a plane crashing into my office building. So I was naturally asked to show "how I predicted the event." I didn't predict it—it was a chance occurrence. I am not playing oracle! I even recently got an e-mail asking me to list the next ten Black Swans. Most fail to get my point about the error of specificity, the narrative fallacy, and the idea of prediction. Contrary to what people might expect, I am not recommending that anyone become a hedgehog—rather, be a fox with an open mind. I know that history is going to be dominated by an improbable event, I just don't know what that event will be.

Reality? What For?

I found no formal, Tetlock-like comprehensive study in economics journals. But, suspiciously, I found no paper trumpeting economists' ability to produce reliable

projections. So I reviewed what articles and working papers in economics I could find. They collectively show no convincing evidence that economists as a community have an ability to predict, and, if they have some ability, their predictions are at best just *slightly* better than random ones—not good enough to help with serious decisions.

The most interesting test of how academic methods fare in the real world was run by Spyros Makridakis, who spent part of his career managing competitions between forecasters who practice a "scientific method" called econometrics—an approach that combines economic theory with statistical measurements. Simply put, he made people forecast *in real life* and then he judged their accuracy. This led to the series of "M-Competitions" he ran, with assistance from Michele Hibon, of which M3 was the third and most recent one, completed in 1999. Makridakis and Hibon reached the sad conclusion that "statistically sophisticated or complex methods do not necessarily provide more accurate forecasts than simpler ones."

I had an identical experience in my quant days—the foreign scientist with the throaty accent spending his nights on a computer doing complicated mathematics rarely fares better than a cabdriver using the simplest methods within his reach. The problem is that we focus on the rare occasion when these methods work and almost never on their far more numerous failures. I kept begging anyone who would listen to me: "Hey, I am an uncomplicated, no-nonsense fellow from Amioun, Lebanon, and have trouble understanding why something is considered valuable if it requires running computers overnight but does not enable me to predict better than any other guy from Amioun." The only reactions I got from these colleagues were related to the geography and history of Amioun rather than a no-nonsense explanation of their business. Here again, you see the narrative fallacy at work, except that in place of journalistic stories you have the more dire situation of the "scientists" with a Russian accent looking in the rearview mirror, narrating with equations, and refusing to look ahead because he may get too dizzy. The econometrician Robert Engel, an otherwise charming gentleman, invented a very complicated statistical method called GARCH and got a Nobel for it. No one tested it to see if it has any validity in real life. Simpler, less sexy methods fare exceedingly better, but they do not take you to Stockholm. You have an expert problem in Stockholm, and I will discuss it in Chapter 17.

This unfitness of complicated methods seems to apply to all methods. Another

study effectively tested practitioners of something called game theory, in which the most notorious player is John Nash, the schizophrenic mathematician made famous by the film *A Beautiful Mind*. Sadly, for all the intellectual appeal of these methods and all the media attention, its practitioners are no better at predicting than university students.

There is another problem, and it is a little more worrisome. Makridakis and Hibon were to find out that the strong empirical evidence of their studies has been ignored by theoretical statisticians. Furthermore, they encountered shocking hostility toward their empirical verifications. “Instead [statisticians] have concentrated their efforts in building more sophisticated models without regard to the ability of such models to more accurately predict real-life data,” Makridakis and Hibon write.

Someone may counter with the following argument: Perhaps economists’ forecasts create feedback that cancels their effect (this is called the Lucas critique, after the economist Robert Lucas). Let’s say economists predict inflation; in response to these expectations the Federal Reserve acts and lowers inflation. So you cannot judge the forecast accuracy in economics as you would with other events. I agree with this point, but I do not believe that it is the cause of the economists’ failure to predict. The world is far too complicated for their discipline.

When an economist fails to predict outliers he often invokes the issue of earthquakes or revolutions, claiming that he is not into geodesics, atmospheric sciences, or political science, instead of incorporating these fields into his studies and accepting that his field does not exist in isolation. Economics is the most insular of fields; it is the one that quotes least from outside itself! Economics is perhaps the subject that currently has the highest number of philistine scholars—scholarship without erudition and natural curiosity can close your mind and lead to the fragmentation of disciplines.

"OTHER THAN THAT," IT WAS OKAY

We have used the story of the Sydney Opera House as a springboard for our discussion of prediction. We will now address another constant in human nature: a systematic error made by project planners, coming from a mixture of human nature, the complexity of the world, or the structure of organizations. In order to survive, institutions may need to give themselves and others the appearance of having a "vision."

Plans fail because of what we have called tunneling, the neglect of sources of uncertainty outside the plan itself.

The typical scenario is as follows. Joe, a nonfiction writer, gets a book contract with a set final date for delivery two years from now. The topic is relatively easy: the authorized biography of the writer Salman Rushdie, for which Joe has compiled ample data. He has even tracked down Rushdie's former girlfriends and is thrilled at the prospect of pleasant interviews. Two years later, minus, say, three months, he calls to explain to the publisher that he will be *a little* delayed. The publisher has seen this coming; he is used to authors being late. The publishing house now has cold feet because the subject has *unexpectedly* faded from public attention—the firm projected that interest in Rushdie would remain high, but attention has faded, seemingly because the Iranians, for some reason, lost interest in killing him.

Let's look at the source of the biographer's underestimation of the time for completion. He projected his own schedule, but he tunneled, as he did not forecast that some "external" events would emerge to slow him down. Among these external events were the disasters on September 11, 2001, which set him back several months; trips to Minnesota to assist his ailing mother (who eventually recovered); and many more, like a broken engagement (though not with Rushdie's ex-girlfriend). "Other than that," it was all within his plan; his own work did not stray the least from schedule. He does not feel responsible for his failure.*

The unexpected has a one-sided effect with projects. Consider the track records of builders, paper writers, and contractors. The unexpected almost always pushes in a single direction: higher costs and a longer time to completion. On very rare occasions, as with the Empire State Building, you get the opposite: shorter completion and lower costs—these occasions are becoming truly exceptional nowadays.

We can run experiments and test for repeatability to verify if such errors in projection are part of human nature. Researchers have tested how students estimate the time needed to complete their projects. In one representative test, they broke a group into two varieties, optimistic and pessimistic. Optimistic students promised twenty-six days; the pessimistic ones forty-seven days. The average actual time to completion turned out to be fifty-six days.

The example of Joe the writer is not acute. I selected it because it concerns a repeatable, routine task—for such tasks our planning errors are milder. With projects of great novelty, such as a military invasion, an all-out war, or something entirely new, errors explode upward. In fact, the more routine the task, the better you learn to forecast. But there is always something nonroutine in our modern environment.

There may be incentives for people to promise shorter completion dates—in order to win the book contract or in order for the builder to get your down payment and use it for his upcoming trip to Antigua. But the planning problem exists even where there is no incentive to underestimate the duration (or the costs) of the task. As I said earlier, we are too narrow-minded a species to consider the possibility of events straying from our mental projections, but furthermore, we are too focused on matters internal to the project to take into account external uncertainty, the "unknown unknown," so to speak, the contents of the unread books.

There is also the nerd effect, which stems from the mental elimination of off-model risks, or *focusing* on what you know. You view the world from *within* a model. Consider that most delays and cost overruns arise from unexpected elements that did not enter into the plan—that is, they lay outside the model at hand—such as strikes, electricity shortages, accidents, bad weather, or rumors of Martian invasions. These small Black Swans that threaten to hamper our projects do not seem to be taken into account. They are too abstract—we don't know how they look and cannot talk about them intelligently.

We cannot truly plan, because we do not understand the future—but this is not necessarily bad news. We could plan *while bearing in mind such limitations*. It just takes guts.

The Beauty of Technology: Excel Spreadsheets

In the not too distant past, say the precomputer days, projections remained vague

and qualitative, one had to make a mental effort to keep track of them, and it was a strain to push scenarios into the future. It took pencils, erasers, reams of paper, and huge wastebaskets to engage in the activity. Add to that an accountant's love for tedious, slow work. The activity of projecting, in short, was effortful, undesirable, and marred with self-doubt.

But things changed with the intrusion of the spreadsheet. When you put an Excel spreadsheet into computer-literate hands you get a "sales projection" effortlessly extending ad infinitum! Once on a page or on a computer screen, or, worse, in a PowerPoint presentation, the projection takes on a life of its own, losing its vagueness and abstraction and becoming what philosophers call reified, invested with concreteness; it takes on a new life as a tangible object.

My friend Brian Hinchcliffe suggested the following idea when we were both sweating at the local gym. Perhaps the ease with which one can project into the future by dragging cells in these spreadsheet programs is responsible for the armies of forecasters confidently producing longer-term forecasts (all the while tunneling on their assumptions). We have become worse planners than the Soviet Russians thanks to these potent computer programs given to those who are incapable of handling their knowledge. Like most commodity traders, Brian is a man of incisive and sometimes brutally painful realism.

A classical mental mechanism, called anchoring, seems to be at work here. You lower your anxiety about uncertainty by producing a number, then you "anchor" on it, like an object to hold on to in the middle of a vacuum. This anchoring mechanism was discovered by the fathers of the psychology of uncertainty, Danny Kahneman and Amos Tversky, early in their heuristics and biases project. It operates as follows. Kahneman and Tversky had their subjects spin a wheel of fortune. The subjects first looked at the number on the wheel, *which they knew was random*, then they were asked to estimate the number of African countries in the United Nations. Those who had a low number on the wheel estimated a low number of African nations; those with a high number produced a higher estimate.

Similarly, ask someone to provide you with the last four digits of his social security number. Then ask him to estimate the number of dentists in Manhattan. You will find that by making him aware of the four-digit number, you elicit an estimate that is correlated with it.

We use reference points in our heads, say sales projections, and start building beliefs around them because less mental effort is needed to compare an idea to a

reference point than to evaluate it in the absolute *(System 1* at work!). We cannot work without a point of reference.

So the introduction of a reference point in the forecaster's mind will work wonders. This is no different from a starting point in a bargaining episode: you open with high number ("I want a million for this house"); the bidder will answer "only eight-fifty"—the discussion will be determined by that initial level.

The Character of Prediction Errors

Like many biological variables, life expectancy is from Mediocristan, that is, it is subjected to mild randomness. It is not scalable, since the older we get, the less likely we are to live. In a developed country a newborn female is expected to die at around 79, according to insurance tables. When she reaches her 79th birthday, her life expectancy, assuming that she is in typical health, is another 10 years. At the age of 90, she should have another 4.7 years to go. At the age of 100, 2.5 years. At the age of 119, if she miraculously lives that long, she should have about nine months left. As she lives beyond the expected date of death, the number of additional years to go decreases. This illustrates the major property of random variables related to the bell curve. The conditional expectation of additional life drops as a person gets older.

With human projects and ventures we have another story. These are often scalable, as I said in Chapter 3. With scalable variables, the ones from Extremistan, you will witness the exact opposite effect. Let's say a project is expected to terminate in 79 days, the same expectation in days as the newborn female has in years. On the 79th day, if the project is not finished, it will be expected to take another 25 days to complete. But on the 90th day, if the project is still not completed, it should have about 58 days to go. On the 100th, it should have 89 days to go. On the 119th, it should have an extra 149 days. On day 600, if the project is not done, you will be expected to need an extra 1,590 days. As you see, *the longer you wait, the longer you will be expected to wait*.

Let's say you are a refugee waiting for the return to your homeland. Each day that passes you are getting farther from, not closer to, the day of triumphal return. The same applies to the completion date of your next opera house. If it was expected to take two years, and three years later you are asking questions, do not expect the project to be completed any time soon. If wars last on average six months, and your conflict has been going on for two years, expect another

few years of problems. The Arab-Israeli conflict is sixty years old, and counting—yet it was considered "a simple problem" sixty years ago. (Always remember that, in a modern environment, wars last longer and kill more people than is typically planned.) Another example: Say that you send your favorite author a letter, knowing that he is busy and has a two-week turnaround. If three weeks later your mailbox is still empty, do not expect the letter to come tomorrow—it will take on average another three weeks. If three months later you still have nothing, you will have to expect to wait another year. Each day will bring you closer to your death but further from the receipt of the letter.

This subtle but extremely consequential property of scalable randomness is unusually counterintuitive. We misunderstand the logic of large deviations from the norm.

I will get deeper into these properties of scalable randomness in Part Three. But let us say for now that they are central to our misunderstanding of the business of prediction.

DON'T CROSS A RIVER IF IT IS (ON AVERAGE) FOUR FEET DEEP

Corporate and government projections have an additional easy-to-spot flaw: they do not attach a *possible error rate* to their scenarios. Even in the absence of Black Swans this omission would be a mistake.

