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## PROLOGUE



### *Mosques in the Clouds*

This book is about luck disguised and perceived as non-luck (that is, skills) and, more generally, randomness disguised and perceived as non-randomness (that is, determinism). It manifests itself in the shape of the *lucky fool*, defined as a person who benefited from a disproportionate share of luck but attributes his success to some other, generally very precise, reason. Such confusion crops up in the most unexpected areas, even science, though not in such an accentuated and obvious manner as it does in the world of business. It is endemic in politics, as it can be encountered in the shape of a country's president discoursing on the jobs that "he" created, "his" recovery, and "his predecessor's" inflation.

We are genetically still very close to our ancestors who roamed the savannah. The formation of our beliefs is fraught with superstitions – even today (I might say, especially today). Just as one day some primitive tribesman scratched his nose, saw rain falling, and developed an elaborate method of scratching his nose to bring on the much-needed rain, we link economic prosperity to some rate cut by the Federal Reserve Board, or the success of a company with the appointment of the new president "at the helm". Bookstores are full of biographies of successful men and women presenting their specific explanation on how they made it big in life (we have an expression, "the right time and the right place" to weaken whatever conclusion can be inferred from them).

This confusion strikes people of different persuasions; the literature professor invests a deep meaning into a mere coincidental occurrence of word patterns, while the financial statistician proudly detects “regularities” and “anomalies” in data that are plain random.

At the cost of appearing biased, I have to say that the literary mind can be intentionally prone to the confusion between *noise* and *meaning*, that is, between a randomly constructed arrangement and a precisely intended message. However, this causes little harm; few claim that art is a tool of investigation of the Truth – rather than an attempt to explain it or make it more palatable. Symbolism is the child of our inability and unwillingness to accept randomness; we give meaning to all manner of shapes; we detect human figures in in photos. *I saw mosaics in the clouds* announced Arthur Rimbaud, the 19th-century French Symbolic poet. This interpretation took him to “poor Abyssinia (in East Africa), where he was brutalized by a Christian Lebanese slave dealer, contracted syphilis, and lost a leg to gangrene. He gave up poetry in disgust at the age of 19, and died anonymously in a Marseilles hospital ward while still in his thirties. But it was too late. European intellectual life developed what seems to be an irreversible taste for symbolism – we are still paying its price, with psychoanalysis and other fads.

Regrettably, some people play the game too seriously; they are paid to read too much into things. All my life I have suffered the conflict between my love of literature and poetry and my profound allergy to most teachers of literature and “critics”. The French poet Paul Valery was surprised to listen to a commentary of his poems that found meanings that had until then escaped him (of course, it was pointed out to him that these were intended by his subconscious).

More generally, we underestimate the share of randomness in about anything, a point that may not merit a book – except when it is the specialist who is the fool of all fools. Disturbingly, science has only recently been able to handle randomness (the growth in available information has been exceeded by the expansion of noise). Probability theory is a young arrival in mathematics; probability applied to practice is almost nonexistent as a discipline.

Consider the left and the right columns of Table P.1. The best way to summarize the major thesis of this book is that it addresses situations (many of them tragicomical) where the left column is mistaken for the

**Table P.1 Table of Confusion**  
*Presenting the central distinctions used in the book*

GENERAL	
Luck	Skills
Randomness	Determinism
Probability	Certainty
Belief, conjecture	Knowledge, certitude
Theory	Reality
Anecdote, coincidence	Causality, law
Forecast	Prophecy
MARKET PERFORMANCE	
Lucky idiot	Skilled investor
Survivorship bias	Market outperformance
FINANCE	
Volatility	Return (or drift)
Stochastic variable	Deterministic variable
PHYSICS AND ENGINEERING	
Noise	Signal
LITERARY CRITICISM	
None (literary critics do not seem to have a name for things they do not understand)	Symbol
PHILOSOPHY OF SCIENCE	
Epistemic probability	Physical probability
Induction	Deduction
Synthetic proposition	Analytic proposition

right one. The sub-sections also illustrate the key areas of discussion on which this book will be based.

The reader may wonder whether the opposite case might not deserve some attention, that is, the situations where non-randomness is mistaken for randomness. Shouldn't we be concerned with situations where patterns and messages may have been ignored? I have two answers. First, I am not overly worried about the existence of

businessmen, particularly those run-of-the-mill variety. Nero is allergic to the vocabulary of business talk, not just on plain aesthetic grounds. Words like “game plan”, “bottom line”, “how to get there from here”, “we provide our clients with solutions”, “our mission” and other hackneyed expressions that dominate meetings lack both the precision and the coloration that he prefers to hear. Whether people populate silence with hollow sentences, or if such meetings present any true merit, he does not know; at any rate he did not want to be part of it. Indeed Nero’s extensive social life includes almost no business people. But unlike me (I can be extremely humiliating when someone tells me the wrong way with inelegant pompousness) Nero handles himself with gentle aloofness in these circumstances.

So, Nero switched careers to what is called proprietary trading. Traders are set up as independent entities in their firms with their own allocation of capital. They are left alone to do as they please, provided of course that their results satisfy the executives. The name proprietary comes from the fact that they trade the company’s own money. At the end of the year they receive between 7% and 12% of the profits generated. The proprietary trader has all the benefits of self employment, and none of the burdens of running the mundane details of his own business. He can work any hours he likes, can travel at a whim and engage in all manner of personal pursuits. It is paradise for an intellectual like Nero who dislikes manual work and values unscheduled meditation. He has been doing that for the past ten years, in the employment of two different trading firms.

#### MODUS OPERANDI

A word on Nero’s methods. He is as conservative a trader as one can be in such a business. In the past he has had good years and less than good years – but virtually no truly “bad” years. Over these years he has slowly built for himself a stable nest egg, thanks to an income ranging between \$300,000 and (at the peak) \$2,500,000. On average, he manages to accumulate \$500,000 a year in after-tax money (from an average income of about \$1,000,000); this goes straight into his savings account. In 1993, he had a flat year and was made to feel uncomfortable in his

company. Other traders made out much better, so the capital at his disposal was severely reduced, and he was made to feel undesirable at the institution. He then went to get an identical job, down to an identically designed workspace, but in a different firm that was friendlier. In the fall of 1994 the traders who had been competing for the great performance award blew up in unison during the worldwide bond market crash that resulted from the random tightening by the Federal Reserve Bank of the United States. They are all currently out of the market, performing a variety of tasks. This business has a high mortality rate.

Why doesn’t Nero make more money? Because of his trading style – or perhaps his personality. His risk aversion is extreme. Nero’s objective is not to maximize his profits, so much as it is to avoid having this entertaining money machine called trading taken away from him. Blowing up would mean returning to the tedium of the university or the non-trading life. Every time his risks increase, he conjures up the image of the quiet hallway at the university, the long mornings at his desk spent in revising a paper, kept awake by bad coffee. No, he does not want to have to face the solemn university library where he was bored to tears. “I am shooting for longevity”, he is wont to say.

Nero has seen many traders *blow up*, and does not want to get into that situation. *Blow up* in the lingo has a precise meaning; it does not just mean to lose money; it means to lose more money than one ever expected, to the point of being thrown out of the business (the equivalent of a doctor losing his license to practice or a lawyer being disbarred). Nero rapidly exits trades after a predetermined loss. He never sells “naked options” (a strategy that would leave him exposed to large possible losses). He never puts himself in a situation where he can lose more than, say, \$1,000,000 – regardless of the probability of such an event. That amount has always been variable; it depends on his accumulated profits for the year. This risk aversion prevented him from making as much money as the other traders on Wall Street who are often called “Masters of the Universe”. The firms he has worked for generally allocate more money to traders with a different style, like John whom we will encounter soon.

Nero’s temperament is such that he does not mind losing small money. “I love taking small losses”, he says. “I just need my winners to be large”. In no circumstances does he want to be exposed to those rare

The interview is illustrative of the destructive aspect of the media, in catering to our heavily warped common sense and biases. I was told that George Will was very famous and extremely respected (that is, for a journalist). He might even be someone of utmost intellectual integrity; his profession, however, is merely to sound smart and intelligent to the hordes. Shiller, on the other hand, understands the ins and outs of randomness; he is trained to deal with rigorous argumentation, but does sound less smart in public because his subject matter is highly counterintuitive. Shiller had been pronouncing the stock market to be overpriced for a long time. George Will indicated to Shiller that had people listened to him in the past they would have lost money, as the market has more than doubled since he started pronouncing it overvalued. To such a realistic and well sounding (but senseless) argument, Shiller was unable to respond except to explain that the fact that he was wrong in one single market call should not carry undue significance. Shiller, as a scientist, did not claim being a prophet or one of the entertainers who comment on the markets on the evening news. Yogi Berra would have had a better time with his confident comment on the fat lady not having sung yet.

I could not understand what Shiller, untrained to compress his ideas into vapid sound-bites, was doing on such a TV show. Clearly, it is foolish to think that an irrational market cannot become even more irrational; Shiller's views on the rationality of the market are not invalidated by the argument that he was wrong in the past. Here I could not help seeing in the person of George Will the representative of so many nightmares in my career; my attempting to prevent someone from playing Russian roulette for \$10 million and seeing journalist George Will humiliating me in public by saying that had the person listened to me it would have cost him a considerable fortune. In addition, Will's comment was not an off-the-cuff remark; he wrote an article on the matter discussing Shiller's bad "prophecy". Such tendency to make and unmake prophets based on the fate of the roulette wheel is symptomatic of our genetic inability to cope with the complex structure of randomness prevailing in the modern world. Mixing forecast and prophecy is symptomatic of randomness foolishness (prophecy belongs to the right column, forecast is its mere left-column equivalent).

## HUMILIATED IN DEBATES

Clearly, this idea of alternative history does not make intuitive sense, which is where the fun begins. For starters, we are not wired in a way to understand probability, a point that we will examine backward and forward in this book. I will just say at this point that researchers of the brain believe that mathematical truths make little sense to our mind, particularly when it comes to the examination of random outcomes. Most results in probability are entirely counterintuitive; we will see plenty of them. Then why argue with a mere journalist whose paycheck comes from playing on the conventional wisdom of the hordes? I recall that every time I have been humiliated in a public discussion on markets by someone (of the George Will variety) who seemed to present more palatable and easier to understand arguments, I turned out (much later) to be right. I do not dispute that arguments should be simplified to their maximum potential; but people often confuse complex ideas that cannot be simplified into a media-friendly statement as symptomatic of a confused mind. MBAs learn the concept of clarity and simplicity, the five-minute-manager take on things. The concept may apply to the business plan for a fertilizer plant, but not to highly probabilistic arguments – which is the reason I have anecdotal evidence in my business that MBAs tend to blow up in financial markets, as they are trained to simplify matters a couple of steps beyond their requirement (I beg the MBA reader not to take offense; I am myself the unhappy holder of the degree).

Beware the confusion between correctness and intelligibility. Part of conventional wisdom favors things that can be explained rather instantly and "in a nutshell" – in many circles it is considered law. Having attended a French elementary school, a *lycée primaire*, I was trained to rehash the popular adage:

*Ce qui se conçoit bien s'énonce clairement  
Et les mots pour le dire viennent aisément*

*What is easy to conceive is clear to express/Words to say it would come effortlessly.*

The reader can imagine my disappointment at realizing, while

## MY SOLON

I have another reason to be obsessed with Solon's warning. I hark back to the very same strip of land in the Eastern Mediterranean where the story took place. My ancestors experienced bouts of extreme opulence and embarrassing penury over the course of a single generation, with abrupt regressions that people around me who have the memory of steady and linear betterment, do not think feasible (at least not at the time of writing). Those around me either have (so far) had few major setbacks (except for the great depression) or, more generally, are not suffused with enough sense of history to reflect backward. For people of my background, Eastern Mediterranean Greek-Orthodox and a graded Eastern Roman citizenship, it was as if our soul had been wired with the remembrance of that sad April day, 500 years ago when Constantinople, under the invading Turks, fell out of history, leaving us the lost subjects of a dead empire, very prosperous minorities in an Islamic world – but with an extremely fragile wealth. Moreover, I vividly remember the image of my own dignified grandfather, a former deputy prime minister and son of a deputy prime minister (whom I never saw without a suit), residing in a nondescript apartment in Athens, his estate having been blown up during the Lebanese civil war. Incidentally, having experienced the ravages of war, I find undignified impoverishment far harsher than physical danger (somehow dying in full dignity appears to me far preferable to living a janitorial life, which is one of the reasons I dislike financial risks far more than physical ones). I am certain that Croesus worried more about the loss of his Kingdom than the perils to his life.

There is an important and non-trivial aspect of historical thinking, perhaps more applicable to the markets than anything else: unlike many “hard” sciences, history cannot lend itself to experimentation. But somehow, overall, history is potent enough to deliver, on time, in the medium to long run, most of the possible scenarios, burying the bad guy. Bad trades catch up with you, it is frequently said in the markets. Mathematicians of probability give that a fancy name: *ergodicity*. It means, roughly, that (under certain conditions), very long sample paths would end up resembling each other. The properties of a very, very long sample path would be similar to the Monte Carlo properties of an

average of shorter ones. The janitor in Chapter 1 who won the lottery, if he lived 1000 years, cannot be expected to win more lotteries. Those who were unlucky in life in spite of their skills would eventually rise. The lucky fool might have benefited from some luck in life; over the longer run he would slowly converge to the state of a less-lucky idiot. Each one would revert to his long-term properties.