I once gave a talk to policy wonks at the Woodrow Wilson Center in Washington, D.C., challenging them to be aware of our weaknesses in seeing ahead.

The attendees were tame and silent. What I was telling them was against everything they believed and stood for; I had gotten carried away with my aggressive message, but they looked thoughtful, compared to the testosterone-charged characters one encounters in business. I felt guilty for my aggressive stance. Few asked questions. The person who organized the talk and invited me must have been pulling a joke on his colleagues. I was like an aggressive atheist making his case in front of a synod of cardinals, while dispensing with the usual formulaic euphemisms.

Yet some members of the audience were sympathetic to the message. One anonymous person (he is employed by a governmental agency) explained to me privately after the talk that in January 2004 his department was forecasting the price of oil for twenty-five years later at $27 a barrel, slightly higher than what it was at the time. Six months later, around June 2004, after oil doubled in price, they had to revise their estimate to $54 (the price of oil is currently, as I am writing these lines, close to $79 a barrel). It did not dawn on them that it was ludicrous to forecast a second time given that their forecast was off so early and so markedly, that this business of forecasting had to be somehow questioned. And they were looking *twenty-five years* ahead! Nor did it hit them that there was something called an error rate to take into account.*

Forecasting without incorporating an error rate uncovers three fallacies, all arising from the same misconception about the nature of uncertainty.

The first fallacy: *variability matters*. The first error lies in taking a projection too seriously, without heeding its accuracy. Yet, for planning purposes, the accuracy in your forecast matters far more than the forecast itself. I will explain it as follows.

Don't cross a river if it is four feet deep on average. You would take a different set of clothes on your trip to some remote destination if I told you that

the temperature was expected to be seventy degrees Fahrenheit, with an expected error rate of forty degrees than if I told you that my margin of error was only five degrees. The policies we need to make decisions on should depend far more on the range of possible outcomes than on the expected final number. I have seen, while working for a bank, how people project cash flows for companies without wrapping them in the thinnest layer of uncertainty. Go to the stockbroker and check on what method they use to forecast sales ten years ahead to "calibrate" their valuation models. Go find out how analysts forecast government deficits. Go to a bank or security-analysis training program and see how they teach trainees to make assumptions; they do not teach you to build an error rate around those assumptions—but their error rate is so large that it is far more significant than the projection itself!

The second fallacy lies in failing to take into account forecast degradation as the projected period lengthens. We do not realize the full extent of the difference between near and far futures. Yet the degradation in such forecasting through time becomes evident through simple introspective examination—without even recourse to scientific papers, which on this topic are suspiciously rare. Consider forecasts, whether economic or technological, made in 1905 for the following quarter of a century. How close to the projections did 1925 turn out to be? For a convincing experience, go read George Orwell's *1984*. Or look at more recent forecasts made in 1975 about the prospects for the new millennium. Many events have taken place and new technologies have appeared that lay outside the forecasters' imaginations; many more that were expected to take place or appear did not do so. Our forecast errors have traditionally been enormous, and there may be no reasons for us to believe that we are suddenly in a more privileged position to see into the future compared to our blind predecessors. Forecasting by bureaucrats tends to be used for anxiety relief rather than for adequate policy making.

The third fallacy, and perhaps the gravest, concerns a misunderstanding of the random character of the variables being forecast. Owing to the Black Swan, these variables can accommodate far more optimistic—or far more pessimistic—scenarios than are currently expected. Recall from my experiment with Dan Goldstein testing the domain-specificity of our intuitions, how we tend to make no mistakes in Mediocristan, but make large ones in Extremistan as we do not realize the consequences of the rare event.

What is the implication here? Even if you agree with a given forecast, you

have to worry about the real possibility of significant divergence from it. These divergences may be welcomed by a speculator who does not depend on steady income; a retiree, however, with set risk attributes cannot afford such gyrations. I would go even further and, using the argument about the depth of the river, state that it is the lower bound of estimates (i.e., the worst case) that matters when engaging in a policy—the worst case is far more consequential than the forecast itself. This is particularly true if the bad scenario is not acceptable. Yet the current phraseology makes no allowance for that. None.

It is often said that "is wise he who can see things coming." Perhaps the wise one is the one who knows that he cannot see things far away.

Get Another Job

The two typical replies I face when I question forecasters' business are: "What should he do? Do you have a better way for us to predict?" and "If you're so smart, show me your own prediction." In fact, the latter question, usually boastfully presented, aims to show the superiority of the practitioner and "doer" over the philosopher, and mostly comes from people who do not know that I was a trader. If there is one advantage of having been in the daily practice of uncertainty, it is that one does not have to take any crap from bureaucrats.

One of my clients asked for my predictions. When I told him I had none, he was offended and decided to dispense with my services. There is in fact a routine, unintrospective habit of making businesses answer questionnaires and fill out paragraphs showing their "outlooks." I have never had an outlook and have never made professional predictions—but at least *I know that I cannot forecast* and a small number of people (those I care about) take that as an asset.

There are those people who produce forecasts uncritically. When asked why they forecast, they answer, "Well, that's what we're paid to do here."

My suggestion: get another job.

This suggestion is not too demanding: unless you are a slave, I assume you have some amount of control over your job selection. Otherwise this becomes a problem of ethics, and a grave one at that. People who are trapped in their jobs who forecast simply because "that's my job," knowing pretty well that their forecast is ineffectual, are not what I would call ethical. What they do is no different from repeating lies simply because "it's my job."

Anyone who causes harm by forecasting should be treated as either a fool or a liar. Some forecasters cause more damage to society than criminals. Please, don't drive a school bus blindfolded.

At JFK

At New York's JFK airport you can find gigantic newsstands with walls full of magazines. They are usually manned by a very polite family from the Indian subcontinent (just the parents; the children are in medical school). These walls present you with the entire corpus of what an "informed" person needs in order "to know what's going on." I wonder how long it would take to read every single one of these magazines, excluding the fishing and motorcycle periodicals (but including the gossip magazines—you might as well have some fun). Half a lifetime? An entire lifetime?

Caravaggio's *The Fortune-Teller*. We have always been suckers for those who tell us about the future. In this picture the fortune-teller is stealing the victim's ring.

Sadly, all this knowledge would not help the reader to forecast what is to happen tomorrow. Actually, it might decrease his ability to forecast.

There is another aspect to the problem of prediction: its inherent limitations, those that have little to do with human nature, but instead arise from the very nature of information itself. I have said that the Black Swan has three attributes: unpredictability, consequences, and retrospective explainability. Let us examine this unpredictability business.*

* The book you have in your hands is approximately and “unexpectedly” fifteen months late.

* While forecast errors have always been entertaining, commodity prices have been a great trap for suckers. Consider this 1970 forecast by U.S. officials (signed by the U.S. Secretaries of the Treasury, State, Interior, and Defense): “the standard price of foreign crude oil by 1980 may well decline and will in any event not experience a substantial increase.” Oil prices went up tenfold by 1980. I just wonder if current forecasters lack in intellectual curiosity or if they are intentionally ignoring forecast errors.

  Also note this additional aberration: since high oil prices are marking up their inventories, oil companies are making record bucks and oil executives are getting huge bonuses because “they did a good job”—as if they brought profits by *causing* the rise of oil prices.

* I owe the reader an answer concerning Catherine’s lover count. She had only twelve.

Chapter Eleven

HOW TO LOOK FOR BIRD POOP

Popper's prediction about the predictors—Poincaré plays with billiard balls—Von Hayek is allowed to be irreverent—Anticipation machines—Paul Samuelson wants you to be rational—Beware the philosopher—Demand some certainties.

We've seen that a) we tend to both tunnel and think "narrowly" (epistemic arrogance), and b) our prediction record is highly overestimated—many people who think they can predict actually can't.

We will now go deeper into the unadvertised structural limitations on our ability to predict. These limitations may arise not from us but from the nature of the activity itself—too complicated, not just for us, but for any tools we have or can conceivably obtain. Some Black Swans will remain elusive, enough to kill our forecasts.

HOW TO LOOK FOR BIRD POOP

In the summer of 1998 I worked at a European-owned financial institution. It wanted to distinguish itself by being rigorous and farsighted. The unit involved in trading had five managers, all serious-looking (always in dark blue suits, even on dress-down Fridays), who had to meet throughout the summer in order "to formulate the five-year plan." This was supposed to be a meaty document, a sort of user's manual for the firm. A five-year plan? To a fellow deeply skeptical of the central planner, the notion was ludicrous; growth within the firm had been organic and unpredictable, bottom-up not top-down. It was well known that the firm's most lucrative department was the product of a chance call from a customer asking for a specific but strange financial transaction. The firm accidentally realized that they could build a unit just to handle these transactions, since they were profitable, and it rapidly grew to dominate their activities.

The managers flew across the world in order to meet: Barcelona, Hong Kong, et cetera. A lot of miles for a lot of verbiage. Needless to say they were usually sleep-deprived. Being an executive does not require very developed frontal lobes, but rather a combination of charisma, a capacity to sustain boredom, and the ability to shallowly perform on harrying schedules. Add to these tasks the "duty" of attending opera performances.

The managers sat down to brainstorm during these meetings, about, of course, the medium-term future—they wanted to have "vision." But then an event occurred that was not in the previous five-year plan: the Black Swan of the Russian financial default of 1998 and the accompanying meltdown of the values of Latin American debt markets. It had such an effect on the firm that, although the institution had a sticky employment policy of retaining managers, none of the five was still employed there a month after the sketch of the 1998 five-year plan.

Yet I am confident that today their replacements are still meeting to work on the next "five-year plan." We never learn.

Inadvertent Discoveries

The discovery of human epistemic arrogance, as we saw in the previous chapter, was allegedly inadvertent. But so were many other discoveries as well. Many more than we think.

The classical model of discovery is as follows: you search for what you know (say, a new way to reach India) and find something you didn't know was there (America).

If you think that the inventions we see around us came from someone sitting in a cubicle and concocting them according to a timetable, think again: almost everything of the moment is the product of serendipity. The term *serendipity* was coined in a letter by the writer Hugh Walpole, who derived it from a fairy tale, "The Three Princes of Serendip." These princes "were always making discoveries by accident or sagacity, of things which they were not in quest of."

In other words, you find something you are not looking for and it changes the world, while wondering after its discovery why it "took so long" to arrive at something so obvious. No journalist was present when the wheel was invented, but I am ready to bet that people did not just embark on the project of inventing the wheel (that main engine of growth) and then complete it according to a timetable. Likewise with most inventions.

Sir Francis Bacon commented that the most important advances are the least predictable ones, those "lying out of the path of the imagination." Bacon was not the last intellectual to point this out. The idea keeps popping up, yet then rapidly dying out. Almost half a century ago, the bestselling novelist Arthur Koestler wrote an entire book about it, aptly called *The Sleepwalkers*. It describes discoverers as sleepwalkers stumbling upon results and not realizing what they have in their hands. We think that the import of Copernicus's discoveries concerning planetary motions was obvious to him and to others in his day; he had been dead seventy-five years before the authorities started getting offended. Likewise we think that Galileo was a victim in the name of science; in fact, the church didn't take him too seriously. It seems, rather, that Galileo caused the uproar himself by ruffling a few feathers. At the end of the year in which Darwin and Wallace presented their papers on evolution by natural selection that changed the way we view the world, the president of the Linnean society, where the papers were presented, announced that the society saw "no striking discovery," nothing in particular that could revolutionize science.

We forget about unpredictability when it is our turn to predict. This is why people can read this chapter and similar accounts, agree entirely with them, yet fail to heed their arguments when thinking about the future.

Take this dramatic example of a serendipitous discovery. Alexander Fleming was cleaning up his laboratory when he found that penicillium mold had

contaminated one of his old experiments. He thus happened upon the antibacterial properties of penicillin, the reason many of us are alive today (including, as I said in Chapter 8, myself, for typhoid fever is often fatal when untreated). True, Fleming was looking for "something," but the actual discovery was simply serendipitous. Furthermore, while in hindsight the discovery appears momentous, it took a very long time for health officials to realize the importance of what they had on their hands. Even Fleming lost faith in the idea before it was subsequently revived.

In 1965 two radio astronomists at Bell Labs in New Jersey who were mounting a large antenna were bothered by a background noise, a hiss, like the static that you hear when you have bad reception. The noise could not be eradicated—even after they cleaned the bird excrement out of the dish, since they were convinced that bird poop was behind the noise. It took a while for them to figure out that what they were hearing was the trace of the birth of the universe, the cosmic background microwave radiation. This discovery revived the big bang theory, a languishing idea that was posited by earlier researchers. I found the following comments on Bell Labs' website commenting on how this "discovery" was one of the century's greatest advances:

> Dan Stanzione, then Bell Labs president and Lucent's chief operating officer when Penzias [one of the radio astronomers involved in the discovery] retired, said Penzias "embodies the creativity and technical excellence that are the hallmarks of Bell Labs." He called him a Renaissance figure who "extended our fragile understanding of creation, and advanced the frontiers of science in many important areas."