*Distilled Thinking on Your PalmPilot*

## BREAKING NEWS

The journalist, my *bête noire*, entered this book with George Will dealing with random outcomes. In the next step I will show how my Monte Carlo toy taught me to favor distilled thinking, by which I mean the thinking based on information around us that is stripped of meaningless but diverting clutter. For the difference between noise and information, the topic of this book (noise has more randomness) has an analog: that between journalism and history. To be competent, a journalist should view matters like a historian, and play down the value of the information he is providing, such as by saying: “today the market went up, but this information is not too relevant as it emanates mostly from noise”. He would certainly lose his job by trivializing the value of the information in his hands. Not only is it difficult for the journalist to think more like a historian, but it is alas the historian who is becoming more like the journalist.

For an idea, age is beauty (it is premature to discuss the mathematics of the point). The applicability of Solon's warning to a life in randomness, in contrast with the exact opposite message delivered by the prevailing media-soaked culture, reinforces my instinct to value distilled thought over newer thinking, regardless of its apparent sophistication – another reason to accumulate the hoary volumes by my bedside (I confess that the only news items I currently read are the far more interesting upscale social gossip stories found in *Tatler*, *Paris Match* and *Vanity Fair* – in addition to *The Economist*). Aside from the decorum of ancient

man crossed the 40-year mark, he had shown that very few ailments could harm him. We now proceed to a mathematical rephrasing of these arguments.

### *Philostratus in Monte Carlo: On the Difference Between Noise and Information*

The wise man listens to meaning, the fool only gets the noise. The modern Greek poet C. P. Cavafy wrote a piece in 1915 after Philostratus' adage: *For to gain perceive things in the future, ordinary people think in the present, but the wise perceive things about to happen.* Cavafy wrote:

*in their intense meditation the hidden sound of things approaching reaches them and they listen reverently while in the street outside the people hear nothing at all.*

I thought hard and long on how to explain with as little mathematics as possible the difference between noise and meaning, and how to show why the time scale is important in judging an historical event. The Monte Carlo simulator can provide us with such an intuition. We will start with an example borrowed from the investment world (that is my profession), as it can be explained rather easily, but the concept can be used in any application.

Let us manufacture a happily retired dentist, living in a pleasant sunny town. We know *a priori* that he is an excellent investor, and that he will be expected to earn a return of 15% in excess of Treasury bills, with a 10% error rate per annum (what we call volatility). It means that out of 100 sample paths, we expect close to 68 of them to fall within a band of plus and minus 10% around the 15% excess return, i.e. between 5% and 25% (to be technical; the bell-shaped normal distribution has 68% of all observations falling between  $-1$  and  $1$  standard deviations). It also means that 95 sample paths would fall between  $-5\%$  and  $35\%$ .

Clearly, we are dealing with a very optimistic situation. The dentist builds for himself a nice trading desk in his attic, aiming to spend every business day there watching the market, while sipping decaffeinated cappuccino. He has an adventurous temperament, so he finds this activity more attractive than drilling the teeth of reluctant old little Park Avenue ladies.

He subscribes to a web-based service that supplies him with continuous prices, now to be obtained for a fraction of what he pays for his coffee. He puts his inventory of securities in his spreadsheet and can thus instantaneously monitor the value of his speculative portfolio. We are living in the era called that of connectivity.

A 15% return with a 10% volatility (or uncertainty) per annum translates into a 93% probability of making money in any given year. But seen at a narrow time scale, this translates into a mere 50.02% probability of making money over any given second as shown in Table 3.1. Over the very narrow time increment, the observation will reveal close to nothing. Yet the dentist's heart will not tell him that. Being emotional, he feels a pang with every loss, as it shows in red on his screen. He feels some pleasure when the performance is positive, but not in equivalent amount as the pain experienced when the performance is negative.

At the end of every day the dentist will be emotionally drained. A minute-by-minute examination of his performance means that each day (assuming eight hours per day) he will have 241 pleasurable minutes against 239 unpleasurable ones. These amount to 60,688 and 60,271, respectively, per year. Now realize that if the unpleasurable minute is

Table 3.1 Probability of making money at different scales.

Scale	Probability
1 year	93%
1 quarter	77%
1 month	67%
1 day	54%
1 hour	51.3%
1 minute	50.17%
1 second	50.02%

struck me while reading Richard Dawkins' *Selfish Gene*<sup>3</sup> is that, although the text does not exhibit a single equation, it seems as if it were translated from the language of mathematics. Yet it is artistic prose.

#### REVERSE TURING TEST

Randomness can be of considerable help with the matter. For there is another, far more entertaining way to make the distinction between the babbler and the thinker. You can sometimes replicate or even imitate what can be mistaken for a literary discourse with a Monte Carlo generator but it is not possible randomly to construct a scientific one. Phetoric can be constructed randomly, but not genuine scientific knowledge. This is the application of Turing's test of artificial intelligence, except in reverse. What is the Turing test? The brilliant British mathematician, eccentric, and computer pioneer Alan Turing came up with the following test: a computer can be said to be intelligent if it can (on average) fool a human into mistaking it for another human. The converse should be true. A human can be said to be unintelligent if we can replicate his speech by a computer, which we know is unintelligent, and fool a human into believing that it was written by a human. Can one produce a piece of work that can be largely mistaken for Derrida entirely randomly?

The answer seems to be yes. Aside from the hoax by Alan Sokal (the same of the hilarious book a few lines ago) who managed to produce nonsense and get it published by some prominent journal,<sup>4</sup> there are Monte Carlo generators designed to structure such texts and write entire papers. Fed with "postmodernist" texts, they can randomize phrases under a method called recursive grammar, and produce grammatically sound but entirely meaningless sentences that sound like Jacques Derrida, Camille Paglia, and such a crowd. Owing to the fuzziness of his thought, the literary intellectual can be fooled by randomness.

At the Monash University program in Australia featuring the Dada Engine built by Andrew C. Bulha,<sup>5</sup> I toyed with the engine and generated a few papers containing the following sentences:

*However, the main theme of the works of Rushdie is not theory, as the dialectic paradigm of reality suggests, but pretheory. The premise*

*of the neosemanticist paradigm of discourse implies that sexual identity, ironically, has significance.*

*Many narratives concerning the role of the writer as observer may be revealed. It could be said that if cultural narrative holds, we have to choose between the dialectic paradigm of narrative and neo-conceptual Marxism. Sartre's analysis of cultural narrative holds that society, paradoxically, has objective value.*

*Thus, the premise of the neodialectic paradigm of expression implies that consciousness may be used to reinforce hierarchy, but only if reality is distinct from consciousness; if that is not the case, we can assume that language has intrinsic meaning.*

Some business speeches belong to this category in their own right, except that they are less elegant and draw on a different type of vocabulary than the literary ones. We can randomly construct a speech imitating that of your chief executive officer to insure whether what he is saying has value, or if it is merely dressed-up nonsense from someone who was lucky to be put there. How? You select randomly five phrases below, then connect them by adding the minimum required to construct a grammatically sound speech.

*We look after our customer's interests/the road ahead/our assets are our people/creation of shareholder value/our vision/our expertise lies in/we provide interactive solutions/we position ourselves in this market/how to serve our customers better/short term pain for long term gain/we will be rewarded in the long run/we play from our strength and improve our weaknesses/courage and determination will prevail/we are committed to innovation and technology/a happy employee is a productive employee/commitment to excellence/strategic plan/our work ethics.*

If this bears too close a resemblance to the speech you just heard from the boss of your company, then I suggest looking for a new job.

The nerdy types at the International Monetary Fund had been taken for a ride by the Russian government who cheated on their account. Let us remember that economists are evaluated on how intelligent they sound, not on a scientific measure of their knowledge of reality. However, the price of the bonds was not fooled. It knew more than the economists, more than the Carloses of the emerging market departments.

Louie, a veteran trader on the neighboring desk who suffered much humiliation by these rich emerging market traders, was there, vindicated. Louie was then a 52-year-old Brooklyn-born-and-raised trader who over three decades survived every single conceivable market cycle. He calmly looked at Carlos being escorted by a security guard to the door like a captured soldier taken to the arena. He muttered in his Brooklyn accent: "*Economics Schmoeconomics. It is all market dynamics.*"

Carlos is now out of the market. The possibility that history may prove him right (at some point in the future) has nothing to do with the fact that he is a bad trader. He has all of the traits of a thoughtful gentleman, and would be an ideal son-in-law. But he has most of the attributes of the bad trader. And, at any point in time, the richest traders are often the worst traders. This, I will call the *cross-sectional problem*: at a given time in the market, the most profitable traders are likely to be those that are best fit to the latest cycle. This does not happen too often with dentists or pianists – because of the nature of randomness.

### *John the High-Yield Trader*

We met John, Nero's neighbor, in Chapter 1. At the age of 35 he had been on Wall Street as a corporate "high-yield" bonds trader for seven years, since his graduation from Pace Graduate Business School. He rose to head up a team of ten traders in record time – thanks to a jump between two similar Wall Street firms that afforded him a generous profit-sharing contract. The contract allowed him to be paid 20% of his profits, as they stood at the end of each calendar year. In addition, he was allowed to invest his own personal money in his trades – a great privilege.

John is not someone who can be termed as principally intelligent, but he was believed to be endowed with a good measure of business sense. He was said to be "pragmatic" and "professional". He gave the impression that he was born a businessperson, never saying anything remotely unusual or out of place. He remained calm in most circumstances, rarely betraying any form of emotion. Even his occasional cursing (this is Wall Street!) was so much in context that it sounded, well, professional.

John dressed impeccably. This was in part due to his monthly trips to London where his unit had a satellite supervising European high-yield activities. He wore a Saville Row tailored dark business suit, with a Ferragamo tie – enough to convey the impression that he was the epitome of the successful Wall Street professional. Each time Nero ran into him he came away feeling poorly dressed.

John's desk engaged principally in an activity called "high-yield" trading, which consisted in acquiring "cheap" bonds that yielded, say 10%, while the borrowing rate for his institution was 5.5%. It netted a 4.5% revenue, also called *interest rate differential* – which seemed small except that he could leverage himself and multiply such profit by the leverage factor. He did this in various countries, borrowing at the local rate and investing in "risky" assets. It was easy for him to amass over \$3 billion dollars in face value of such trade across a variety of continents. He hedged the interest rate exposure by selling U.S., U.K., French, and other government bond futures, thus limiting his bet to the differential between the two instruments. He felt protected by this hedging strategy – cocooned (or so he thought) against those nasty fluctuations in the world's global interest rates.

#### THE QUANT WHO KNEW COMPUTERS AND EQUATIONS

John was assisted by Henry, a foreign *quant* whose English was incomprehensible, but who was believed to be at least equally competent in risk-management methods. John knew no math, he relied on Henry. "His brains and my business sense", he was wont to say. Henry supplied him with risk assessments concerning the overall portfolio. Whenever John felt worried, he would ask Henry for another

Furthermore, things can get even more surprising when randomness changes in shape, as with regime switches. A regime switch corresponds to situations when all of the attributes of a system change to the point of it becoming unrecognizable to the observer. Darwinian fitness applies to species developing over a very long time, not observed over a short term – time aggregation eliminates much of the effects of randomness; things (I read *noise*) balance out over the long run, as people say.

Owing to the abrupt rare events, we do not live in a world where things “converge” continuously towards betterment. Nor do things in life move *continuously* at all. The belief in continuity was ingrained in our scientific culture until the early twentieth century. It was said that *nature does not make jumps*; people quote this in well-sounding Latin: *natura no facit saltus*. It is generally attributed to the eighteenth-century botanist Linnaeus, who obviously got it all wrong. It was also used by Leibniz as a justification of calculus, as he believed that things are continuous no matter the resolution at which we look at them. Like many well-sounding “make sense” types of statements (such dynamics made perfect intellectual sense), it turned out to be entirely wrong, as it was denied by quantum mechanics. We discovered that, in the very small, particles jump (discretely) between states; they do not slide between them.

#### CAN EVOLUTION BE FOOLED BY RANDOMNESS?

We end this chapter with the following thought. Recall that someone with only casual knowledge about the problems of randomness would believe that an animal is at the maximum fitness for the conditions of his time. This is not what evolution means; *on average* animals will be fit, but not every single one of them, and not at all times. Just as an animal could have survived because its sample path was lucky, the “best” operators in a given business can come from a subset of operators who survived because of over-fitness to a sample path – a sample path that was free of the evolutionary rare event. One vicious attribute is that the longer these animals can go without encountering the rare event, the more vulnerable they will be to it. We said that should one extend time to infinity, then, by *ergodicity*, that event will happen with certainty –

the species will be wiped out! For evolution means fitness to one and only time series, not the average of all the possible environments.

By some viciousness of the structure of randomness, a profitable person like John, someone who is a pure loser in the long run and correspondingly unfit for survival, presents a high degree of eligibility in the short run and has the propensity to multiply his genes. Recall the hormonal effect on posture and its signaling effect to other potential mates. His success (or pseudo-success owing to its fragility) will show in his features as a beacon. An innocent potential mate will be fooled into thinking (unconditionally) that he has a superior genetic makeup, until the following rare event. Solon seems to have gotten the point; but try to explain the problem to a naïve business Darwinist – or your rich neighbor across the street.

far more likely than B. Odds are that we would make money by betting for event A, but it is not a good idea to do so.