Renaissance shmenaissance. The two fellows were looking for bird poop! Not only were they not looking for anything remotely like the evidence of the big bang but, as usual in these cases, they did not immediately see the importance of their find. Sadly, the physicist Ralph Alpher, the person who initially conceived of the idea, in a paper coauthored with heavyweights George Gamow and Hans Bethe, was surprised to read about the discovery in *The New York Times*. In fact, in the languishing papers positing the birth of the universe, scientists were doubtful whether such radiation could ever be measured. As happens so often in discovery, those looking for evidence did not find it; those not looking for it found it and were hailed as discoverers.

We have a paradox. Not only have forecasters generally failed dismally to foresee the drastic changes brought about by unpredictable discoveries, but incremental change has turned out to be generally slower than forecasters expected. When a new technology emerges, we either grossly underestimate or

severely overestimate its importance. Thomas Watson, the founder of IBM, once predicted that there would be no need for more than just a handful of computers.

That the reader of this book is probably reading these lines not on a screen but in the pages of that anachronistic device, the book, would seem quite an aberration to certain pundits of the "digital revolution." That you are reading them in archaic, messy, and inconsistent English, French, or Swahili, instead of in Esperanto, defies the predictions of half a century ago that the world would soon be communicating in a logical, unambiguous, and Platonically designed lingua franca. Likewise, we are not spending long weekends in space stations as was universally predicted three decades ago. In an example of corporate arrogance, after the first moon landing the now-defunct airline Pan Am took advance bookings for round-trips between earth and the moon. Nice prediction, except that the company failed to foresee that it would be out of business not long after.

A Solution Waiting for a Problem

Engineers tend to develop tools for the pleasure of developing tools, not to induce nature to yield its secrets. It so happens that *some* of these tools bring us more knowledge; because of the silent evidence effect, we forget to consider tools that accomplished nothing but keeping engineers off the streets. Tools lead to unexpected discoveries, which themselves lead to other unexpected discoveries. But rarely do our tools seem to work as intended; it is only the engineer's gusto and love for the building of toys and machines that contribute to the augmentation of our knowledge. Knowledge does not progress from tools designed to verify or help theories, but rather the opposite. The computer was not built to allow us to develop new, visual, geometric mathematics, but for some other purpose. It happened to allow us to discover mathematical objects that few cared to look for. Nor was the computer invented to let you chat with your friends in Siberia, but it has caused some long-distance relationships to bloom. As an essayist, I can attest that the Internet has helped me to spread my ideas by bypassing journalists. But this was not the stated purpose of its military designer.

The laser is a prime illustration of a tool made for a given purpose (actually no real purpose) that then found applications that were not even dreamed of at the time. It was a typical "solution looking for a problem." Among the early

applications was the surgical stitching of detached retinas. Half a century later, *The Economist* asked Charles Townes, the alleged inventor of the laser, if he had had retinas on his mind. He had not. He was satisfying his desire to split light beams, and that was that. In fact, Townes's colleagues teased him quite a bit about the irrelevance of his discovery. Yet just consider the effects of the laser in the world around you: compact disks, eyesight corrections, microsurgery, data storage and retrieval—all unforeseen applications of the technology.*

We build toys. Some of those toys change the world.

Keep Searching

In the summer of 2005 I was the guest of a biotech company in California that had found inordinate success. I was greeted with T-shirts and pins showing a bell-curve buster and the announcement of the formation of the Fat Tails Club ("fat tails" is a technical term for Black Swans). This was my first encounter with a firm that lived off Black Swans of the positive kind. I was told that a scientist managed the company and that he had the instinct, as a scientist, to just let scientists look wherever their instinct took them. Commercialization came later. My hosts, scientists at heart, understood that research involves a large element of serendipity, which can pay off big as long as one knows how serendipitous the business can be and structures it around that fact. Viagra, which changed the mental outlook and social mores of retired men, was meant to be a hypertension drug. Another hypertension drug led to a hair-growth medication. My friend Bruce Goldberg, who understands randomness, calls these unintended side applications "corners." While many worry about unintended consequences, technology adventurers thrive on them.

The biotech company seemed to follow implicitly, though not explicitly, Louis Pasteur's adage about creating luck by sheer exposure. "Luck favors the prepared," Pasteur said, and, like all great discoverers, he knew something about accidental discoveries. The best way to get maximal exposure is to keep researching. Collect opportunities—on that, later.

To predict the spread of a technology implies predicting a large element of fads and social contagion, which lie outside the objective utility of the technology itself (assuming there is such an animal as objective utility). How many wonderfully useful ideas have ended up in the cemetery, such as the Segway, an electric scooter that, it was prophesized, would change the

morphology of cities, and many others. As I was mentally writing these lines I saw a *Time* magazine cover at an airport stand announcing the “meaningful inventions” of the year. These inventions seemed to be meaningful as of the issue date, or perhaps for a couple of weeks after. Journalists can teach us how to *not* learn.

HOW TO PREDICT YOUR PREDICTIONS!

This brings us to Sir Doktor Professor Karl Raimund Popper's attack on historicism. As I said in Chapter 5, this was his most significant insight, but it remains his least known. People who do not really know his work tend to focus on Popperian falsification, which addresses the verification or nonverification of claims. This focus obscures his central idea: he made skepticism a *method*, he made of a skeptic someone constructive.

Just as Karl Marx wrote, in great irritation, a diatribe called *The Misery of Philosophy* in response to Proudhon's *The Philosophy of Misery*, Popper, irritated by some of the philosophers of his time who believed in the scientific understanding of history, wrote, as a pun, *The Misery of Historicism* (which has been translated as *The Poverty of Historicism*).*

Popper's insight concerns the limitations in forecasting historical events and the need to downgrade "soft" areas such as history and social science to a level slightly above aesthetics and entertainment, like butterfly or coin collecting. (Popper, having received a classical Viennese education, didn't go quite that far; I do. I am from Amioun.) What we call here soft historical sciences are narrative dependent studies.

Popper's central argument is that in order to predict historical events you need to predict technological innovation, itself fundamentally unpredictable.

"Fundamentally" unpredictable? I will explain what he means using a modern framework. Consider the following property of knowledge: If you expect that you will know *tomorrow* with certainty that your boyfriend has been cheating on you all this time, then you know *today* with certainty that your boyfriend is cheating on you and will take action *today*, say, by grabbing a pair of scissors and angrily cutting all his Ferragamo ties in half. You won't tell yourself, This is what I will figure out tomorrow, but today is different so I will ignore the information and have a pleasant dinner. This point can be generalized to all forms of knowledge. There is actually a law in statistics called the *law of iterated expectations*, which I outline here in its strong form: if I expect to expect something at some date in the future, then I already expect that something at present.

Consider the wheel again. If you are a Stone Age historical thinker called on to predict the future in a comprehensive report for your chief tribal planner, you

must project the invention of the wheel or you will miss pretty much all of the action. Now, if you can prophesy the invention of the wheel, you already know what a wheel looks like, and thus you already *know how* to build a wheel, so you are already on your way. The Black Swan needs to be predicted!

But there is a weaker form of this law of iterated knowledge. It can be phrased as follows: *to understand the future to the point of being able to predict it, you need to incorporate elements from this future itself*. If you know about the discovery you are about to make in the future, then you have almost made it. Assume that you are a special scholar in Medieval University's Forecasting Department specializing in the projection of future history (for our purposes, the remote twentieth century). You would need to hit upon the inventions of the steam machine, electricity, the atomic bomb, and the Internet, as well as the institution of the airplane onboard massage and that strange activity called the business meeting, in which well-fed, but sedentary, men voluntarily restrict their blood circulation with an expensive device called a necktie.

This incapacity is not trivial. The mere knowledge that something has been invented often leads to a series of inventions of a similar nature, even though not a single detail of this invention has been disseminated—there is no need to find the spies and hang them publicly. In mathematics, once a proof of an arcane theorem has been announced, we frequently witness the proliferation of similar proofs coming out of nowhere, with occasional accusations of leakage and plagiarism. There may be no plagiarism: the information that the solution exists is itself a big piece of the solution.

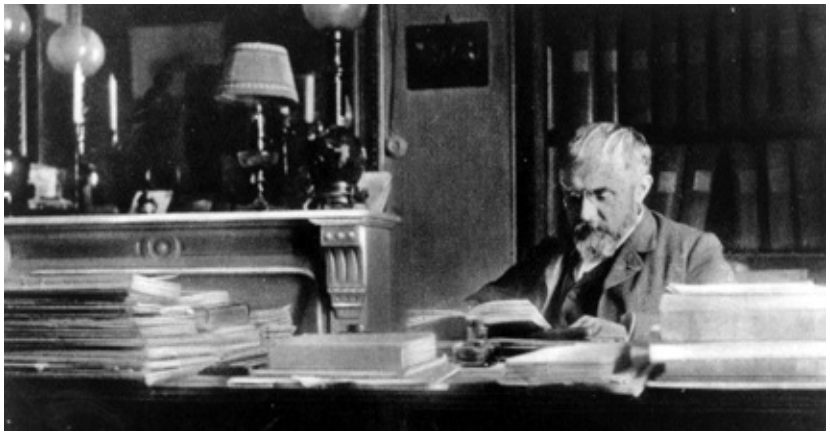
By the same logic, we are not easily able to conceive of future inventions (if we were, they would have already been invented). On the day when we are able to foresee inventions we will be living in a state where everything conceivable has been invented. Our own condition brings to mind the apocryphal story from 1899 when the head of the U.S. patent office resigned because he deemed that there was nothing left to discover—except that on that day the resignation would be justified.*

Popper was not the first to go after the limits to our knowledge. In Germany, in the late nineteenth century, Emil du Bois-Reymond claimed that *ignoramus et ignorabimus*—we are ignorant and will remain so. Somehow his ideas went into oblivion. But not before causing a reaction: the mathematician David Hilbert set to defy him by drawing a list of problems that mathematicians would need to solve over the next century.

Even du Bois-Reymond was wrong. We are not even good at understanding the unknowable. Consider the statements we make about things that we will never come to know—we confidently underestimate what knowledge we may acquire in the future. Auguste Comte, the founder of the school of positivism, which is (unfairly) accused of aiming at the scientization of everything in sight, declared that mankind would forever remain ignorant of the chemical composition of the fixed stars. But, as Charles Sanders Peirce reported, “The ink was scarcely dry upon the printed page before the spectroscope was discovered and that which he had deemed absolutely unknowable was well on the way of getting ascertained.” Ironically, Comte’s other projections, concerning what we would come to learn about the workings of society, were grossly—and dangerously—overstated. He assumed that society was like a clock that would yield its secrets to us.

I’ll summarize my argument here: Prediction requires knowing about technologies that will be discovered in the future. But that very knowledge would almost automatically allow us to start developing those technologies right away. Ergo, we do not know what we will know.

Some might say that the argument, as phrased, seems obvious, that we always think that we have reached definitive knowledge but don’t notice that those past societies we laugh at also thought the same way. My argument is trivial, so why don’t we take it into account? The answer lies in a pathology of human nature. Remember the psychological discussions on asymmetries in the perception of skills in the previous chapter? We see flaws in others and not in ourselves. Once again we seem to be wonderful at self-deceit machines.



Monsieur le professeur Henri Poincaré. Somehow they stopped making this kind of thinker. *Courtesy of Université Nancy-2*.

Henri Poincaré, in spite of his fame, is regularly considered to be an undervalued scientific thinker, given that it took close to a century for some of his ideas to be appreciated. He was perhaps the last great thinking mathematician (or possibly the reverse, a mathematical thinker). Every time I see a T-shirt bearing the picture of the modern icon Albert Einstein, I cannot help thinking of Poincaré—Einstein is worthy of our reverence, but he has displaced many others. There is so little room in our consciousness; it is winner-take-all up there.

Third Republic–Style Decorum

Again, Poincaré is in a class by himself. I recall my father recommending Poincaré's essays, not just for their scientific content, but for the quality of his French prose. The grand master wrote these wonders as serialized articles and composed them like extemporaneous speeches. As in every masterpiece, you see a mixture of repetitions, digressions, everything a "me too" editor with a prepackaged mind would condemn—but these make his text even more readable owing to an iron consistency of thought.