This point is rather common and simple; it is understood by anyone making a simple bet. Yet I had to struggle all my life with people in the financial markets who do not seem to internalize it. I am not talking of novices; I am talking of people with advanced degrees (albeit MBAs) who cannot come to grips with the difference.

How could people miss such a point? Why do they confuse probability and expectation, that is, probability and probability times the payoff? Mainly because much of people's schooling comes from examples in symmetric environments, like a coin toss, where such a difference does not matter. In fact the so-called "bell Curve" that seems to have found universal use in society is entirely symmetric. More on that later.

### *Bull and Bear Zoology*

The general press floods us with concepts like *bullish* and *bearish* as these mean to refer to the effect of higher (bullish) or lower (bearish) prices in the financial markets. But also we hear people saying "I am *bullish* on Johnny" or "I am *bearish* on that guy Nassim in the back who seems incomprehensible to me", to denote the belief in the likelihood of someone's rise in life. I have to say that the notion *bullish* or *bearish* are often hollow words with no application in a world of randomness – particularly if such a world, like ours, presents asymmetric outcomes.

When I was in the employment of the New York office of a large investment house, I was subjected on occasions to the harrying weekly "discussion meeting", which gathered most professionals of the New York trading room. I do not conceal that I was not fond of such gatherings, and not only because they cut into my gym time. While the meetings included traders, that is, people who are judged on their numerical performance, it was mostly a forum for salespeople (people capable of charming customers), and the category of entertainers called Wall Street "economists" or "strategists" who make pronouncements on the fate of

the markets, but do not engage in any form of risk taking, thus having their success dependent on rhetoric rather than actually testable facts. During the discussion, people were supposed to present their opinions on the state of the world. To me, the meeting was pure intellectual pollution. Everyone had a story, a theory, and insights that they wanted others to share. I resent the person who, without having done much homework in libraries, thinks that he is onto something rather original and insightful on a given subject matter (and respect people with scientific minds like my friend Stan Jonas who feel compelled to spend their nights reading wholesale on a subject matter, trying to figure out what was done on the subject by others before emitting an opinion – would the reader listen to the opinion of a doctor who does not read medical papers?).

I have to confess that my optimal strategy (to soothe my boredom and allergy to confident platitudes) was to speak as much as I could, while totally avoiding listening to other people's replies by trying to solve equations in my head. Speaking too much would help me clarify my mind, and, with a little bit of luck, I would not be "invited" back (that is, forced to attend) the following week.

I was once asked in one of those meetings to express my views on the stock market. I stated, not without a modicum of pomp, that I believed that the market would go slightly up over the next week with a high probability. How high? "About 70%". Clearly, that was a very strong opinion. But then someone interjected "But, Nassim, you just boasted being short a very large quantity of SP500 futures, making a bet that the market would go down. What made you change your mind?". "I did not change my mind! I have a lot of faith in my bet! (audience laughing). As a matter of fact I now feel like selling even more!" The other employees in the room seemed utterly confused. "Are you bullish or are you bearish?" I was asked by the strategist. I replied that I could not understand the words "bullish" and "bearish" outside of their purely zoological consideration. Just as with events A and B in the preceding example, my opinion was that the market was more likely to go up ("I would be bullish"), but that it was preferable to short it ("I would be bearish"), because, in the event of its going down, it could go down a lot. Suddenly, the few traders in the room understood my opinion and started voicing similar opinions. And I was not forced to come back to the following discussion.

*Journal* during their train ride to reflect properly on the attributes of random events. Or perhaps they watched too many gurus on television. Or perhaps they spent too much time upgrading their PalmPilot. Even some experienced trading veterans do not seem to get the point that frequencies do not matter. Jim Rogers, a “legendary” investor, made the following statement:

*I don't buy options. Buying options is another way to go to the poorhouse. Someone did a study for the SEC and discovered that 90 percent of all options expire as losses. Well, I figured out that 90 percent of all long option positions lost money, that meant that 90 percent of all short option positions make money. If I want to use options to be bullish, I sell calls.*

Visibly, the statistic that 90% of all option positions lost money is meaningless, (i.e., the *frequency*) if we do not take into account *how much* money is made on average during the remaining 10%. If we make 50 times our bet on average when the option is in the money, then I can safely make the statement that buying options is another way to go to the palazzo rather than the poorhouse. Mr Jim Rogers seems to have gone very far in life for someone who does not distinguish between probability and expectation (strangely, he was the partner of George Soros, a complex man who thrived on rare events – more on him later).

One such rare event is the stock market crash of 1987, which made me as a trader and allowed me the luxury of becoming involved in all manner of scholarship. Nero of the smaller house in Chapter 1 aims to get out of harm's way by avoiding exposure to rare events – a mostly defensive approach. I am far more aggressive than Nero and go one step further; I have organized my career and business in such a way as to be able to benefit from them. In other words, I aim at profiting from the rare event, with my asymmetric bets.

#### SYMMETRY AND SCIENCE

In most disciplines, such asymmetry does not matter. Unfortunately, the techniques used in finance are often imported from other areas – finance

is still a young discipline (it is certainly not yet a “science”). People in most fields outside of finance do not have problems eliminating extreme values from their sample, when the difference in payoff between different outcomes is not significant, which is generally the case in education and medicine. A professor who computes the average of his students' grades removes the highest and lowest observations, which he would call *outliers*, and takes the average of the remaining ones, without this being an unsound practice. A casual weather forecaster does the same with extreme temperatures – an unusual occurrence might be deemed to skew the overall result (though we will see that this may turn out to be a mistake when it comes to forecasting future properties of the ice cap). So people in finance borrow the technique and ignore infrequent events, not noticing that the effect of a rare event can bankrupt a company.

Many scientists in the physical world are also subject to such foolishness, misreading statistics. One flagrant example is in the global-warming debate. Many scientists failed to notice it in its early stages as they removed from their sample the spikes in temperature, under the belief that these were not likely to recur. It may be a good idea to take out the extremes when computing the average temperatures for vacation scheduling. But it does not work when we study the physical properties of the weather. These scientists initially ignored the fact that these spikes, although rare, had the effect of adding disproportionately to the cumulative melting of the ice cap. Just as in finance, an event, although rare, that brings large consequences cannot just be ignored.

Figure 6.1 shows a series of points starting with an initial level  $W_0$  and ending at the period concerned  $W_t$ . It can also be seen as the performance, hypothetical or realized, of your favorite trading strategy, the track record of an investment manager, the price of a foot of average Palazzo real estate in Renaissance Florence, the price series of the Mongolian stock market, or the difference between the U.S. and Mongolian stock markets. It is composed of a given number of sequential observations  $W_1, W_2$ , etc., ordered in such a way that the one to the right comes *after* the one to the left.

If we were dealing with a deterministic world – that is, a world stripped of randomness (the right-column world in Table P.1 on page 3), and we knew with certainty that it was the case, things would be rather

Note that the economist Robert Lucas dealt a blow to econometrics by arguing that if people were rational then their rationality would cause them to figure out predictable patterns from the past and adapt, so that past information would be completely useless for predicting the future (the argument, phrased in a very mathematical form, earned him a Nobel Memorial Prize in Economics). We are human and act according to our knowledge, which integrates past data. I can translate his point with the following analogy. If rational traders detect a pattern of stocks rising on Mondays, then, immediately such a pattern becomes detectable, it would be ironed out by people buying on Friday in anticipation of such an effect. There is no point searching for patterns that are available to everyone with a brokerage account; once detected, they would be ironed out.

Somehow, what came to be known as the *Lucas critique* was not carried through by the "scientists". It was confidently believed that the scientific successes of the industrial revolution could be carried through into the social sciences, particularly with such movements as Marxism. Pseudoscience came with a collection of idealistic nerds who tried to create a tailor-made society, the epitome of which is the central planner. Economics was the most likely candidate for such use of science; you can disguise charlatanism under the weight of equations, and nobody can catch you since there is no such thing as a controlled experiment. Now the spirit of such methods, called *scientism* by its detractors (like myself), continued past Marxism, into the discipline of finance as a few technicians thought that their mathematical knowledge could lead them to understand markets. The practice of "financial engineering" came along with massive doses of pseudoscience. Practitioners of these methods measure risks, using the tool of past history as an indication of the future. We will just say at this point that the mere possibility of the distributions not being stationary makes the entire concept seem like a costly (perhaps *very costly*) mistake. This leads us to a more fundamental question: the problem of induction, to which we will turn in the next chapter.

## SEVEN



## THE PROBLEM OF INDUCTION

*On the chromodynamics of swans. Taking Solon's warning into some philosophical territory. How Victor Niederhoffer taught me empiricism; I added deduction. Why it is not scientific to take science seriously. Soros promotes Popper. That bookstore on 21st and Fifth Avenue. Pascal's wager.*

*From Bacon to Hume*

Now we discuss this problem viewed from the broader standpoint of the philosophy of scientific knowledge. There is a problem in inference well known as the problem of induction. It is a problem that has been haunting science for a long time, but science has not been as harmed by it as the financial markets. Why? Because the randomness content compounds its effects. Nowhere is the problem of induction more relevant than in my world of finance – and nowhere has it been as ignored!

## CYGNUS ATRATUS

In his *Treatise on Human Nature*, the Scots philosopher David Hume posed the issue in the following way (as rephrased in the now famous *black swan problem* by John Stuart Mill): *No amount of observations of white swans can allow the inference that all swans are white, but the observation of a single black swan is sufficient to refute that conclusion.*

Hume had been irked by the fact that science in his day (the eighteenth century) had experienced a swing from scholasticism, entirely based on deductive reasoning (no emphasis on the observations of the real world) to, owing to Francis Bacon, an overreaction into naïve and unstructured empiricism. Bacon had argued against “spinning the cobweb of learning” with little practical result. Science had shifted, thanks to Bacon, into an emphasis on empirical observation. The problem is that, without a proper method, empirical observations can lead you astray. Hume came to warn us against such knowledge, and to stress the need for some rigor in the gathering and interpretation of knowledge – what is called epistemology (from *episteme*, Greek for learning). Hume is the first modern *epistemologist*, (epistemologists are often called methodologists or philosophers of science). What I am writing here is not strictly true, for Hume said things far worse than that; he was an obsessive skeptic and never believed that a link between two items could be truly established as being causal. But we will tone him down a bit for this book.

## NIEDERHOFFER, VICTORIAN GENTLEMAN

It is worth noting that finance has its Francis Bacon in the person of Victor Niederhoffer. He was the very first to stand against the *cobweb of learning* of the University of Chicago and the efficient market religion of the 1960s, when it was at its worst. In contrast with the scholasticism of financial theorists, he looked at data in search of anomalies – and found enough of them to be able to conduct a successful career in randomness and deliver an insightful book, *The Education of a Speculator*. Since then, an entire industry of such operators, called “statistical arbitrageurs”, flourished, the major and most successful ones

were initially his trainees. While Niederhoffer had a publicized hiccup, some of his trainees fared well because they added rigor and *methodology* to their statistical inference. In other words, Niederhoffer’s empiricism missed just a modicum of methodology.

I have to admit that for all my intellectual disagreements with him I have been inspired by his empiricism and owe him a large share of my intellectual growth. I experienced a jump in my trading style in 1996, when Victor blurted to me that any “testable” statement should be *tested* (it was so obvious but I had not done it until then). His advice went straight home. A testable statement is one that can be broken down into quantitative components and subjected to statistical examination. For instance, a conventional-wisdom style statement like

*accidents happen closer to home*

can be tested by taking the average distance between the accident and the domicile of the driver (if, say, about 20% of accidents happen within a 12-mile radius). However, one needs to be careful in the interpretation; a naïve interpreter of the result would tell you that you are more likely to have an accident if you drive in your neighborhood than if you did so in remote places, which is an example of naïve empiricism. Why? Because accidents may happen closer to home simply because people spend their time driving close to home (if people spend 20% of their time driving in a 12-mile radius).

Since that very same day I have not made a single testable proposition without testing it, thanks to the computer which I rarely use for non-computational tasks. However, the differences between Victor Niederhoffer and myself remain immense; I can use data to disprove a proposition, never to prove one. I can use history to refute a conjecture, never to affirm it. For instance, the statement

*The market never goes down 20% in a given 3-month period*

can be tested, but is completely meaningless if verified. I can quantitatively reject the proposition by finding counterexamples, but it is impossible for me to accept it simply because in past data the market never went down 20% in any 3-month period.

Like Pascal, I will therefore state the following argument. If the science of statistics can benefit me in anything, I will use it. If it poses a threat, then I will not. I want to take the best of what the past can give me without its dangers. Accordingly, I will use statistics and inductive methods to make aggressive bets, but I will not use them to manage my risks and exposure. Surprisingly, all the surviving traders I know seem to have done the same. They trade on ideas based on some observation (that includes past history) but, like the Popperian scientists, they make sure that the costs of being wrong are limited (and their probability is not derived from past data). Unlike Carlos and John, they knew before getting involved in the trading strategy which even would prove their conjecture wrong and allow for it to be that Carlos and John used past history both to make their bets and measure their risk. They would then terminate their trade. This is called a stop loss, a predetermined exit point, a protection from the black swan. I find it rarely practiced.