Poincaré became a prolific essayist in his thirties. He seemed in a hurry and died prematurely, at fifty-eight; he was in such a rush that he did not bother correcting typos and grammatical errors in his text, even after spotting them, since he found doing so a gross misuse of his time. They no longer make geniuses like that—or they no longer let them write in their own way.

Poincaré's reputation as a thinker waned rapidly after his death. His idea that concerns us took almost a century to resurface, but in another form. It was indeed a great mistake that I did not carefully read his essays as a child, for in his magisterial *La science et l'hypothèse*, I discovered later, he angrily disparages the use of the bell curve.

I will repeat that Poincaré was the true kind of philosopher of science: his philosophizing came from his witnessing the limits of the subject itself, which is what true philosophy is all about. I love to tick off French literary intellectuals by naming Poincaré as my favorite French philosopher. *"Him a philosophe? What do you mean, monsieur?"* It is always frustrating to explain to people that the thinkers they put on the pedestals, such as Henri Bergson or Jean-Paul Sartre, are largely the result of fashion production and can't come close to Poincaré in

terms of sheer influence that will continue for centuries to come. In fact, there is a scandal of prediction going on here, since it is the French Ministry of National Education that decides who is a philosopher and which philosophers need to be studied.

I am looking at Poincaré's picture. He was a bearded, portly and imposing, well-educated patrician gentleman of the French Third Republic, a man who lived and breathed general science, looked deep into his subject, and had an astonishing breadth of knowledge. He was part of the class of mandarins that gained respectability in the late nineteenth century: upper middle class, powerful, but not exceedingly rich. His father was a doctor and professor of medicine, his uncle was a prominent scientist and administrator, and his cousin Raymond became a president of the republic of France. These were the days when the grandchildren of businessmen and wealthy landowners headed for the intellectual professions.

However, I can hardly imagine him on a T-shirt, or sticking out his tongue like in that famous picture of Einstein. There is something non-playful about him, a Third Republic style of dignity.

In his day, Poincaré was thought to be the king of mathematics and science, except of course by a few narrow-minded mathematicians like Charles Hermite who considered him too intuitive, too intellectual, or too "hand-waving." When mathematicians say "hand-waving," disparagingly, about someone's work, it means that the person has: a) insight, b) realism, c) something to say, and it means that d) he is right because that's what critics say when they can't find anything more negative. A nod from Poincaré made or broke a career. Many claim that Poincaré figured out relativity before Einstein—and that Einstein got the idea from him—but that he did not make a big deal out of it. These claims are naturally made by the French, but there seems to be some validation from Einstein's friend and biographer Abraham Pais. Poincaré was too aristocratic in both background and demeanor to complain about the ownership of a result.

Poincaré is central to this chapter because he lived in an age when we had made extremely rapid intellectual progress in the fields of prediction—think of celestial mechanics. The scientific revolution made us feel that we were in possession of tools that would allow us to grasp the future. Uncertainty was gone. The universe was like a clock and, by studying the movements of the pieces, we could project into the future. It was only a matter of writing down the right models and having the engineers do the calculations. The future was a mere

extension of our technological certainties.

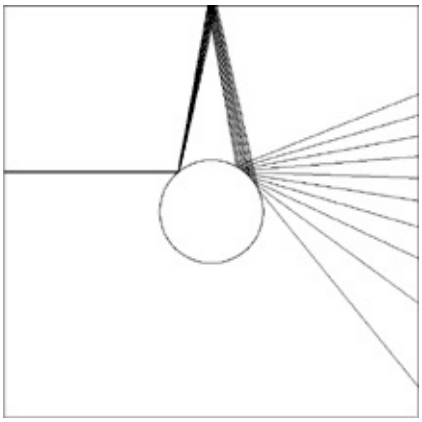
The Three Body Problem

Poincaré was the first known big-gun mathematician to understand and explain that there are fundamental limits to our equations. He introduced nonlinearities, small effects that can lead to severe consequences, an idea that later became popular, perhaps a bit too popular, as chaos theory. What's so poisonous about this popularity? Because Poincaré's entire point is about the limits that nonlinearities put on forecasting; they are not an invitation to use mathematical techniques to make extended forecasts. Mathematics can show us its own limits rather clearly.

There is (as usual) an element of the unexpected in this story. Poincaré initially responded to a competition organized by the mathematician Gösta Mittag-Leffer to celebrate the sixtieth birthday of King Oscar of Sweden. Poincaré's memoir, which was about the stability of the solar system, won the prize that was then the highest scientific honor (as these were the happy days before the Nobel Prize). A problem arose, however, when a mathematical editor checking the memoir before publication realized that there was a calculation error, and that, after consideration, it led to the opposite conclusion—unpredictability, or, more technically, nonintegrability. The memoir was discreetly pulled and reissued about a year later.

Poincaré's reasoning was simple: as you project into the future you may need an increasing amount of precision about the dynamics of the process that you are modeling, since your error rate grows very rapidly. The problem is that near precision is not possible since the degradation of your forecast compounds abruptly—you would eventually need to figure out the past with infinite precision. Poincaré showed this in a very simple case, famously known as the "three body problem." If you have only two planets in a solar-style system, with nothing else affecting their course, then you may be able to indefinitely predict the behavior of these planets, no sweat. But add a third body, say a comet, ever so small, between the planets. Initially the third body will cause no drift, no impact; later, with time, its effects on the two other bodies may become explosive. Small differences in where this tiny body is located will eventually dictate the future of the behemoth planets.

FIGURE 2: PRECISION AND FORECASTING



One of the readers of a draft of this book, David Cowan, gracefully drew this picture of scattering, which shows how, at the second bounce, variations in the initial conditions can lead to extremely divergent results. As the initial imprecision in the angle is multiplied, every additional bounce will be further magnified. This causes a severe multiplicative effect where the error grows out disproportionately.

Explosive forecasting difficulty comes from complicating the mechanics, ever so slightly. Our world, unfortunately, is far more complicated than the three body problem; it contains far more than three objects. We are dealing with what is now called a dynamical system—and the world, we will see, is a little too much of a dynamical system.

Think of the difficulty in forecasting in terms of branches growing out of a tree; at every fork we have a multiplication of new branches. To see how our intuitions about these nonlinear multiplicative effects are rather weak, consider this story about the chessboard. The inventor of the chessboard requested the following compensation: one grain of rice for the first square, two for the second, four for the third, eight, then sixteen, and so on, doubling every time, sixty-four times. The king granted this request, thinking that the inventor was asking for a pittance—but he soon realized that he was outsmarted. The amount of rice exceeded all possible grain reserves!

This multiplicative difficulty leading to the need for greater and greater precision in assumptions can be illustrated with the following simple exercise concerning the prediction of the movements of billiard balls on a table. I use the example as computed by the mathematician Michael Berry. If you know a set of basic parameters concerning the ball at rest, can compute the resistance of the table (quite elementary), and can gauge the strength of the impact, then it is

rather easy to predict what would happen at the first hit. The second impact becomes more complicated, but possible; you need to be more careful about your knowledge of the initial states, and more precision is called for. The problem is that to correctly compute the ninth impact, you need to take into account the gravitational pull of someone standing next to the table (modestly, Berry's computations use a weight of less than 150 pounds). And to compute the fifty-sixth impact, every single elementary particle of the universe needs to be present in your assumptions! An electron at the edge of the universe, separated from us by 10 billion light-years, must figure in the calculations, since it exerts a meaningful effect on the outcome. Now, consider the additional burden of having to incorporate predictions about *where these variables will be in the future*. Forecasting the motion of a billiard ball on a pool table requires knowledge of the dynamics of the entire universe, down to every single atom! We can easily predict the movements of large objects like planets (though not too far into the future), but the smaller entities can be difficult to figure out—and there are so many more of them.

Note that this billiard-ball story assumes a plain and simple world; it does not even take into account these crazy social matters possibly endowed with free will. Billiard balls do not have a mind of their own. Nor does our example take into account relativity and quantum effects. Nor did we use the notion (often invoked by phonies) called the "uncertainty principle." We are not concerned with the limitations of the precision in measurements done at the subatomic level. We are just dealing with billiard balls!

In a dynamical system, where you are considering more than a ball on its own, where trajectories in a way depend on one another, the ability to project into the future is not just reduced, but is subjected to a fundamental limitation. Poincaré proposed that we can only work with qualitative matters—some property of systems can be *discussed*, but not computed. You can think rigorously, but you cannot use numbers. Poincaré even invented a field for this, analysis in situ, now part of topology. Prediction and forecasting are a more complicated business than is commonly accepted, but it takes someone who knows mathematics to understand that. To accept it takes both understanding and courage.

In the 1960s the MIT meteorologist Edward Lorenz rediscovered Poincaré's results on his own—once again, by accident. He was producing a computer model of weather dynamics, and he ran a simulation that projected a weather system a few days ahead. Later he tried to repeat the same simulation with the

exact same model and what he thought were the same input parameters, but he got wildly different results. He initially attributed these differences to a computer bug or a calculation error. Computers then were heavier and slower machines that bore no resemblance to what we have today, so users were severely constrained by time. Lorenz subsequently realized that the consequential divergence in his results arose not from error, but from a small rounding in the input parameters. This became known as the butterfly effect, since a butterfly moving its wings in India could cause a hurricane in New York, two years later. Lorenz's findings generated interest in the field of chaos theory.

Naturally researchers found predecessors to Lorenz's discovery, not only in the work of Poincaré, but also in that of the insightful and intuitive Jacques Hadamard, who thought of the same point around 1898, and then went on to live for almost seven more decades—he died at the age of ninety-eight.*

They Still Ignore Hayek

Popper and Poincaré's findings limit our ability to see into the future, making it a very complicated reflection of the past—if it is a reflection of the past at all. A potent application in the social world comes from a friend of Sir Karl, the intuitive economist Friedrich Hayek. Hayek is one of the rare celebrated members of his "profession" (along with J. M. Keynes and G.L.S. Shackle) to focus on true uncertainty, on the limitations of knowledge, on the unread books in Eco's library.

In 1974 he received the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel, but if you read his acceptance speech you will be in for a bit of a surprise. It was eloquently called "The Pretense of Knowledge," and he mostly railed about other economists and about the idea of the planner. He argued against the use of the tools of hard science in the social ones, and depressingly, right before the big boom for these methods in economics. Subsequently, the prevalent use of complicated equations made the environment for true empirical thinkers worse than it was before Hayek wrote his speech. Every year a paper or a book appears, bemoaning the fate of economics and complaining about its attempts to ape physics. The latest I've seen is about how economists should shoot for the role of lowly philosophers rather than that of high priests. Yet, in one ear and out the other.

For Hayek, a true forecast is done organically by a system, not by fiat. One

single institution, say, the central planner, cannot *aggregate* knowledge; many important pieces of information will be missing. But society as a whole will be able to integrate into its functioning these multiple pieces of information. Society as a whole thinks outside the box. Hayek attacked socialism and managed economies as a product of what I have called *nerd knowledge, or Platonicity*—owing to the growth of scientific knowledge, we overestimate our ability to understand the subtle changes that constitute the world, and what weight needs to be imparted to each such change. He aptly called this "scientism."

This disease is severely ingrained in our institutions. It is why I fear governments and large corporations—it is hard to distinguish between them. Governments make forecasts; companies produce projections; every year various forecasters project the level of mortgage rates and the stock market at the end of the following year. Corporations survive not because they have made good forecasts, but because, like the CEOs visiting Wharton I mentioned earlier, they may have been the lucky ones. And, like a restaurant owner, they may be hurting themselves, not us—perhaps helping us and subsidizing our consumption by giving us goods in the process, like cheap telephone calls to the rest of the world funded by the overinvestment during the dotcom era. We consumers can let them forecast all they want if that's what is necessary for them to get into business. Let them go hang themselves if they wish.

As a matter of fact, as I mentioned in Chapter 8, we New Yorkers are all benefiting from the quixotic overconfidence of corporations and restaurant entrepreneurs. This is the benefit of capitalism that people discuss the least.

But corporations can go bust as often as they like, thus subsidizing us consumers by transferring their wealth into our pockets—the more bankruptcies, the better it is for us—unless they are "too big to fail" and require subsidies, which is an argument in favor of letting companies go bust early. Government is a more serious business and we need to make sure we do not pay the price for its folly. As individuals we should love free markets because operators in them can be as incompetent as they wish.

The only criticism one might have of Hayek is that he makes a hard and qualitative distinction between social sciences and physics. He shows that the methods of physics do not translate to its social science siblings, and he blames the engineering-oriented mentality for this. But he was writing at a time when physics, the queen of science, seemed to zoom in our world. It turns out that even the natural sciences are far more complicated than that. He was right about

the social sciences, he is certainly right in trusting hard scientists more than social theorizers, but what he said about the weaknesses of social knowledge applies to all knowledge. All knowledge.

Why? Because of the confirmation problem, one can argue that we know very little about our natural world; we advertise the read books and forget about the unread ones. Physics has been successful, but it is a narrow field of hard science in which we have been successful, and people tend to generalize that success to all science. It would be preferable if we were better at understanding cancer or the (highly nonlinear) weather than the origin of the universe.

How Not to Be a Nerd

Let us dig deeper into the problem of knowledge and continue the comparison of Fat Tony and Dr. John in Chapter 9. Do nerds tunnel, meaning, do they focus on crisp categories and miss sources of uncertainty? Remember from the Prologue my presentation of Platonification as a top-down focus on a world composed of these crisp categories.*

Think of a bookworm picking up a new language. He will learn, say, Serbo-Croatian or !Kung by reading a grammar book cover to cover, and memorizing the rules. He will have the impression that some higher grammatical authority set the linguistic regulations so that nonlearned ordinary people could subsequently speak the language. In reality, languages grow organically; grammar is something people without anything more exciting to do in their lives codify into a book. While the scholastic-minded will memorize declensions, the a-Platonic nonnerd will acquire, say, Serbo-Croatian by picking up potential girlfriends in bars on the outskirts of Sarajevo, or talking to cabdrivers, then fitting (if needed) grammatical rules to the knowledge he already possesses.

Consider again the central planner. As with language, there is no grammatical authority codifying social and economic events; but try to convince a bureaucrat or social scientist that the world might not want to follow his “scientific” equations. In fact, thinkers of the Austrian school, to which Hayek belonged, used the designations *tacit* or *implicit* precisely for that part of knowledge that cannot be written down, but that we should avoid repressing. They made the distinction we saw earlier between “know-how” and “know-what”—the latter being more elusive and more prone to nerdification.

To clarify, Platonic is top-down, formulaic, closed-minded, self-serving, and

commoditized; a-Platonic is bottom-up, open-minded, skeptical, and empirical.

The reason for my singling out the great Plato becomes apparent with the following example of the master's thinking: Plato believed that we should use both hands with equal dexterity. It would not "make sense" otherwise. He considered favoring one limb over the other a deformation caused by the "folly of mothers and nurses." Asymmetry bothered him, and he projected his ideas of elegance onto reality. We had to wait until Louis Pasteur to figure out that chemical molecules were either left-or right-handed and that this mattered considerably.

One can find similar ideas among several disconnected branches of thinking. The earliest were (as usual) the empirics, whose bottom-up, theory-free, "evidence-based" medical approach was mostly associated with Philnus of Cos, Serapion of Alexandria, and Glaucias of Tarentum, later made skeptical by Menodotus of Nicomedia, and currently well-known by its vocal practitioner, our friend the great skeptical philosopher Sextus Empiricus. Sextus who, we saw earlier, was perhaps the first to discuss the Black Swan. The empirics practiced the "medical art" without relying on reasoning; they wanted to benefit from chance observations by making guesses, and experimented and tinkered until they found something that worked. They did minimal theorizing.

Their methods are being revived today as evidence-based medicine, after two millennia of persuasion. Consider that before we knew of bacteria, and their role in diseases, doctors rejected the practice of hand washing because it *made no sense* to them, despite the evidence of a meaningful decrease in hospital deaths. Ignaz Semmelweis, the mid-nineteenth-century doctor who promoted the idea of hand washing, wasn't vindicated until decades after his death. Similarly it may not "make sense" that acupuncture works, but if pushing a needle in someone's toe systematically produces relief from pain (in properly conducted empirical tests), then it could be that there are functions too complicated for us to understand, so let's go with it for now while keeping our minds open.

Academic Libertarianism

To borrow from Warren Buffett, don't ask the barber if you need a haircut—and don't ask an academic if what he does is relevant. So I'll end this discussion of Hayek's libertarianism with the following observation. As I've said, the problem with organized knowledge is that there is an occasional divergence of interests

between academic guilds and knowledge itself. So I cannot for the life of me understand why today's libertarians do not go after tenured faculty (except perhaps because many libertarians are academics). We saw that companies can go bust, while governments remain. But while governments remain, civil servants can be demoted and congressmen and senators can be eventually voted out of office. In academia a tenured faculty is permanent—the business of knowledge has permanent "owners." Simply, the charlatan is more the product of control than the result of freedom and lack of structure.

Prediction and Free Will

If you know all possible conditions of a physical system you can, in theory (though not, as we saw, in practice), project its behavior into the future. But this only concerns inanimate objects. We hit a stumbling block when social matters are involved. It is another matter to project a future when humans are involved, *if you consider them living beings and endowed with free will.*

If I can predict all of your actions, under given circumstances, then you may not be as free as you think you are. You are an automaton responding to environmental stimuli. You are a slave of destiny. And the illusion of free will could be reduced to an equation that describes the result of interactions among molecules. It would be like studying the mechanics of a clock: a genius with extensive knowledge of the initial conditions and the causal chains would be able to extend his knowledge to the future of *your* actions. Wouldn't that be stifling?

However, if you believe in free will you can't truly believe in social science and economic projection. You cannot predict how people will act. Except, of course, if there is a trick, and that trick is the cord on which neoclassical economics is suspended. You simply assume that individuals will be *rational* in the future and thus act predictably. There is a strong link between rationality, predictability, and mathematical tractability. A rational individual will perform a *unique* set of actions in specified circumstances. There is one and only one answer to the question of how "rational" people satisfying their best interests would act. Rational actors must be coherent: they cannot prefer apples to oranges, oranges to pears, then pears to apples. If they did, then it would be difficult to generalize their behavior. It would also be difficult to project their behavior in time.

In orthodox economics, rationality became a straitjacket. Platonified economists ignored the fact that people might prefer to do something other than maximize their economic interests. This led to mathematical techniques such as "maximization," or "optimization," on which Paul Samuelson built much of his work. Optimization consists in finding the mathematically optimal policy that an economic agent could pursue. For instance, what is the "optimal" quantity you should allocate to stocks? It involves complicated mathematics and thus raises a barrier to entry by non-mathematically trained scholars. I would not be the first to say that this optimization set back social science by reducing it from the intellectual and reflective discipline that it was becoming to an attempt at an "exact science." By "exact science," I mean a second-rate engineering problem for those who want to pretend that they are in the physics department—so-called physics envy. In other words, an intellectual fraud.

Optimization is a case of sterile modeling that we will discuss further in Chapter 17. It had no practical (or even theoretical) use, and so it became principally a competition for academic positions, a way to make people compete with mathematical muscle. It kept Platonified economists out of the bars, solving equations at night. The tragedy is that Paul Samuelson, a quick mind, is said to be one of the most intelligent scholars of his generation. This was clearly a case of very badly invested intelligence. Characteristically, Samuelson intimidated those who questioned his techniques with the statement "Those who can, do science, others do methodology." If you knew math, you could "do science." This is reminiscent of psychoanalysts who silence their critics by accusing them of having trouble with their fathers. Alas, it turns out that it was Samuelson and most of his followers who did not *know* much math, or did not know how to use what math they knew, how to apply it to reality. They only knew enough math to be blinded by it.

Tragically, before the proliferation of empirically blind idiot savants, interesting work had been begun by true thinkers, the likes of J. M. Keynes, Friedrich Hayek, and the great Benoît Mandelbrot, all of whom were displaced because they moved economics away from the precision of second-rate physics. Very sad. One great underestimated thinker is G.L.S. Shackle, now almost completely obscure, who introduced the notion of "unknowledge," that is, the unread books in Umberto Eco's library. It is unusual to see Shackle's work mentioned at all, and I had to buy his books from secondhand dealers in London.

Legions of empirical psychologists of the heuristics and biases school have

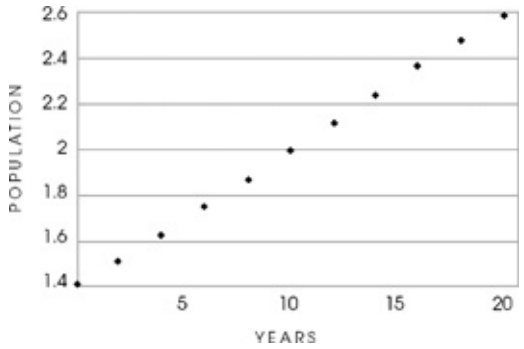
shown that the model of rational behavior under uncertainty is not just grossly inaccurate but plain wrong as a description of reality. Their results also bother Platonified economists because they reveal that there are several ways to be irrational. Tolstoy said that happy families were all alike, while each unhappy one is unhappy in its own way. People have been shown to make errors equivalent to preferring apples to oranges, oranges to pears, and *pears to apples*, depending on how the relevant questions are presented to them. The sequence matters! Also, as we have seen with the anchoring example, subjects' estimates of the number of dentists in Manhattan are influenced by which random number they have just been presented with—the *anchor*. Given the randomness of the anchor, we will have randomness in the estimates. So if people make inconsistent choices and decisions, the central core of economic optimization fails. You can no longer produce a "general theory," and without one you cannot predict.

You have to learn to live without a general theory, for Pluto's sake!

THE GRUENESS OF EMERALD

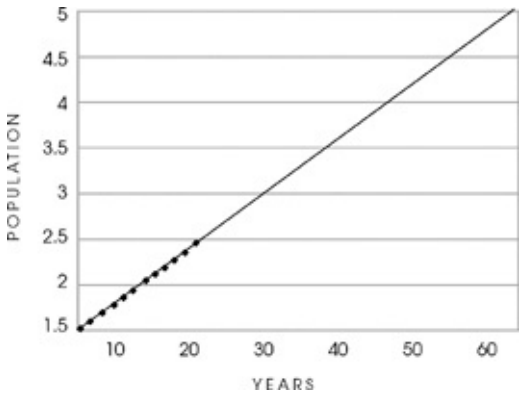
Recall the turkey problem. You look at the past and derive some rule about the future. Well, the problems in projecting from the past can be even worse than what we have already learned, because the same past data can confirm a theory and also its exact opposite! If you survive until tomorrow, it could mean that either a) you are more likely to be immortal or b) that you are closer to death. Both conclusions rely on the exact same data. If you are a turkey being fed for a long period of time, you can either naïvely assume that feeding *confirms your safety* or be shrewd and consider that it *confirms the danger* of being turned into supper. An acquaintance's unctuous past behavior may indicate his genuine affection for me and his concern for my welfare; it may also confirm his mercenary and calculating desire to get my business one day.

FIGURE 3



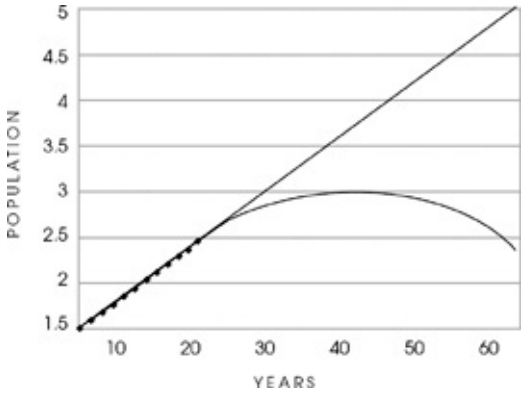
A series of a seemingly growing bacterial population (or of sales records, or of any variable observed through time—such as the total feeding of the turkey in Chapter 4).

FIGURE 4



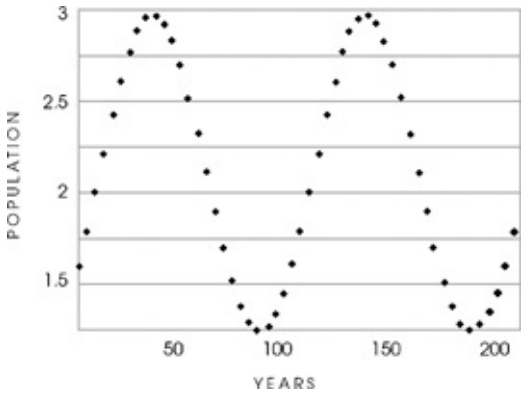
Easy to fit the trend—there is one and only one linear model that fits the data. You can project a continuation into the future.

FIGURE 5



We look at a broader scale. Hey, other models also fit it rather well.

FIGURE 6



And the real “generating process” is extremely simple but it had nothing to do with a linear model! Some parts of it appear to be linear and we are fooled by extrapolating in a direct line.*

So not only can the past be misleading, but there are also many degrees of freedom in our interpretation of past events.

For the technical version of this idea, consider a series of dots on a page representing a number through time—the graph would resemble Figure 1 showing the first thousand days in Chapter 4. Let’s say your high school teacher asks you to extend the series of dots. With a linear model, that is, using a ruler, you can run only a straight line, a *single* straight line from the past to the future. The linear model is unique. There is one and only one straight line that can project from a series of points. But it can get trickier. If you do not limit yourself to a straight line, you find that there is a huge family of curves that can do the job of connecting the dots. If you project from the past in a linear way, you continue a trend. But possible future deviations from the course of the past are infinite.

This is what the philosopher Nelson Goodman called the riddle of induction: We project a straight line only because we have a linear model in our head—the fact that a number has risen for 1,000 days straight should make you more confident that it will rise in the future. But if you have a nonlinear model in your head, it might confirm that the number should decline on day 1,001.

Let’s say that you observe an emerald. It was green yesterday and the day before yesterday. It is green again today. Normally this would confirm the “green” property: we can assume that the emerald will be green tomorrow. But to Goodman, the emerald’s color history could equally confirm the “grue” property. What is this grue property? The emerald’s grue property is to be green until some specified date, say, December 31, 2006, and then blue thereafter.

The riddle of induction is another version of the narrative fallacy—you face an infinity of “stories” that explain what you have seen. The severity of Goodman’s riddle of induction is as follows: if there is no longer even a single unique way to “generalize” from what you see, to make an inference about the unknown, then how should you operate? The answer, clearly, will be that you should employ “common sense,” but your common sense may not be so well developed with respect to some Extremistan variables.

THAT GREAT ANTICIPATION MACHINE

The reader is entitled to wonder, So, NNT, why on earth do we plan? Some people do it for monetary gain, others because it's "their job." But we also do it without such intentions—spontaneously.

Why? The answer has to do with human nature. Planning may come with the package of what makes us human, namely, our consciousness.

There is supposed to be an evolutionary dimension to our need to project matters into the future, which I will rapidly summarize here, since it can be an excellent candidate explanation, an excellent conjecture, though, since it is linked to evolution, I would be cautious.

The idea, as promoted by the philosopher Daniel Dennett, is as follows: What is the most potent use of our brain? It is precisely the ability to project conjectures into the future and play the counterfactual game—"If I punch him in the nose, then he will punch me back right away, or, worse, call his lawyer in New York." One of the advantages of doing so is that we can let our conjectures die in our stead. Used correctly and in place of more visceral reactions, the ability to project effectively frees us from immediate, first-order natural selection —as opposed to more primitive organisms that were vulnerable to death and only grew by the improvement in the gene pool through the selection of the best. In a way, projecting allows us to cheat evolution: it now takes place in our head, as a series of projections and counterfactual scenarios.

This ability to mentally play with conjectures, even if it frees us from the laws of evolution, is itself supposed to be the product of evolution—it is as if evolution has put us on a long leash whereas other animals live on the very short leash of immediate dependence on their environment. For Dennett, our brains are "anticipation machines;" for him the human mind and consciousness are emerging properties, those properties necessary for our accelerated development.

Why do we listen to experts and their forecasts? A candidate explanation is that society reposes on specialization, effectively the division of knowledge. You do not go to medical school the minute you encounter a big health problem; it is less taxing (and certainly safer) for you to consult someone who has already done so. Doctors listen to car mechanics (not for health matters, just when it comes to problems with their cars); car mechanics listen to doctors. We have a natural tendency to listen to the expert, even in fields where there may be no

experts.

---

* Most of the debate between creationists and evolutionary theorists (of which I do not partake) lies in the following: creationists believe that the world comes from some form of design while evolutionary theorists see the world as a result of random changes by an aimless process. But it is hard to look at a computer or a car and consider them the result of aimless process. Yet they are.

* Recall from Chapter 4 how Algazel and Averroës traded insults through book titles. Perhaps one day I will be lucky enough to read an attack on this book in a diatribe called *The White Swan*.

* Such claims are not uncommon. For instance the physicist Albert Michelson imagined, toward the end of the nineteenth century, that what was left for us to discover in the sciences of nature was no more than fine-tuning our precisions by a few decimal places.

* There are more limits I haven't even attempted to discuss here. I am not even bringing up the class of incomputability people call NP completeness.

* This idea pops up here and there in history, under different names. Alfred North Whitehead called it the "fallacy of misplaced concreteness," e.g., the mistake of confusing a model with the physical entity that it means to describe.

* These graphs also illustrate a statistical version of the narrative fallacy—you find a model that fits the past. "Linear regression" or "R-square" can ultimately fool you beyond measure, to the point where it is no longer funny. You can fit the linear part of the curve and claim a high R-square, meaning that your model fits the data very well and has high predictive powers. All that off hot air: you only fit the linear segment of the series. Always remember that "R-square" is unfit for Extremistan; it is only good for academic promotion.

Chapter Twelve

EPISTEMOCRACY, A DREAM

This is only an essay—Children and philosophers vs. adults and nonphilosophers—Science as an autistic enterprise—The past too has a past—Mispredict and live a long, happy life (if you survive)

Someone with a low degree of epistemic arrogance is not too visible, like a shy person at a cocktail party. We are not predisposed to respect humble people, those who try to suspend judgment. Now contemplate *epistemic humility*. Think of someone heavily introspective, tortured by the awareness of his own ignorance. He lacks the courage of the idiot, yet has the rare guts to say "I don't know." He does not mind looking like a fool or, worse, an ignoramus. He hesitates, he will not commit, and he agonizes over the consequences of being wrong. He introspects, introspects, and introspects until he reaches physical and nervous exhaustion.

This does not necessarily mean that he lacks confidence, only that he holds his own knowledge to be suspect. I will call such a person an *epistemocrat;* the province where the laws are structured with this kind of human fallibility in mind I will call an *epistemocracy*.

The major modern epistemocrat is Montaigne.

Monsieur de Montaigne, Epistemocrat

At the age of thirty-eight, Michel Eyquem de Montaigne retired to his estate, in the countryside of southwestern France. Montaigne, which means mountain in Old French, was the name of the estate. The area is known today for the Bordeaux wines, but in Montaigne's time not many people invested their mental energy and sophistication in wine. Montaigne had stoic tendencies and would not have been strongly drawn to such pursuits anyway. His idea was to write a modest collection of "attempts," that is, essays. The very word *essay* conveys the

tentative, the speculative, and the nondefinitive. Montaigne was well grounded in the classics and wanted to meditate on life, death, education, knowledge, and some not uninteresting biological aspects of human nature (he wondered, for example, whether cripples had more vigorous libidos owing to the richer circulation of blood in their sexual organs).

The tower that became his study was inscribed with Greek and Latin sayings, almost all referring to the vulnerability of human knowledge. Its windows offered a wide vista of the surrounding hills.

Montaigne's subject, officially, was himself, but this was mostly as a means to facilitate the discussion; he was not like those corporate executives who write biographies to make a boastful display of their honors and accomplishments. He was mainly interested in *discovering* things about himself, making us discover things about himself, and presenting matters that could be generalized—generalized to the entire human race. Among the inscriptions in his study was a remark by the Latin poet Terence: *Homo sum, humani a me nil alienum puto*—I am a man, and nothing human is foreign to me.

Montaigne is quite refreshing to read after the strains of a modern education since he fully accepted human weaknesses and understood that no philosophy could be effective unless it took into account our deeply ingrained imperfections, the limitations of our rationality, the flaws that make us human. It is not that he was ahead of his time; it would be better said that later scholars (advocating rationality) were backward.

He was a thinking, ruminating fellow, and his ideas did not spring up in his tranquil study, but while on horseback. He went on long rides and came back with ideas. Montaigne was neither one of the academics of the Sorbonne nor a professional man of letters, and he was *not* these things on two planes. First, he was a *doer;* he had been a magistrate, a businessman, and the mayor of Bordeaux before he retired to mull over his life and, mostly, his own knowledge. Second, he was an antidogmatist: he was a skeptic with charm, a fallible, noncommittal, personal, introspective writer, and, primarily, someone who, in the great classical tradition, wanted to be a man. Had he been in a different period, he would have been an empirical skeptic—he had skeptical tendencies of the Pyrrhonian variety, the antidogmatic kind like Sextus Empiricus, particularly in his awareness of the need to suspend judgment.

Epistemocracy

Everyone has an idea of utopia. For many it means equality, universal justice, freedom from oppression, freedom from work (for some it may be the more modest, though no more attainable, society with commuter trains free of lawyers on cell phones). To me utopia is an epistemocracy, a society in which anyone of rank is an epistemocrat, and where epistemocrats manage to be elected. It would be a society governed from the basis of the awareness of ignorance, not knowledge.

Alas, one cannot assert authority by accepting one's own fallibility. Simply, people need to be blinded by knowledge—we are made to follow leaders who can gather people together because the advantages of being in groups trump the disadvantages of being alone. It has been more profitable for us to bind together in the wrong direction than to be alone in the right one. Those who have followed the assertive idiot rather than the introspective wise person have passed us some of their genes. This is apparent from a social pathology: psychopaths rally followers.

Once in a while you encounter members of the human species with so much intellectual superiority that they can change their minds effortlessly.

Note here the following Black Swan asymmetry. I believe that you can be dead certain about *some* things, and ought to be so. You can be more confident about disconfirmation than confirmation. Karl Popper was accused of promoting self-doubt while writing in an aggressive and confident tone (an accusation that is occasionally addressed to this author by people who don't follow my logic of skeptical empiricism). Fortunately, we have learned a lot since Montaigne about how to carry on the skeptical-empirical enterprise. The Black Swan asymmetry allows you to be confident *about what is wrong*, not about what you believe is right. Karl Popper was once asked whether one "could falsify falsification" (in other words, if one could be skeptical about skepticism). His answer was that he threw students out of his lectures for asking far more intelligent questions than that one. Quite tough, Sir Karl was.

THE PAST'S PAST, AND THE PAST'S FUTURE

Some truths only hit children—adults and nonphilosophers get sucked into the minutiae of practical life and need to worry about "serious matters," so they abandon these insights for seemingly more relevant questions. One of these truths concerns the larger difference in texture and quality between the past and the future. Thanks to my studying this distinction all my life, I understand it better than I did during my childhood, but I no longer envision it as vividly.

The only way you can imagine a future "similar" to the past is by assuming that it will be an *exact* projection of it, hence predictable. Just as you know with some precision when you were born, you would then know with equal precision when you will die. The notion of future mixed with *chance*, not a deterministic extension of your perception of the past, is a mental operation that our mind cannot perform. Chance is too fuzzy for us to be a category by itself. There is an asymmetry between past and future, and it is too subtle for us to understand naturally.

The first consequence of this asymmetry is that, in people's minds, the relationship between the past and the future does not learn from the relationship between the past and the past previous to it. There is a blind spot: when we think of tomorrow we do not frame it in terms of what we thought about yesterday on the day before yesterday. Because of this introspective defect we fail to learn about the difference between our past predictions and the subsequent outcomes. When we think of tomorrow, we just project it as another yesterday.

This small blind spot has other manifestations. Go to the primate section of the Bronx Zoo where you can see our close relatives in the happy primate family leading their own busy social lives. You can also see masses of tourists laughing at the caricature of humans that the lower primates represent. Now imagine being a member of a higher-level species (say a "real" philosopher, a truly wise person), far more sophisticated than the human primates. You would certainly laugh at the people laughing at the nonhuman primates. Clearly, to those people amused by the apes, the idea of a being who would look down on them the way they look down on the apes cannot immediately come to their minds—if it did, it would elicit self-pity. They would stop laughing.

Accordingly, an element in the mechanics of how the human mind learns from the past makes us believe in definitive solutions—yet not consider that those who preceded us thought that they too had definitive solutions. We laugh at

others and we don’t realize that someone will be just as justified in laughing at us on some not too remote day. Such a realization would entail the recursive, or second-order, thinking that I mentioned in the Prologue; we are not good at it.

This mental block about the future has not yet been investigated and labeled by psychologists, but it appears to resemble autism. Some autistic subjects can possess high levels of mathematical or technical intelligence. Their social skills are defective, but that is not the root of their problem. Autistic people cannot put themselves in the shoes of others, cannot view the world from their standpoint. They see others as inanimate objects, like machines, moved by explicit rules. They cannot perform such simple mental operations as “he knows that I don’t know that I know,” and it is this inability that impedes their social skills. (Interestingly, autistic subjects, regardless of their “intelligence,” also exhibit an inability to comprehend uncertainty.)

Just as autism is called “mind blindness,” this inability to think dynamically, to position oneself with respect to a future observer, we should call “future blindness.”

Prediction, Misprediction, and Happiness

I searched the literature of cognitive science for any research on “future blindness” and found nothing. But in the literature on happiness I did find an examination of our chronic errors in prediction that will make us happy.

This prediction error works as follows. You are about to buy a new car. It is going to change your life, elevate your status, and make your commute a vacation. It is so quiet that you can hardly tell if the engine is on, so you can listen to Rachmaninoff’s nocturnes on the highway. This new car will bring you to a permanently elevated plateau of contentment. People will think, Hey, he has a great car, every time they see you. Yet you forget that the last time you bought a car, you also had the same expectations. You do not anticipate that the effect of the new car will eventually wane and that you will revert to the initial condition, as you did last time. A few weeks after you drive your new car out of the showroom, it will become dull. If you had expected this, you probably would not have bought it.

You are about to commit a prediction error that you have already made. Yet it would cost so little to introspect!

Psychologists have studied this kind of misprediction with respect to both

pleasant and unpleasant events. We overestimate the effects of both kinds of future events on our lives. We seem to be in a psychological predicament that makes us do so. This predicament is called “anticipated utility” by Danny Kahneman and “affective forecasting” by Dan Gilbert. The point is not so much that we tend to mispredict our future happiness, but rather that we do not learn recursively from past experiences. We have evidence of a mental block and distortions in the way we fail to learn from our past errors in projecting the future of our affective states.

We grossly overestimate the length of the effect of misfortune on our lives. You think that the loss of your fortune or current position will be devastating, but you are probably wrong. More likely, you will adapt to anything, as you probably did after past misfortunes. You may feel a sting, but it will not be as bad as you expect. This kind of misprediction may have a purpose: to motivate us to perform *important* acts (like buying new cars or getting rich) and to prevent us from taking certain unnecessary risks. And it is part of a more general problem: we humans are supposed to fool ourselves a little bit here and there. According to Trivers’s theory of self-deception, this is supposed to orient us favorably toward the future. But self-deception is not a desirable feature outside of its natural domain. It prevents us from taking some unnecessary risks—but we saw in Chapter 6 how it does not as readily cover a spate of modern risks that we do not fear because they are not vivid, such as investment risks, environmental dangers, or long-term security.

Helenus and the Reverse Prophecies

If you are in the business of being a seer, describing the future to other less-privileged mortals, you are judged on the merits of your predictions.

Helenus, in *The Iliad*, was a different kind of seer. The son of Priam and Hecuba, he was the cleverest man in the Trojan army. It was he who, under torture, told the Achaeans how they would capture Troy (apparently he didn’t predict that he himself would be captured). But this is not what distinguished him. Helenus, unlike other seers, was able to predict *the past* with great precision —without having been given any details of it. He predicted backward.

Our problem is not just that we do not know the future, we do not know much of the past either. We badly need someone like Helenus if we are to know history. Let us see how.

The Melting Ice Cube

Consider the following thought experiment borrowed from my friends Aaron Brown and Paul Wilmott:

Operation 1 (the melting ice cube): Imagine an ice cube and consider how it may melt over the next two hours while you play a few rounds of poker with your friends. Try to envision the shape of the resulting puddle.

Operation 2 (where did the water come from?): Consider a puddle of water on the floor. Now try to reconstruct in your mind's eye the shape of the ice cube it may once have been. Note that the puddle may not have necessarily originated from an ice cube.

The second operation is harder. Helenus indeed had to have skills.

The difference between these two processes resides in the following. If you have the right models (and some time on your hands, and nothing better to do) you can predict with great precision how the ice cube will melt—this is a specific engineering problem devoid of complexity, easier than the one involving billiard balls. However, from the pool of water you can build infinite possible ice cubes, if there was in fact an ice cube there at all. The first direction, from the ice cube to the puddle, is called the *forward process*. The second direction, the *backward process*, is much, much more complicated. The forward process is generally used in physics and engineering; the backward process in nonrepeatable, nonexperimental historical approaches.

In a way, the limitations that prevent us from unfrying an egg also prevent us from reverse engineering history.

Now, let me increase the complexity of the forward-backward problem just a bit by assuming nonlinearity. Take what is generally called the "butterfly in India" paradigm from the discussion of Lorenz's discovery in the previous chapter. As we have seen, a small input in a complex system can lead to nonrandom large results, depending on very special conditions. A single butterfly flapping its wings in New Delhi may be the certain *cause* of a hurricane in North Carolina, though the hurricane may take place a couple of years later. However, *given the observation of a hurricane in North Carolina*, it is dubious that you could figure out the causes with any precision: there are billions of billions of such small things as wing-flapping butterflies in Timbuktu or sneezing wild dogs in Australia that could have caused it. The process from the butterfly to the hurricane is greatly simpler than the reverse process *from* the

hurricane *to* the potential butterfly.

Confusion between the two is disastrously widespread in common culture. This "butterfly in India" metaphor has fooled at least one filmmaker. For instance, *Happenstance* (a.k.a. *The Beating of a Butterfly's Wings),* a French-language film by one Laurent Firode, meant to encourage people to focus on small things that can change the course of their lives. Hey, since a small event (a petal falling on the ground and getting your attention) can lead to your choosing one person over another as a mate for life, you should focus on these very small details. Neither the filmmaker nor the critics realized that they were dealing with the backward process; there are trillions of such small things in the course of a simple day, and examining all of them lies outside of our reach.

Once Again, Incomplete Information

Take a personal computer. You can use a spreadsheet program to generate a random sequence, a succession of points we can call a history. How? The computer program responds to a very complicated equation of a nonlinear nature that produces numbers that seem random. The equation is very simple: if you know it, you can predict the sequence. It is almost impossible, however, for a human being to reverse engineer the equation and predict further sequences. I am talking about a simple one-line computer program (called the "tent map") generating a handful of data points, not about the billions of simultaneous events that constitute the real history of the world. In other words, even if history were a nonrandom series generated by some "equation of the world," as long as reverse engineering such an equation does not seem within human possibility, it should be deemed random and not bear the name "deterministic chaos." Historians should stay away from chaos theory and the difficulties of reverse engineering except to discuss general properties of the world and learn the limits of what they can't know.

This brings me to a greater problem with the historian's craft. I will state the fundamental problem of practice as follows: while in theory randomness is an intrinsic property, in practice, randomness is *incomplete information*, what I called *opacity* in Chapter 1.

Nonpractitioners of randomness do not understand the subtlety. Often, in conferences when they hear me talk about uncertainty and randomness, philosophers, and sometimes mathematicians, bug me about the least relevant

point, namely whether the randomness I address is “true randomness” or “deterministic chaos” that masquerades as randomness. A true random system is in fact random and does not have predictable properties. A chaotic system has entirely predictable properties, but they are hard to know. So my answer to them is dual.

a) There is no functional difference in practice between the two since we will never get to make the distinction—the difference is mathematical, not practical. If I see a pregnant woman, the sex of her child is a purely random matter to me (a 50 percent chance for either sex)—but not to her doctor, who might have done an ultrasound. In practice, randomness is fundamentally incomplete information.

b) The mere fact that a person is talking about the difference implies that he has never made a meaningful decision under uncertainty—which is why he does not realize that they are indistinguishable in practice.

Randomness, in the end, is just unknowledge. The world is opaque and appearances fool us.

What They Call Knowledge

One final word on history.

History is like a museum where one can go to see the repository of the past, and taste the charm of olden days. It is a wonderful mirror in which we can see our own narratives. You can even track the past using DNA analyses. I am fond of literary history. Ancient history satisfies my desire to build my own self-narrative, my identity, to connect with my (complicated) Eastern Mediterranean roots. I even prefer the accounts of older, patently less accurate books to modern ones. Among the authors I’ve reread (the ultimate test of whether you like an author is if you’ve reread him) the following come to mind: Plutarch, Livy, Suetonius, Diodorus Siculus, Gibbon, Carlyle, Renan, and Michelet. These accounts are patently substandard, compared to today’s works; they are largely anecdotal, and full of myths. But I know this.

History is useful for the thrill of knowing the past, and for the narrative (indeed), provided it remains a harmless narrative. One should learn under severe caution. History is certainly not a place to theorize or derive general knowledge, nor is it meant to help in the future, without some caution. We can get negative confirmation from history, which is invaluable, but we get plenty of illusions of knowledge along with it.

This brings me back once again to Menodotus and the treatment of the turkey problem and how to not be a sucker for the past. The empirical doctor's approach to the problem of induction was to *know* history without theorizing from it. Learn to read history, get all the knowledge you can, do not frown on the anecdote, but do not draw any causal links, do not try to reverse engineer too much—but if you do, do not make big scientific claims. Remember that the empirical skeptics had respect for custom: they used it as a default, a basis for action, but not for more than that. This clean approach to the past they called *epilogism*.*

But most historians have another opinion. Consider the representative introspection *What Is History?* by Edward Hallett Carr. You will catch him explicitly pursuing causation as a central aspect of his job. You can even go higher up: Herodotus, deemed to be the father of the subject, defined his purpose in the opening of his work:

> To preserve a memory of the deeds of the Greeks and barbarians, "and in particular, beyond everything else, to give a *cause* [emphasis mine] to their fighting one another."

You see the same with all theoreticians of history, whether Ibn Khaldoun, Marx, or Hegel. The more we try to turn history into anything other than an enumeration of accounts to be enjoyed with minimal theorizing, the more we get into trouble. Are we so plagued with the narrative fallacy?†

We may have to wait for a generation of skeptical-empiricist historians capable of understanding the difference between a forward process and a reverse one.

Just as Popper attacked the historicists in their making claims about the future, I have just presented the weakness of the historical approach in knowing the *past* itself.

After this discussion about future (and past) blindness, let us see what to do about it. Remarkably, there are extremely practical measures we can take. We will explore this next.

---

* Yogi Berra might have a theory of epilogism with his saying, "You can observe a lot by just watching."

† While looking at the past it would be a good idea to resist naïve analogies. Many people have compared the United States today to Ancient Rome, both from a military standpoint (the destruction of Carthage was often invoked as an incentive for the destruction of enemy regimes) and from a social one (the

endless platitudinous warnings of the upcoming decline and fall). Alas, we need to be extremely careful in transposing knowledge from a simple environment that is closer to type 1, like the one we had in antiquity, to today's type 2, complex system, with its intricate webs of casual links. Another error is to draw casual conclusions from the absence of nuclear war, since, invoking the Casanova argument of Chapter 8, I would repeat that we would not be here had a nuclear war taken place, and it is not a good idea for us to derive a "cause" when our survival is conditioned on that cause.

Chapter Thirteen

APPELLES THE PAINTER, OR WHAT DO YOU DO IF YOU CANNOT PREDICT?*

You should charge people for advice—My two cents here—Nobody knows anything, but, at least, he knows it—Go to parties

ADVICE IS CHEAP, VERY CHEAP

It is not a good habit to stuff one's text with quotations from prominent thinkers, except to make fun of them or provide a historical reference. They "make sense," but well-sounding maxims force themselves on our gullibility and do not always stand up to empirical tests. So I chose the following statement by the überphilosopher Bertrand Russell precisely because I disagree with it.

> The demand for certainty is one which is natural to man, but is nevertheless an intellectual vice. If you take your children for a picnic on a doubtful day, they will demand a dogmatic answer as to whether it will be fine or wet, and be disappointed in you when you cannot be sure. …
>
> But so long as men are not *trained* [emphasis mine] to withhold judgment in the absence of evidence, they will be led astray by cocksure prophets … For the learning of every virtue there is an appropriate discipline, and for the learning of suspended judgment the best discipline is philosophy.

The reader may be surprised that I disagree. It is hard to disagree that the demand for certainty is an intellectual vice. It is hard to disagree that we can be led astray by some cocksure prophet. Where I beg to differ with the great man is that I do not believe in the track record of advice-giving "philosophy" in helping us deal with the problem; nor do I believe that virtues can be *easily* taught; nor do I urge people to strain in order to avoid making a judgment. Why? Because we have to deal with humans as humans. We cannot *teach* people to withhold judgment; judgments are embedded in the way we view objects. I do not see a "tree;" I see a pleasant or an ugly tree. It is not possible without great, paralyzing effort to strip these small values we attach to matters. Likewise, it is not possible to hold a situation in one's head without some element of bias. Something in our dear human nature makes us want to believe; so what?

Philosophers since Aristotle have taught us that we are deep-thinking animals, and that we can learn by reasoning. It took a while to discover that we do effectively think, but that we more readily narrate backward in order to give ourselves the illusion of understanding, and give a cover to our past actions. The minute we forgot about this point, the "Enlightenment" came to drill it into our heads for a second time.

I'd rather degrade us humans to a level certainly above other known animals but not quite on a par with the ideal Olympian man who can absorb philosophical statements and act accordingly. Indeed, if philosophy were *that* effective, the self-help section of the local bookstore would be of some use in consoling souls experiencing pain—but it isn't. We forget to philosophize when

under strain.

I'll end this section on prediction with the following two lessons, one very brief (for the small matters), one rather lengthy (for the large, important decisions).

Being a Fool in the Right Places

The lesson for the small is: *be human!* Accept that being human involves some amount of epistemic arrogance in running your affairs. Do not be ashamed of that. Do not try to always withhold judgment—opinions are the stuff of life. Do not try to avoid predicting—yes, after this diatribe about prediction I am *not* urging you to stop being a fool. Just be a fool in the right places.*

What you should avoid is unnecessary dependence on large-scale harmful predictions—those and only those. Avoid the big subjects that may hurt your future: be fooled in small matters, not in the large. Do not listen to economic forecasters or to predictors in social science (they are mere entertainers), but do make your own forecast for the picnic. By all means, demand certainty for the next picnic; but avoid government social-security forecasts for the year 2040.

Know how to rank beliefs not according to their plausibility but by the harm they may cause.

Be Prepared

The reader might feel queasy reading about these general failures to see the future and wonder what to do. But if you shed the idea of full predictability, there are plenty of things to do provided you remain conscious of their limits. Knowing that you cannot predict does not mean that you cannot benefit from unpredictability.

The bottom line: be prepared! Narrow-minded prediction has an analgesic or therapeutic effect. Be aware of the numbing effect of magic numbers. Be prepared for all relevant eventualities.

Recall the empirics, those members of the Greek school of empirical medicine. They considered that you should be open-minded in your medical diagnoses to let luck play a role. By luck, a patient might be cured, say, by eating some food that accidentally turns out to be the cure for his disease, so that the treatment can then be used on subsequent patients. The *positive* accident (like hypertension medicine producing side benefits that led to Viagra) was the empirics' central method of medical discovery.

This same point can be generalized to life: maximize the serendipity around you.

Sextus Empiricus retold the story of Apelles the Painter, who, while doing a portrait of a horse, was attempting to depict the foam from the horse's mouth. After trying very hard and making a mess, he gave up and, in irritation, took the sponge he used for cleaning his brush and threw it at the picture. Where the sponge hit, it left a perfect representation of the foam.

Trial and error means trying a lot. In *The Blind Watchmaker*, Richard Dawkins brilliantly illustrates this notion of the world without grand design, moving by small incremental random changes. Note a slight disagreement on my part that does not change the story by much: the world, rather, moves by *large* incremental random changes.

Indeed, we have psychological and intellectual difficulties with trial and error, and with accepting that series of small failures are necessary in life. My colleague Mark Spitznagel understood that we humans have a mental hang-up about failures: "You need to love to lose" was his motto. In fact, the reason I felt immediately at home in America is precisely because American culture encourages the process of failure, unlike the cultures of Europe and Asia where failure is met with stigma and embarrassment. America's specialty is to take these small risks for the rest of the world, which explains this country's disproportionate share in innovations. Once established, an idea or a product is later "perfected" over there.

Volatility and Risk of Black Swan

People are often ashamed of losses, so they engage in strategies that produce very little volatility but contain the risk of a large loss—like collecting nickels in

front of steamrollers. In Japanese culture, which is ill-adapted to randomness and badly equipped to understand that bad performance can come from bad luck, losses can severely tarnish someone's reputation. People hate volatility, thus engage in strategies exposed to blowups, leading to occasional suicides after a big loss.

Furthermore, this trade-off between volatility and risk can show up in careers that give the appearance of being stable, like jobs at IBM until the 1990s. When laid off, the employee faces a total void: he is no longer fit for anything else. The same holds for those in protected industries. On the other hand, consultants can have volatile earnings as their clients' earnings go up and down, but face a lower risk of starvation, since their skills match demand—*fluctuat nec mergitur* (fluctuates but doesn't sink). Likewise, dictatorships that do not appear volatile, like, say, Syria or Saudi Arabia, face a larger risk of chaos than, say, Italy, as the latter has been in a state of continual political turmoil since the second war. I learned about this problem from the finance industry, in which we see "conservative" bankers sitting on a pile of dynamite but fooling themselves because their operations seem dull and lacking in volatility.

Barbell Strategy

I am trying here to generalize to real life the notion of the "barbell" strategy I used as a trader, which is as follows. If you know that you are vulnerable to prediction errors, and if you accept that most "risk measures" are flawed, because of the Black Swan, then your strategy is to be as hyperconservative and hyperaggressive as you can be instead of being mildly aggressive or conservative. Instead of putting your money in "medium risk" investments (how do you know it is medium risk? by listening to tenure-seeking "experts"?), you need to put a portion, say 85 to 90 percent, in extremely safe instruments, like Treasury bills—as safe a class of instruments as you can manage to find on this planet. The remaining 10 to 15 percent you put in extremely speculative bets, as leveraged as possible (like options), preferably venture capital–style portfolios.* That way you do not depend on errors of risk management; no Black Swan can hurt you at all, beyond your "floor," the nest egg that you have in maximally safe investments. Or, equivalently, you can have a speculative portfolio and insure it (if possible) against losses of more than, say, 15 percent. You are "clipping" your incomputable risk, the one that is harmful to you. Instead of having medium risk, you have high risk on one side and no risk on the other. The

average will be medium risk but constitutes a positive exposure to the Black Swan. More technically, this can be called a "convex" combination. Let us see how this can be implemented in all aspects of life.

"Nobody Knows Anything"

The legendary screenwriter William Goldman was said to have shouted "Nobody knows anything!" in relation to the prediction of movie sales. Now, the reader may wonder how someone as successful as Goldman can figure out what to do without making predictions. The answer stands perceived business logic on its head. He knew that he could not predict individual events, but he was well aware that the unpredictable, namely a movie turning into a blockbuster, would benefit him immensely.

So the second lesson is more aggressive: you can actually take advantage of the problem of prediction and epistemic arrogance! As a matter of fact, I suspect that the most successful businesses are precisely those that know how to work around inherent unpredictability and even exploit it.

Recall my discussion of the biotech company whose managers understood that the essence of research is in the unknown unknowns. Also, notice how they seized on the "corners," those free lottery tickets in the world.

Here are the (modest) tricks. But note that the more modest they are, the more effective they will be.

a. *First, make a distinction between* positive contingencies *and* negative ones. Learn to distinguish between those human undertakings in which the lack of predictability can be (or has been) extremely beneficial and those where the failure to understand the future caused harm. There are both positive and negative Black Swans. William Goldman was involved in the movies, a positive–Black Swan business. Uncertainty did occasionally pay off there.

   A negative–Black Swan business is one where the unexpected can hit hard and hurt severely. If you are in the military, in catastrophe insurance, or in homeland security, you face only downside. Likewise, as we saw in Chapter 7, if you are in banking and lending, surprise outcomes are likely to be negative for you. You lend, and in the best of circumstances you get your loan back—but you may lose all of your money if the borrower defaults. In the event that the borrower enjoys great financial success, he is

not likely to offer you an additional dividend.

Aside from the movies, examples of positive–Black Swan businesses are: some segments of publishing, scientific research, and venture capital. In these businesses, you lose small to make big. You have little to lose per book and, for completely unexpected reasons, any given book might take off. The downside is small and easily controlled. The problem with publishers, of course, is that they regularly pay up for books, thus making their upside rather limited and their downside monstrous. (If you pay $10 million for a book, your Black Swan is it not being a bestseller.) Likewise, while technology can carry a great payoff, paying for the hyped-up story, as people did with the dot-com bubble, can make any upside limited and any downside huge. It is the venture capitalist who invested in a speculative company and sold his stake to unimaginative investors who is the beneficiary of the Black Swan, not the "me, too" investors.

In these businesses you are lucky if you don't know anything—particularly if others don't know anything either, but aren't aware of it. And you fare best if you know where your ignorance lies, if you are the only one looking at the unread books, so to speak. This dovetails into the "barbell" strategy of taking maximum exposure to the positive Black Swans while remaining paranoid about the negative ones. For your exposure to the positive Black Swan, you do not need to have any precise understanding of the structure of uncertainty. I find it hard to explain that when you have a very limited loss you need to get as aggressive, as speculative, and sometimes as "unreasonable" as you can be.

Middlebrow thinkers sometimes make the analogy of such strategy with that of collecting "lottery tickets." It is plain wrong. First, lottery tickets do not have a scalable payoff; there is a known upper limit to what they can deliver. The ludic fallacy applies here—the scalability of real-life payoffs compared to lottery ones makes the payoff unlimited or of unknown limit. Secondly, the lottery tickets have known rules and laboratory-style well-presented possibilities; here we do not know the rules and can benefit from this additional uncertainty, since it cannot hurt you and can only benefit you.*

b. *Don't look for the* precise *and the* local. Simply, do not be narrow-minded. The great discoverer Pasteur, who came up with the notion that chance favors the prepared, understood that you do not look for something

particular every morning but work hard to let contingency enter your working life. As Yogi Berra, another great thinker, said, “You got to be very careful if you don’t know where you’re going, because you might not get there.”

Likewise, do not try to predict precise Black Swans—it tends to make you more vulnerable to the ones you did not predict. My friends Andy Marshall and Andrew Mays at the Department of Defense face the same problem. The impulse on the part of the military is to devote resources to predicting the next problems. These thinkers advocate the opposite: invest in preparedness, not in prediction.

Remember that infinite vigilance is just not possible.

c. *Seize any opportunity, or anything that looks like opportunity*. They are rare, much rarer than you think. Remember that positive Black Swans have a necessary first step: you need to be exposed to them. Many people do not realize that they are getting a lucky break in life when they get it. If a big publisher (or a big art dealer or a movie executive or a hotshot banker or a big thinker) suggests an appointment, cancel anything you have planned: you may never see such a window open up again. I am sometimes shocked at how little people realize that these opportunities do not grow on trees. Collect as many free nonlottery tickets (those with open-ended payoffs) as you can, and, once they start paying off, do not discard them. Work hard, not in grunt work, but in chasing such opportunities and maximizing exposure to them. This makes living in big cities invaluable because you increase the odds of serendipitous encounters—you gain exposure to the envelope of serendipity. The idea of settling in a rural area on grounds that one has good communications “in the age of the Internet” tunnels out of such sources of positive uncertainty. Diplomats understand that very well: casual chance discussions at cocktail parties usually lead to big breakthroughs—not dry correspondence or telephone conversations. Go to parties! If you’re a scientist, you will chance upon a remark that might spark new research. And if you are autistic, send your associates to these events.
d. *Beware of precise plans by governments*. As discussed in Chapter 10, let governments predict (it makes officials feel better about themselves and justifies their existence) but do not set much store by what they say. Remember that the interest of these civil servants is to survive and self-

perpetuate—not to get to the truth. It does not mean that governments are useless, only that you need to keep a vigilant eye on their side effects. For instance, regulators in the banking business are prone to a severe expert problem and they tend to condone reckless but (hidden) risk taking. Andy Marshall and Andy Mays asked me if the private sector could do better in predicting. Alas, no. Once again, recall the story of banks hiding explosive risks in their portfolios. It is not a good idea to trust corporations with matters such as rare events because the performance of these executives is not observable on a short-term basis, and they will game the system by showing good performance so they can get their yearly bonus. The Achilles' heel of capitalism is that if you make corporations compete, it is sometimes the one that is most exposed to the negative Black Swan that will appear to be the most fit for survival. Also recall from the footnote on Ferguson's discovery in Chapter 1 that markets are not good predictors of wars. No one in particular is a good predictor of anything. Sorry.

e. "There are some people who, if they don't already know, you can't tell 'em," as the great philosopher of uncertainty Yogi Berra once said. *Do not waste your time trying to fight forecasters, stock analysts, economists, and social scientists, except to play pranks on them*. They are considerably easy to make fun of, and many get angry quite readily. It is ineffective to moan about unpredictability: people will continue to predict foolishly, especially if they are paid for it, and you cannot put an end to institutionalized frauds. If you ever do have to heed a forecast, keep in mind that its accuracy degrades rapidly as you extend it through time.

If you hear a "prominent" economist using the word *equilibrium*, or *normal distribution*, do not argue with him; just ignore him, or try to put a rat down his shirt.

The Great Asymmetry

All these recommendations have one point in common: asymmetry. Put yourself in situations where favorable consequences are much larger than unfavorable ones.

Indeed, the notion of *asymmetric outcomes* is the central idea of this book: I will never get to know the unknown since, by definition, it is unknown. However, I can always guess how it might affect me, and I should base my