*Thank You Solon*

Finally, I have to confess that upon finishing my writing of Part I that writing about the genius of Solon's insight has carried an extreme effect on both my thinking and my private life. The composition of Part I made me even more confident in my withdrawal from the media and my distancing myself from other members of the business community, mostly other investors and traders for whom I am developing more and more contempt. I am currently enjoying a thrill of the classics I have not felt since childhood. My mind, by escaping the news pollution, allowed me to evade the bull market that prevailed over the past 15 years (and professionally benefit from its demise). I am now thinking of the next step: to recreate a low-information, more deterministic ancient time, say in the nineteenth century, all the while benefiting from some of the technical gains (such as the Monte Carlo engine), all of the medical breakthroughs and all the gains of social justice of our age. I would then have the best of everything. This is called evolution.

## PART II



### MONKEYS ON TYPEWRITERS - SURVIVORSHIP AND OTHER BIASES

theory. Besides, a manager would question whether such non-randomness can lead to any meaningful profitable rules. If I need to gamble \$1 on 10,000 runs and expect to make \$1 for my efforts, then I would do much better in the part-time employment of a janitorial agency.

But the result bears another suspicious element. Of more practical relevance here is the following severe problem about non-randomness. Even the fathers of statistical science forgot that a random series of runs need not exhibit a pattern to look random; as a matter of fact, a series that is perfectly patternless would be extremely suspicious and appear to be man-made. A single random run is bound to exhibit some pattern – if one looks hard enough. Note that Professor Pearson was among the first scholars who were interested in creating artificial random data generators, the one could use as tables for various scientific and engineering simulations (the precursors of our Monte Carlo simulator). The problem is that they did not want these tables to exhibit any form of regularity. Yet real randomness does not look random!

I would further illustrate the point with the study of a phenomenon well known as cancer clusters. Consider a square with 16 random darts hitting it with equal probability of being at any place in the square. If we divide the square into 16 smaller squares, it is expected that each smaller square will contain one dart on average – but only on average. There is a very small probability of having exactly 16 darts in 16 different squares. The average grid will have more than one dart in a few squares, and no dart at all in many squares. It will be an exceptionally rare incident that no (cancer) cluster would show on the grid. Now, transpose our grid with the darts in it to overlay a map of any region. Some newspaper will declare that one of the areas (the one with more than the average of darts) harbors radiation that causes cancer, prompting lawyers to start soliciting the patients.

#### THE DOG THAT DID NOT BARK: ON BIASES IN SCIENTIFIC KNOWLEDGE

By the same argument, science is marred by a pernicious survivorship bias, affecting the way research gets published. In a way that is similar to journalism, research that yields no result does not make it to print.

That may seem sensible, as newspapers do not have to have a screaming headline saying that nothing new is taking place (though the Bible was smart enough to declare *ein chadash tacht hashemesh* – “nothing new under the sun”, providing the information that things just do recur). The problem is that a finding of absence and an absence of findings get mixed together. There may be great information in the fact that *nothing* took place. As Sherlock Holmes noted in the *Silver Blaze* case – the curious thing was that the dog did not bark. More problematically, there are plenty of scientific results that are left out of publications because they are not statistically significant, but nevertheless provide information.<sup>9</sup>

#### *I Have No Conclusion*

I am frequently asked the question: when is it truly not luck? To be honest, I am unable to answer it. I can tell that person A seems less lucky than person B, but the confidence in such knowledge can be so weak as to be meaningless. I prefer to remain a skeptic. People frequently misinterpret my opinion. I never said that every rich man is an idiot and every unsuccessful person unlucky, only that in absence of much additional information I prefer to reserve my judgment. It is safer.

horizon. Now what if you are 80? Is your life expectancy *minus* seven years? What these journalists confuse is the unconditional and conditional life expectancy. At birth, your unconditional life expectancy may be 73 years. But as you advance in age and do not die, your life expectancy increases along with your life. Why? Because the other people by dying have taken your spot in the statistics, for expectation means average. So if you are 73 and are in good health, you may still have, say, nine years *in expectation*. But the expectation would change, and at 82, you will have another five years, provided of course you are still alive. Even someone 100 years old still has a positive conditional life expectation. Such a statement, when one thinks about it, is not too different from the one that says: *Our operation has a mortality rate of 1%. So far we have operated on 99 patients with great success; you are our 100th, and you have a 100% probability of dying on the table.*

T.V. financial planners may confuse a few people. This is quite harmless. What is far more worrying is the supply of information by non-professionals to professionals; it is to the journalists that we turn next.

#### THE BLOOMBERG EXPLANATIONS

I have, on my desk, a machine eponymously called a *Bloomberg*<sup>TM</sup> (after the legendary founder Michael Bloomberg). It acts as a safe e-mail service, a news service, a historical data retrieving tool, a charting system, an invaluable analytical aid and, not least, a screen where I can see the price of securities and currencies. I have gotten so addicted to it that I cannot operate without it, as I would otherwise feel cut off from the rest of the world. I use it to get in contact with my friends, confirm appointments, and solve some of those entertaining quarrels that put some sharpness into life. Somehow, traders who do not have a Bloomberg address do not exist for us (they have to have recourse to the more plebeian internet). But there is one aspect of Bloomberg I would dispense with; the journalist's commentary. Why? Because they engage in explaining things and perpetuate the right-column, left-column confusion in a serious manner. Bloomberg is not the sole perpetrator; it is just that I have not been exposed to newspapers' business sections over the past decade, preferring to read real prose instead.

As I am writing these lines I see the following headlines on my Bloomberg:

- *Dow is up 1.03 on lower interest rates.*
- *Dollar down 0.12 yen on higher Japanese surplus.*

And so on for an entire page. If I translate it well, the journalist claims to provide an explanation for something that amounts to *perfect noise*. A move of 1.03 with the Dow at 11,000 constitutes less than a 0.01% move. Such a move does not warrant an explanation. There is nothing there that an honest person can try to explain; there are no reasons to adduce. But like apprentice professors of comparative literature, journalists being paid to provide explanations will gladly and readily provide them. The only solution is for Michael Bloomberg to stop paying his journalists for providing commentary.

*Significance*: how did I decide that it was perfect noise? Take a simple analogy. If you engage in a mountain bicycle race with a friend across Siberia and, a month later, beat him by one single second, you clearly cannot quite boast that you are faster than him. You might have been helped by something, or it can be just plain randomness, nothing else. That second is not in itself significant enough for someone to draw conclusions. I would not write in my pre-bed-time diary: *cyclist A is better than cyclist B because he is fed with spinach whereas cyclist B has a diet rich in tofu. The reason I am making this inference is because he beat him by 1.3 seconds in a 3,000 mile race.* Should the difference be one week, then I could start analyzing whether tofu is the reason, or if there are other factors.

*Causality*: there is another problem; even assuming statistical significance, one has to accept a cause and effect, meaning that the event in the market can be linked to the cause proffered. *Post hoc ergo propter hoc* (it is the reason because it came after). Say Hospital A delivered 52% of boys and Hospital B delivered the same year only 48%; would you try to give the explanation that you had a boy *because* it was delivered in hospital A?

Causality can be very complex. It is very difficult to isolate a single cause when there are plenty around. This is called multivariate analysis. For instance, if the stock market can react to U.S. domestic interest

stacked in his favor or against him. Even when the odds are clearly stacked against the gambler, he sometimes transcends the odds by believing that destiny selected him in some manner. This shows in the very sophisticated people one meets in casinos where they normally should not be found. I even ran into world-class probability experts who had a gambling habit on the side, throwing all of their knowledge to the wind. For example, a former colleague of mine and one of the most intelligent people I have ever met, frequently went to Las Vegas, and seemed to be such a turkey that the casino provided him with complimentary luxury suites and transportation. He even consulted a fortune teller prior to taking large trading positions and tried to get reimbursed by our employer.

### *The Skinner Pigeon Experiment*

At 25, I was totally ignorant of the behavioral sciences. I had been fooled by my education and culture into believing that *my superstitions were cultural*, and that, consequently, they could be shed through the exercise of so-called reason. Taken at the general level of society, modern life would eliminate them as science and logic would enter it. But in my case, I was over time getting more sophisticated intellectually, but the floodgates of randomness were bursting and I was becoming more superstitious.

These superstitions needed to be biological – but I was brought up in an era when the dogma was that it was nurture, rarely nature, that was the culprit. Clearly, there was nothing cultural about my link between my wearing glasses and a random market outcome. There was nothing cultural in my link between my use of entrance and my performance as a trader. There was nothing cultural in my wearing the same tie as the day before. Something in us has not developed properly over the past thousand years and I was dealing with the remnant of our old brain.

To probe the point further, we need to look at such formations of causal associations in the lower forms of life. The famous Harvard psychologist B.F. Skinner constructed a box for rats and pigeons,

equipped with a switch that the pigeon can operate by pecking. In addition, an electrical mechanism delivers food into the box. Skinner designed the box in order to study more general properties of the behavior of a collection of nonhumans, but it was in 1948 that he had the brilliant idea of ignoring the lever and focusing on the food delivery. He programmed it to deliver food at random to the famished birds.

He saw quite astonishing behavior on the part of the birds; they developed an extremely sophisticated rain-dance type of behavior in response to their ingrained statistical machinery. One bird swung its head rhythmically against a specific corner of the box, others spun their heads anti-clockwise; literally all of the birds developed a specific ritual that progressively became hard-wired into their mind as linked to their feeding.

This problem has a more worrying extension; we are not made to view things as independent from each other. When viewing two events A and B, it is hard not to assume that A causes B, B causes A, or both cause each other. Our bias is immediately to establish a causal link. While to a budding trader this causes hardly any worse costs than a few pennies in cab fare, it can draw the scientist into spurious inference. For it is harder to act as if one were ignorant than as if one were smart; scientists know that it is emotionally harder to reject a hypothesis than to accept it (what is called type I and type II errors) – quite a difficult matter when we have such sayings as *felix qui potuit cognoscere causas* (happy is he who understands what is behind things). It is very hard for us to just shut up. We are not cut out for it. Popper or not, we take things too seriously.

### *Philostratus Redux*

I offered no solution to the problem of statistical inference at a low resolution. I discussed in Chapter 3 the technical difference between noise and meaning – but it is time to discuss the execution. The Greek philosopher Pyrrho, who advocated a life of equanimity and indifference, was criticized for failing to keep his composure during a

the most spectacular in its impact on generations of rhetoricians and thinkers. Carneades was not merely a skeptic; he was a dialectician, someone who never committed himself to any of the premises from which he argued, or to any of the conclusions he drew from them. He stood all his life against arrogant dogma and belief in one sole truth. Few credible thinkers rival Carneades in their rigorous skepticism (a class that would include the medieval Arab philosopher Al Gazali, Hume, and Kant – but only Popper came to elevate his skepticism to an all-encompassing scientific methodology). As the skeptics' main teaching was that nothing could be accepted with certainty, conclusions of various degrees of probability could be formed, and these supplied a guide to conduct.

Stepping further back in time and searching for the first known uses of probabilistic thinking in history, we find it harks back to sixth-century B.C. Greek Sicily. There, the notion of probability was used in a legal framework by the very first rhetoricians who, when arguing a case, needed to show the existence of a doubt concerning the certainty of the accusation. The first known rhetorician was a Syracusean named Korax who engaged in teaching people how to argue from probability. At the core of his method was the notion of the *most probable*. For example, the ownership of a piece of land, in the absence of further information and physical evidence, should go to the person after whose name it is best known. One of his indirect students, Gorgias, took this method of argumentation to Athens, where it flourished. It is the establishment of such *most probable* notions that taught us to view the possible contingencies as distinct and separable events with probabilities attached to each one of them.

#### PROBABILITY THE CHILD OF SKEPTICISM

Until the Mediterranean basin was dominated with monotheism, which led to the belief in some form of uniqueness of the truth (to be superseded later by episodes of communism), skepticism had gained currency among many major thinkers – and certainly permeated the world. The Romans did not have a religion *per se*; they were too tolerant to accept a given truth. There were a collection of a variety of flexible and syncretic superstitions. I will not get too theological, except

to say that we had to wait for a dozen centuries in the Western world to espouse critical thinking again. Indeed, for some strange reason during the middle ages, Arabs were critical thinkers (through their post-classical philosophical tradition) when Christian thought was dogmatic, then after the renaissance, the roles mysteriously reversed.

One author from antiquity who provides us evidence of such thinking is the garrulous Cicero. He preferred to be guided by probability than allege with certainty – very handy, some said, because it allowed him to contradict himself. This may be a reason for us, who have learned from Popper how to remain self-critical, to respect him more, as he did not hew stubbornly to an opinion for the mere fact that he had voiced it in the past. Indeed your average literature professor would fault him for his contradictions and his change of mind.

It was not until modern times that such desire to be free from our own past statements emerged. Nowhere was it made more eloquently than in rioting student graffiti in Paris. The student movement that took place in France in 1968, with the youth no doubt choking under the weight of years of having to sound intelligent and coherent, produced, among other jewels, the following demand:

*We demand the right to contradict ourselves!*

#### *Monsieur de Norpois's Opinions*

Modern times provide us with a depressing story. Self-contradiction is made culturally to be shameful, a matter that can prove disastrous in science. Marcel Proust's novel *In Search of Time Lost* features a semi-retired diplomat, Marquis de Norpois, who, like all diplomats before the advent of the fax machine, was a socialite who spent considerable time in salons. The narrator of the novel sees Monsieur de Norpois openly contradicting himself on some issue (some prewar rapprochement between France and Germany). When reminded of his previous position, Monsieur de Norpois did not seem to recall it. Proust reviles him: