- Likewise with randomness, uncertainty, chaos: you want to use them, not hide from them. You want to be the fire and wish for the wind.

- The resilient resists shocks and stays the same; the antifragile gets better.

- The antifragile loves randomness and uncertainty, which also means—crucially—a love of errors, a certain class of errors. Antifragility has a singular property of allowing us to deal with the unknown, to do things without understanding them—and do them well. Let me be more aggressive: we are largely better at doing than we are at thinking, thanks to antifragility. I'd rather be dumb and antifragile than extremely smart and fragile, any time.

- I have made the claim that most of history comes from Black Swan events, while we worry about fine-tuning our understanding of the ordinary, and hence develop models, theories, or representations that cannot possibly track them or measure the possibility of these shocks.

- We didn't get where we are thanks to the sissy notion of resilience. And, what's worse, we didn't get where we are today thanks to policy makers—but thanks to the appetite for risks and errors of a certain class of people we need to encourage, protect, and respect.

- Less is more and usually more effective.

- Steve Jobs figured out that "you have to work hard to get your thinking clean to make it simple." The Arabs have an expression for trenchant prose: no skill to understand it, mastery to write it.

- First ethical rule: If you see fraud and do not say fraud, you are a fraud.

- Just as being nice to the arrogant is no better than being arrogant toward the nice, being accommodating toward anyone committing a nefarious action condones it. Further, many writers and scholars speak in private,

- If you want to become antifragile, put yourself in the situation "loves mistakes"—to the right of "hates mistakes"—by making these numerous and small in harm. We will call this process and approach the "barbell" strategy.

- For the idea of antifragility is not part of our consciousness—but, luckily, it is part of our ancestral behavior, our biological apparatus, and a ubiquitous property of every system that has survived.

- Hydra, in Greek mythology, is a serpent-like creature that dwells in the lake of Lerna, near Argos, and has numerous heads. Each time one is cut off, two grow back. So harm is what it likes. Hydra represents antifragility.

- We know more than we think we do, a lot more than we can articulate. If our formal systems of thought denigrate the natural, and in fact we don't have a name for antifragility, and fight the concept whenever we use our brains, it does not mean that our actions neglect it. Our perceptions and intuitions, as expressed in deeds, can be superior to what we know and tabulate, discuss in words, and teach in a classroom.

- the road to robustification starts with a modicum of harm.

- In other words, hormesis is the norm, and its absence is what hurts us. Hormesis

- So we can now also see the domain dependence of our minds, a “domain” being an area or category of activity. Some people can understand an idea in one domain, say, medicine, and fail to recognize it in another, say, socioeconomic life. Or they get it in the classroom, but not in the more complicated texture of the street. Humans somehow fail to recognize situations outside the contexts in which they usually learn about them.

- Latin saying that sophistication is born out of hunger (artificia docuit fames).

- The excess energy released from overreaction to setbacks is what innovates!

- This mechanism of overcompensation hides in the most unlikely places. If tired after an intercontinental flight, go to the gym for some exertion instead of resting. Also, it is a well-known trick that if you need something urgently done, give the task to the busiest (or second busiest) person in the office. Most humans manage to squander their free time, as free time makes them dysfunctional, lazy, and unmotivated—the busier they get, the more active they are at other tasks. Overcompensation, here again.

- I learned that the noise produced by the person is inverse to the pecking order: as with mafia dons, the most powerful traders were the least audible. One should have enough self-control to make the audience work hard to listen, which causes them to switch into intellectual overdrive.

- Tell the next MBA analyst or business school professor you run into that redundancy is not defensive; it is more like investment than insurance. And tell them that what they call “inefficient” is often very efficient.

- Psychologists have shown the irony of the process of thought control: the more energy you put into trying to control your ideas and what you think about, the more your ideas end up controlling you.

- Take this easy-to-use heuristic (which is, to repeat the definition, a simple compressed rule of thumb) to detect the independence and robustness of someone’s reputation. With few exceptions, those who dress outrageously are robust or even antifragile in reputation; those clean-shaven types who dress in suits and ties are fragile to information about them.

- When you don’t have debt you don’t care about your reputation in economics circles—and somehow it is only when you don’t care about your reputation that you tend to have a good one.

- It is quite perplexing that those from whom we have benefited the most aren’t those who have tried to help us (say with “advice”) but rather those who have actively tried—but eventually failed—to harm us.

- We can use the distinction as a marker between living and nonliving. The fact that the artificial needs to be antifragile for us to be able to use it as tissue is quite a telling difference between the biological and the synthetic.

- In the complex world, the notion of “cause” itself is suspect; it is either nearly impossible to detect or not really defined—another reason to ignore newspapers, with their constant supply of causes for things.

- Measures that aim at reducing variability and swings in the lives of children are also reducing variability and differences within our said to be Great Culturally Globalized Society.

- obsequious verbosity is something rather painful under the condition of jet lag.

- I myself, while writing these lines, try to avoid the tyranny of a precise and explicit plan, drawing from an opaque source inside me that gives me surprises.

- remarkably, what the author is bored writing bores the reader.

- The fragility of every startup is necessary for the economy to be antifragile, and that’s what makes, among other things, entrepreneurship work: the fragility of individual entrepreneurs and their necessarily high failure rate.

- Restaurants are fragile; they compete with each other, but the collective of local restaurants is antifragile for that very reason.

- So some parts on the inside of a system may be required to be fragile in order to make the system antifragile as a result. Or the organism itself might be fragile, but the information encoded in the genes reproducing it will be antifragile.

- In fact, the most interesting aspect of evolution is that it only works because of its antifragility; it is in love with stressors, randomness, uncertainty, and disorder—while individual organisms are relatively fragile, the gene pool takes advantage of shocks to enhance its fitness.

- evolution is not about a species, but at the service of the whole of nature.

- When you are fragile, you depend on things following the exact planned course, with as little deviation as possible—for deviations are more harmful than helpful. This is why the fragile needs to be very predictive in its approach, and, conversely, predictive systems cause fragility. When you want deviations, and you don’t care about the possible dispersion of outcomes that the future can bring, since most will be helpful, you are antifragile.

Echa un vistazo a esta cita.

- The story of the Titanic illustrates the difference between gains for the system and harm to some of its individual parts.

- Further, my characterization of a loser is someone who, after making a mistake, doesn’t introspect, doesn’t exploit it, feels embarrassed and defensive rather than enriched with a new piece of information, and tries to explain why he made the mistake rather than moving on. These types often consider themselves the “victims” of some large plot, a bad boss, or bad weather.

- He who has never sinned is less reliable than he who has only sinned once. And someone who has made plenty of errors—though never the same error more than once—is more reliable than someone who has never made any.

- This is the central illusion in life: that randomness is risky, that it is a bad thing—and that eliminating randomness is done by eliminating randomness.

- Further, such variability helps improve the system (hence the antifragility).

- Nature loves small errors (without which genetic variations are impossible), humans don't—hence when you rely on human judgment you are at the mercy of a mental bias that disfavors antifragility.

- Switzerland is the most antifragile place on the planet; it benefits from shocks that take place in the rest of the world.

- When I expressed this idea to my co-author Mark Blyth, he blurted out the obvious: "Stalin could not have existed in a municipality."

- I use the example of Switzerland to show the natural antifragility of political systems and how stability is achieved by managing noise, having a mechanism for letting it run its natural course, not by minimizing it.

- So with the butcher surprising it, the turkey will have a revision of belief—right when its confidence in the statement that the butcher loves turkeys is maximal and "it is very quiet" and soothingly predictable in the life of the turkey. This example builds on an adaptation of a metaphor by Bertrand Russell. The key here is that such a surprise will be a Black Swan event; but just for the turkey, not for the butcher.

- Nor did the point escape Machiavelli. Jean-Jacques Rousseau wrote, citing him: "It seemed, wrote Machiavelli, that in the midst of murders and civil wars, our republic became stronger [and] its citizens infused with virtues. … A little bit of agitation gives resources to souls and what makes the species prosper isn't peace, but freedom."

- And here is something comforting about statelings at war: mediocrity cannot handle more than one enemy, so war here turns into an alliance there.

- It is hard to explain to naive data-driven people that risk is in the future, not in the past.

- In a famous paper "On Governors," published in 1867, Maxwell modeled the behavior and showed mathematically that tightly controlling the speed of engines leads to instability.

- Fluctuat nec mergitur (fluctuates, or floats, but does not sink) goes the Latin saying.

- The idea of injecting random noise into a system to improve its functioning has been applied across fields. By a mechanism called stochastic resonance, adding random noise to the background makes you hear the sounds (say, music) with more accuracy. We saw earlier that the psychological effect of overcompensation helps us get signals in the midst of noise; here it is not psychological but a physical property of the system. Weak SOS signals, too weak to get picked up by remote receptors, can become audible in the presence of background noise

and random interference. By adding to the signal, random hiss allows it to rise sufficiently above the threshold of detection to become audible—nothing in that situation does better than randomness, which comes for free.

- Just as with Buridan's donkey, the heat causes the atoms to become unstuck from their initial positions and wander randomly through states of higher energy; the cooling gives them more chances of finding new, better configurations.

- Randomness works well in search—sometimes better than humans. Nathan Myhrvold brought to my attention a controversial 1975 paper published in Science showing that random drilling was superior to whatever search method was being employed at the time. And, ironically, the so-called chaotic systems, those experiencing a brand of variations called chaos, can be stabilized by adding randomness to them. I watched an eerie demonstration of the effects, presented by a doctoral student who first got balls to jump chaotically on a table in response to steady vibrations on the surface. These steady shocks made the balls jump in a jumbled and inelegant manner. Then, as by magic, he moved a switch and the jumps became orderly and smooth. The magic is that such change of regime, from chaos to order, did not take place by removing chaos, but by adding random, completely random but low-intensity shocks. I came out of the beautiful experiment with so much enthusiasm that I wanted to inform strangers on the street, "I love randomness!"

Paper luck ready!

- absence of fire lets highly flammable material accumulate.

- remember that volatility is information.

- We need to learn to think in second steps, chains of consequences, and side effects.

- Remember that you need a name for the color blue when you build a narrative, but not in action—the thinker lacking a word for "blue" is handicapped; not the doer. (I've had a hard time conveying to intellectuals the intellectual superiority of practice.)

- The story of the nation-state is that of the concentration and magnification of human errors.

- And the final lesson is that one should not expect laurels for bringing the truth.

- To sum up, anything in which there is naive interventionism, nay, even just intervention, will have iatrogenics.

- There is a Latin expression festina lente, "make haste slowly." The Romans were not the only ancients to respect the act of voluntary omission. The Chinese thinker Lao Tzu coined the doctrine of wu-wei, "passive achievement."

- A very rarely discussed property of data: it is toxic in large quantities—even in moderate quantities.

- And if you observe data on an hourly basis, as people immersed in the news and market price variations do, the split becomes 99.5 percent noise to 0.5 percent signal. That is two hundred

times more noise than signal—which is why anyone who listens to news (except when very, very significant events take place) is one step below sucker.

- Kato: our track record in figuring out significant rare events in politics and economics is not close to zero; it is zero.

- The idea of proposing the Triad was born there and then as an answer to my frustration: Fragility-Robustness-Antifragility as a replacement for predictive methods.

- There are ample empirical findings to the effect that providing someone with a random numerical forecast increases his risk taking, even if the person knows the projections are random.

- let us use the argument of Chapter 2: if you have extra cash in the bank (in addition to stockpiles of tradable goods such as cans of Spam and hummus and gold bars in the basement), you don't need to know with precision which event will cause potential difficulties.* It could be a war, a revolution, an earthquake, a recession, an epidemic, a terrorist attack, the secession of the state of New Jersey, anything—you do not need to predict much, unlike those who are in the opposite situation, namely, in debt. Those, because of their fragility, need to predict with more, a lot more, accuracy.

- antifragility is necessarily how things move forward under the mother of all stressors, called time.

- Not seeing a tsunami or an economic event coming is excusable; building something fragile to them is not.

- Another illustration, this time in economics, is the Swedish government's focus on total fiscal responsibility after their budget troubles in 1991—it makes them much less dependent on economic forecasts. This allowed them to shrug off later crises.

- The Idea of Becoming a Non-Turkey

- Social, economic, and cultural life lie in the Black Swan domain, physical life much less so. Further, the idea is to separate domains into those in which these Black Swans are both unpredictable and consequential, and those in which rare events are of no serious concern, either because they are predictable or because they are inconsequential.

- My point is that wisdom in decision making is vastly more important—not just practically, but philosophically—than knowledge.

- To become a successful philosopher king, it is much better to start as a king than as a philosopher, as

- When you become rich, the pain of losing your fortune exceeds the emotional gain of getting additional wealth, so you start living under continuous emotional threat.

- It is hard to stick to a good discipline of mental write-off when things are going well, yet that's when one needs the discipline the most.

- My idea of the modern Stoic sage is someone who transforms fear into prudence, pain into information, mistakes into initiation, and desire into undertaking.

- Seneca also provides us a catalogue of social deeds: invest in good actions. Things can be taken away from us—not good deeds and acts of virtue.

- The concept I used earlier is more to lose from adversity. If you have more to lose than to benefit from events of fate, there is an asymmetry, and not a good one. And such asymmetry is universal. Let us see how it brings us to fragility.

- To see why asymmetric payoffs like volatility, just consider that if you have less to lose than to gain, more upside than downside, then you like volatility (it will, on balance, bring benefits), and you are also antifragile.

- something that has not yet been understood by governments. Indeed, growth was very modest, less than 1 percent per head, throughout the golden years surrounding the Industrial Revolution, the period that propelled Europe into domination. But as low as it was, it was robust growth—unlike the current fools' race of states shooting for growth like teenage drivers infatuated with speed.

- I initially used the image of the barbell to describe a dual attitude of playing it safe in some areas (robust to negative Black Swans) and taking a lot of small risks in others (open to positive Black Swans), hence achieving antifragility. That is extreme risk aversion on one side and extreme risk loving on the other, rather than just the "medium" or the beastly "moderate" risk attitude that in fact is a sucker game (because medium risks can be subjected to huge measurement errors). But the barbell also results, because of its construction, in the reduction of downside risk—the elimination of the risk of ruin.

How to avoid ruin and chieve antifragility

- For antifragility is the combination aggressiveness plus paranoia—clip your downside, protect yourself from extreme harm, and let the upside, the positive Black Swans, take care of itself.

- A barbell can be any dual strategy composed of extremes, without the corruption of the middle—somehow they all result in favorable asymmetries.

- One finds similar ideas in ancestral lore: it is explained in a Yiddish proverb that says "Provide for the worst; the best can take care of itself." This may sound like a platitude, but it is not: just observe how people tend to provide for the best and hope that the worst will take care of itself. We have ample evidence that people are averse to small losses, but not so much toward very large Black Swan risks (which they underestimate), since they tend to insure for small probable losses, but not large infrequent ones. Exactly backwards.

- A friend of mine built himself a very secure profession as a book editor, in which he was known to be very good. Then, after a decade or so, he left completely for something speculative and highly risky. This is a true barbell in every sense of the word: he can fall back on his previous profession should the speculation fail, or fail to bring the expected satisfaction.

- Seneca elected to do: he initially had a very active, adventurous life, followed by a philosophical withdrawal to write and meditate, rather than a “middle” combination of both. Many of the “doers” turned “thinkers” like Montaigne have done a serial barbell: pure action, then pure reflection.

- In social policy, it consists in protecting the very weak and letting the strong do their job, rather than helping the middle class to consolidate its privileges, thus blocking evolution and bringing all manner of economic problems that tend to hurt the poor the most.

- My writing approach is as follows: on one hand a literary essay that can be grasped by anyone and on the other technical papers, nothing in between—such as interviews with journalists or newspaper articles or op-ed pieces, outside of the requirements of publishers.

- If you dislike someone, leave him alone or eliminate him; don’t attack him verbally.

- teleological argument (from telos, “based on the end”)

- The Teleological Fallacy

Key for paper . Experimenting and gatherkng info

- The error of thinking you know exactly where you are going and assuming that you know today what your preferences will be tomorrow has an associated one. It is the illusion of thinking that others, too, know where they are going, and that they would tell you what they want if you just asked them. Never ask people what they want, or where they want to go, or where they think they should go, or, worse, what they think they will desire tomorrow. The strength of the computer entrepreneur Steve Jobs was precisely in distrusting market research and focus groups—those based on asking people what they want—and following his own imagination. His modus was that people don’t know what they want until you provide them with it.

- Like Britain in the Industrial Revolution, America’s asset is, simply, risk taking and the use of optionality, this remarkable ability to engage in rational forms of trial and error, with no comparative shame in failing, starting again, and repeating failure.

- Financial options may be expensive because people know they are options and someone is selling them and charging a price—but most interesting options are free, or at the worst, cheap.

- Centrally, we just don’t need to know what’s going on when we buy cheaply—when we have the asymmetry working for us. But this property goes beyond buying cheaply: we do not need to understand things when we have some edge. And the edge from optionality is in the larger payoff when you are right, which makes it unnecessary to be right too often.

- Authors, artists, and even philosophers are much better off having a very small number of fanatics behind them than a large number of people who appreciate their work. The number of persons who dislike the work don’t count—there is no such thing as the opposite of buying your book, or the equivalent of losing points in a soccer game, and this absence of negative domain for book sales provides the author with a measure of optionality.

- Beyond books, consider this simple heuristic: your work and ideas, whether in politics, the arts, or other domains, are antifragile if, instead of having one hundred percent of the people finding your mission acceptable or mildly commendable, you are better off having a high percentage of people disliking you and your message (even intensely), combined with a low percentage of extremely loyal and enthusiastic supporters. Options like dispersion of outcomes and don't care about the average too much.

- Another business that does not care about the average but rather the dispersion around the average is the luxury goods industry—jewelry, watches, art, expensive apartments in fancy locations, expensive collector wines, gourmet farm-raised probiotic dog food, etc. Such businesses only care about the pool of funds available to the very rich.

- This explains the bubble in real estate prices in Central London, determined by inequality in Russia and the Arabian Gulf and totally independent of the real estate dynamics in Britain.

- No one at present dares to state the obvious: growth in society may not come from raising the average the Asian way, but from increasing the number of people in the "tails," that small, very small number of risk takers crazy enough to have ideas of their own, those endowed with that very rare ability called imagination, that rarer quality called courage, and who make things happen.

Key

- If you "have optionality," you don't have much need for what is commonly called intelligence, knowledge, insight, skills, and these complicated things that take place in our brain cells. For you don't have to be right that often. All you need is the wisdom to not do unintelligent things to hurt yourself (some acts of omission) and recognize favorable outcomes when they occur.

- This property allowing us to be stupid, or, alternatively, allowing us to get more results than the knowledge may warrant, I will call the "philosopher's stone" for now, or "convexity bias

- Nature is all about the exploitation of optionality; it illustrates how optionality is a substitute for intelligence.*

- The mechanism of optionlike trial and error (the fail-fast model), a.k.a. convex tinkering. Low-cost mistakes, with known maximum losses, and large potential payoff (unbounded). A central feature of positive Black Swans: the gains are unbounded (unlike a lottery ticket), or, rather, with an unknown limit; but the losses from errors are limited and known.

- Risk taking ain't gambling, and optionality ain't lottery tickets.

- The implication is nontrivial. For if you think that education causes wealth, rather than being a result of wealth, or that intelligent actions and discoveries are the result of intelligent ideas, you will be in for a surprise. Let us see what kind of surprise.

- technology is only trivial retrospectively—not prospectively.

- For randomness plays a role at two levels: the invention and the implementation.

- For there is a category of things that we can call half-invented, and taking the half-invented into the invented is often the real breakthrough.

- The historian David Wooton relates a gap of two centuries between the discovery of germs and the acceptance of germs as a cause of disease, a delay of thirty years between the germ theory of putrefaction and the development of antisepsis, and a delay of sixty years between antisepsis and drug therapy.

- few want to jeopardize their jobs and reputation for the sake of change.

- There is something (here, perception, ideas, theories) and a function of something (here, a price or reality, or something real). The conflation problem is to mistake one for the other, forgetting that there is a "function" and that such function has different properties.

- Optionality is Promethean, narratives are Epimethean—one has reversible and benign mistakes, the other symbolizes the gravity and irreversibility of the consequences of opening Pandora's box.

- As Yogi Berra said, "In theory there is no difference between theory and practice; in practice there is."

- We separated knowledge into two categories, the formal and the Fat Tonyish, heavily grounded in the antifragility of trial and error and risk taking with less downside, barbell-style—a de-intellectualized form of risk taking (or, rather, intellectual in its own way). In an opaque world, that is the only way to go.

- Subject to turkey problems (mistaking evidence of absence for absence of evidence)

- Narrative is instrumental

- No meaningful dependence on a story—the narrative can be just for motivation

- Broad domain, open space of action

- An idea does not survive because it is better than the competition, but rather because the person who holds it has survived! Accordingly, wisdom you learn from your grandmother should be vastly superior (empirically, hence scientifically) to what you get from a class in business school (and, of course, considerably cheaper). My sadness is that we have been moving farther and farther away from grandmothers.

- Something hit me then. Nobody worries that a child ignorant of the various theorems of aerodynamics and incapable of solving an equation of motion would be unable to ride a bicycle.

- Practitioners don't write; they do. Birds fly and those who lecture them are the ones who write their story. So it is easy to see that history is truly written by losers with time on their hands and a protected academic position.

- No, we don't put theories into practice. We create theories out of practice. That was our story, and it is easy to infer from it—and from similar stories—that the confusion is generalized. The theory is the child of the cure, not the opposite—ex cura theoria nascitur.

- It is just that things that are implemented tend to want to be born from practice, not theory.

- before the thirteenth century no more than five persons in the whole of Europe knew how to perform a division. No theorem, shmeorem. But builders could figure out the resistance of materials without the equations we have today—buildings that are, for the most part, still standing.

- we are quite certain that the Romans, admirable engineers, built aqueducts without mathematics (Roman numerals did not make quantitative analysis very easy). Otherwise, I believe, these would not be here, as a patent side effect of mathematics is making people over-optimize and cut corners, causing fragility. Just look how the new is increasingly more perishable than the old.

- As to the hobbyist in general, evidence shows him (along with the hungry adventurer and the private investor) to be at the source of the Industrial Revolution.

- Visibly the money should go to the tinkerers, the aggressive tinkerers who you trust will milk the option.

- Unlike technology, medicine has a long history of domestication of luck;

- knowledge was not in the hands of humans, but

- Collaboration has explosive upside, what is mathematically called a superadditive function, i.e., one plus one equals more than two, and one plus one plus one equals much, much more than three.

- since you cannot forecast collaborations and cannot direct them, you cannot see where the world is going. All you can do is create an environment that facilitates these collaborations, and lay the foundation for prosperity.

- William Starbuck, has published a few papers debunking the effectiveness of planning—it makes the corporation option-blind, as it gets locked into a non-opportunistic course of action.

- Matthew Stewart, who, trained as a philosopher, found himself in a management consultant job, gives a pretty revolting, if funny, inside story in The Management Myth. It is similar to the self-serving approach of bankers. Abrahamson and Friedman, in their beautiful book A Perfect Mess, also debunk many of these neat, crisp, teleological approaches. It turns out, strategic planning is just superstitious babble.

- evidence of absence is not absence of evidence, a simple point that has the following implications: for the antifragile, good news tends to be absent from past data, and for the fragile it is the bad news that doesn’t show easily.

- When engaging in tinkering, you incur a lot of small losses, then once in a while you find something rather significant. Such methodology will show nasty attributes when seen from the outside—it hides its qualities, not its defects. In the antifragile case (of positive asymmetries, positive Black Swan businesses), such as trial and error, the sample track record will tend to underestimate the long-term average; it will hide the qualities, not the defects.

- simply, rare events are rare, and tend not to show up in past samples, and given that the rare is almost always negative, we get a rosier picture than reality.

- Under positive asymmetries, that is, the antifragile case, the “unseen” is positive. So “empirical evidence” tends to miss positive events and underestimate the total benefits.

- We will return to these two distinct payoffs, with “bounded left” (limited losses, like Thales’ bet) and “bounded right” (limited gains, like insurance or banking). The distinction is crucial, as most payoffs in life fall in either one or the other category.

- Let me stop to issue rules based on the chapter so far. (i) Look for optionality; in fact, rank things according to optionality, (ii) preferably with open-ended, not closed-ended, payoffs; (iii) Do not invest in business plans but in people, so look for someone capable of changing six or seven times over his career, or more (an idea that is part of the modus operandi of the venture capitalist Marc Andreessen); one gets immunity from the backfit narratives of the business plan by investing in people. It is simply more robust to do so; (iv) Make sure you are barbelled, whatever that means in your business.

- But we find it hard to apply this lesson to technical skills acquired in schools, that is, to accept the crucial fact that what is picked up in the classroom stays largely in the classroom.

- The trick is to be bored with a specific book, rather than with the act of reading.

- Avoidance of boredom is the only worthy mode of action.

- I started, around the age of thirteen, to keep a log of my reading hours, shooting for between thirty and sixty a week,

- I read the likes of Dostoyevsky, Turgenev, Chekhov, Bishop Bossuet, Stendhal, Dante, Proust, Borges, Calvino, Céline, Schultz, Zweig (didn’t like), Henry Miller, Max Brod, Kafka, Ionesco, the surrealists, Faulkner, Malraux (along with other wild adventurers such as Conrad and Melville; the first book I read in English was Moby-Dick) and similar authors in literature, many of them obscure, and Hegel, Schopenhauer, Nietzsche, Marx, Jaspers, Husserl, Lévi-Strauss, Levinas, Scholem, Benjamin, and similar ones in philosophy because they had the golden status of not being on the school program, and I managed to read nothing that was prescribed by school so to this day I haven’t read Racine, Corneille, and other bores.

- In school, I had figured out that when one could write essays with a rich, literary, but precise vocabulary (though not inadequate to the topic at hand), and maintain some coherence throughout, what one writes about becomes secondary and the examiners get a hint about one’s style and rigor from that.

- It was a barbell—play it safe at school and read on your own,

- One day in the 1980s I had dinner with a famous speculator, a hugely successful man. He muttered the hyperbole that hit home: “much of what other people know isn’t worth knowing.”

- there is something central in following one's own direction in the selection of readings: what I was given to study in school I have forgotten; what I decided to read on my own, I still remember.

- Indeed, the most severe mistake made in life is to mistake the unintelligible for the unintelligent—something Nietzsche figured out.

- Socrates' technique was to make his interlocutor, who started with a thesis, agree to a series of statements, then proceed to show him how the statements he agreed to are inconsistent with the original thesis, thus establishing that he has no clue as to what he was talking about. Socrates used it mostly to show people how lacking in clarity they were in their thoughts, how little they knew about the concepts they used routinely—and the need for philosophy to elucidate these concepts.

- (only suckers wait for answers; questions are not made for answers):

- FAT TONY: "My dear Socrates … you know why they are putting you to death? It is because you make people feel stupid for blindly following habits, instincts, and traditions. You may be occasionally right. But you may confuse them about things they've been doing just fine without getting in trouble. You are destroying people's illusions about themselves. You are taking the joy of ignorance out of the things we don't understand. And you have no answer; you have no answer to offer them."

- if you cannot get a map from a territory, build a territory out of the map.

- "What is not intelligible to me is not necessarily unintelligent" is perhaps the most potent sentence in all of Nietzsche's century—and we used a version of it in the prologue, in the very definition of the fragilista who mistakes what he does not understand for nonsense.

- The payoff, what happens to you (the benefits or harm from it), is always the most important thing, not the event itself. Philosophers talk about truth and falsehood. People in life talk about payoff, exposure, and consequences (risks and rewards), hence fragility and antifragility. And sometimes philosophers and thinkers and those who study conflate Truth with risks and rewards.

- If you sat with a pencil and jotted down all the decisions you've taken in the past week, or, if you could, over your lifetime, you would realize that almost all of them have had asymmetric payoff, with one side carrying a larger consequence than the other. You decide principally based on fragility, not probability. Or to rephrase, You decide principally based on fragility, not so much on True/False.

- If I tell you that some result is true with 95 percent confidence level, you would be quite satisfied. But what if I told you that the plane was safe with 95 percent confidence level? Even 99 percent confidence level would not do, as a 1 percent probability of a crash would be quite a bit alarming (today commercial planes operate with less than one in several hundred thousand probabilities of crashing, and the ratio is improving, as we saw that every error leads to the improvement of overall safety). So, to repeat, the probability (hence True/False)

- b**t is fragile. Which scam in history has lasted forever? I have an enormous faith in Time and History as eventual debunkers of fragility. Education is an institution that has been growing without external stressors; eventually the thing will collapse.

- We practitioners and quants aren't too fazed by remarks on the part of academics—it would be like prostitutes listening to technical commentary by nuns.

- For the fragile, shocks bring higher harm as their intensity increases (up to a certain level). FIGURE 9. The King and His Son. The harm from the size of the stone as a function of the size of the stone (up to a point). Every additional weight of the stone harms more than the previous one. You see nonlinearity (the harm curves inward, with a steeper and steeper vertical slope).

- Asymmetry is necessarily nonlinearity. More harm than benefits: simply, an increase in intensity brings more harm than a corresponding decrease offers benefits.

- conditional on something being unharmed (or having survived), then it is more harmed by a single rock than a thousand pebbles, that is, by a single large infrequent event than by the cumulative effect of smaller shocks.

- If for a human, jumping one millimeter (an impact of small force) caused an exact linear fraction of the damage of, say, jumping to the ground from thirty feet, then the person would already be dead from cumulative harm. Actually a simple computation shows that he would have expired within hours from touching objects or pacing in his living room, given the multitude of such stressors and their total effect.

- A simple case—known heuristically by weight lifters. In the bodyguard-emulating story in Chapter 2, I focused only on the maximum I could do. Lifting one hundred pounds once brings more benefits than lifting fifty pounds twice, and certainly a lot more than lifting one pound a hundred times. Benefits here are in weight-lifter terms: strengthening the body, muscle mass, and bar-fight looks rather than resistance and the ability to run a marathon. The second fifty pounds play a larger role, hence the nonlinear (that is, we will see, convexity) effect. Every additional pound brings more benefits, until one gets close to the limit, what weight lifters call "failure."

- Figure 12 also shows why the convex likes volatility. If you earn more than you lose from fluctuations, you want a lot of fluctuations.

- I have been advocating the injection of redundancy into people's lives and had been boasting to him and others that, since my New Year's resolution of 2007, I have never been late to anything, not even by a minute

- This is the central problem of efficiency: these types of errors compound, multiply, swell, with an effect that only goes in one direction—the wrong direction.

- The point has been aptly expressed by P. W. Anderson in the title of his paper "More Is Different." And what scientists involved in complexity call "emerging properties" is the nonlinear result of adding units, as the sum becomes increasingly different from the parts. Just look at how different the large stone is from the pebbles: the latter have the same weight and the same general shape, but that's about it.

- Consuming no protein at all on Monday and catching up on Wednesday seemingly causes a different—better—physiological response, possibly because the deprivation, as a stressor, activates some pathways that facilitate the subsequent absorption of the nutrients

- So both persons have covered the exact same distance, in exactly the same time—same average. Castor, who walked all the way, presumably will not get the same health benefits and gains in strength as Polydeuces, who sprinted.

- In spite of what is studied in business schools concerning "economies of scale," size hurts you at times of stress; it is not a good idea to be large during difficult times.

- But the numbers show, at best, no gain from such increase in size—that was already true in 1978, when Richard Roll voiced the "hubris hypothesis," finding it irrational for companies to engage in mergers given their poor historical record. Recent data, more than three decades later, still confirm both the poor record of mergers and the same hubris as managers seem to ignore the bad economic aspect of the transaction. There appears to be something about size that is harmful to corporations.

- Large animals are more fragile to shocks than small ones—again, stone and pebbles. Jared Diamond, always ahead of others, figured out such vulnerability in a paper called "Why Cats Have Nine Lives." If you throw a cat or a mouse from an elevation of several times their height, they will typically manage to survive. Elephants, by comparison, break limbs very easily.

- Now, to see the effect of fragility from size, look at Figure 15 showing losses as a function of quantity sold. A fire sale of $70 billion worth of stocks leads to a loss of $6 billion. But a fire sale a tenth of the size, $7 billion would result in no loss at all, as markets would absorb the quantities without panic, maybe without even noticing. So this tells us that if, instead of having one very large bank, with Monsieur Kerviel as a rogue trader, we had ten smaller banks, each with a proportional Monsieur Micro-Kerviel, and each conducted his rogue trading independently and at random times, the total losses for the ten banks would be close to nothing.

- Bridge and tunnel projects involve monolithic planning, as these cannot be broken up into small portions; their percentage costs overruns increase markedly with size. Same with dams. For roads, built by small segments, there is no serious size effect, as the project managers incur only small errors and can adapt to them. Small segments go one small error at the time, with no serious role for squeezes.

- It is completely wrong to use the calculus of benefits without including the probability of failure.*

- Just consider that the price of wheat more than tripled in the years 2004–2007 in response to a small increase in net demand, around 1 percent.* Bottlenecks are the mothers of all squeezes.

- The interpretation I had in the past was that a psychological bias, the underestimation of the random structure of the world, was the cause behind such underestimation—projects take

longer than planned because the estimates are too optimistic. We have evidence of such bias, called overconfidence.

- Black Swan effects are necessarily increasing, as a result of complexity, interdependence between parts, globalization, and the beastly thing called “efficiency” that makes people now sail too close to the wind. Add to that consultants and business schools.

- No psychologist who has discussed the “planning fallacy” has realized that, at the core, it is not essentially a psychological problem, not an issue with human errors; it is inherent to the nonlinear structure of the projects. Just as time cannot be negative, a three-month project cannot be completed in zero or negative time. So, on a timeline going left to right, errors add to the right end, not the left end of it. If uncertainty were linear we would observe some projects completed extremely early (just as we would arrive sometimes very early, sometimes very late). But this is not the case.

- because of nonlinear scaling, more is different.

- The same with operational leverage on the part of a fragile company. Should sales increase 10 percent, then profits would increase less than they would decrease should sales drop 10 percent.

- This method is very general. I even used it with Fukushima-style computations and realized how fragile their computation of small probabilities was—in fact all small probabilities tend to be very fragile to errors, as a small change in the assumptions can make the probability rise dramatically, from one per million to one per hundred. Indeed, a ten-thousand-fold underestimation.

- Finally, this method can show us where the math in economic models is bogus—which models are fragile and which ones are not. Simply do a small change in the assumptions, and look at how large the effect, and if there is acceleration of such effect. Acceleration implies—as with Fannie Mae—that someone relying on the model blows up from Black Swan effects.

- Clearly, temperature changes become more and more harmful as they deviate from seventy degrees. As you see, the second piece of information, the variability, turned out to be more important than the first. The notion of average is of no significance when one is fragile to variations—the dispersion in possible thermal outcomes here matters much more. Your grandmother is fragile to variations of temperature, to the volatility of the weather. Let us call that second piece of information the second-order effect, or, more precisely, the convexity effect.

- the more nonlinear the response, the less relevant the average, and the more relevant the stability around such average.

- The following note would allow us to understand: (a) The severity of the problem of conflation (mistaking the price of oil for geopolitics, or mistaking a profitable bet for good forecasting—not convexity of payoff and optionality). (b) Why anything with optionality has a long-term advantage—and how to measure it. (c) An additional subtle property called Jensen’s inequality.

- We can see here that the function of something becomes different from the something under nonlinearities.

- Someone with a linear payoff needs to be right more than 50 percent of the time. Someone with a convex payoff, much less. The hidden benefit of antifragility is that you can guess worse than random and still end up outperforming. Here lies the power of optionality—your function of something is very convex, so you can be wrong and still do fine—the more uncertainty, the better.

- This hidden "convexity bias" comes from a mathematical property called Jensen's inequality. This is what the common discourse on innovation is missing. If you ignore the convexity bias, you are missing a chunk of what makes the nonlinear world go round. And it is a fact that such an idea is missing from the discourse. Sorry.

- Let me summarize the argument: if you have favorable asymmetries, or positive convexity, options being a special case, then in the long run you will do reasonably well, outperforming the average in the presence of uncertainty. The more uncertainty, the more role for optionality to kick in, and the more you will outperform. This property is very central to

- Proclus was known to repeat the metaphor that statues are carved by subtraction.

- Michelangelo was asked by the pope about the secret of his genius, particularly how he carved the statue of David, largely considered the masterpiece of all masterpieces. His answer was: "It's simple. I just remove everything that is not David."

Inversion

- I have used all my life a wonderfully simple heuristic: charlatans are recognizable in that they will give you positive advice, and only positive advice, exploiting our gullibility and sucker-proneness for recipes that hit you in a flash as just obvious, then evaporate later as you forget them. Just look at the "how to" books with, in their title, "Ten Steps for—" (fill in: enrichment, weight loss, making friends, innovation, getting elected, building muscles, finding a husband, running an orphanage, etc.). Yet in practice it is the negative that's used by the pros, those selected by evolution: chess grandmasters usually win by not losing; people become rich by not going bust (particularly when others do); religions are mostly about interdicts; the learning of life is about what to avoid. You reduce most of your personal risks of accident thanks to a small number of measures.

- Now when it comes to knowledge, the same applies. The greatest—and most robust—contribution to knowledge consists in removing what we think is wrong—subtractive epistemology.

- In life, antifragility is reached by not being a sucker.

- So the central tenet of the epistemology I advocate is as follows: we know a lot more what is wrong than what is right, or, phrased according to the fragile/robust classification, negative knowledge (what is wrong, what does not work) is more robust to error than positive knowledge (what is right, what works).

- And, as expected, via negativa is part of classical wisdom. For the Arab scholar and religious leader Ali Bin Abi-Taleb (no relation), keeping one's distance from an ignorant person is equivalent to keeping company with a wise man.

- "People think focus means saying yes to the thing you've got to focus on. But that's not what it means at all. It means saying no to the hundred other good ideas that there are. You have to pick carefully. I'm actually as proud of the things we haven't done as the things I have done. Innovation is saying no to 1,000 things."

- The less-is-more idea in decision making can be traced to Spyros Makridakis, Robyn Dawes, Dan Goldstein, and Gerd Gigerenzer, who have all found in various contexts that simpler methods for forecasting and inference can work much, much better than complicated ones. Their simple rules of thumb are not perfect, but are designed to not be perfect; adopting some intellectual humility and abandoning the aim at sophistication can yield powerful effects.

- Some people are aware of the eighty/twenty idea, based on the discovery by Vilfredo Pareto more than a century ago that 20 percent of the people in Italy owned 80 percent of the land, and vice versa. Of these 20 percent, 20 percent (that is, 4 percent) would have owned around 80 percent of the 80 percent (that is, 64 percent). We end up with less than 1 percent representing about 50 percent of the total. These describe winner-take-all Extremistan effects.

- Few realize that we are moving into the far more uneven distribution of 99/1 across many things that used to be 80/20: 99 percent of Internet traffic is attributable to less than 1 percent of sites, 99 percent of book sales come from less than 1 percent of authors … and I need to stop because numbers are emotionally stirring. Almost everything contemporary has winner-take-all effects, which includes sources of harm and benefits. Accordingly, as I will show, 1 percent modification of systems can lower fragility (or increase antifragility) by about 99 percent—and all it takes is a few steps, very few steps, often at low cost, to make things better and safer.

- The people involved were blind to the paradox that we have never had more data than we have now, yet have less predictability than ever.

- the simple argument that Black Swans and tail events run the socioeconomic world—and these events cannot be predicted—is sufficient to invalidate their statistics.

- discovered that I had been intuitively using the less-is-more idea as an aid in decision making (contrary to the method of putting a series of pros and cons side by side on a computer screen). For instance, if you have more than one reason to do something (choose a doctor or veterinarian, hire a gardener or an employee, marry a person, go on a trip), just don't do it. It does not mean that one reason is better than two, just that by invoking more than one reason you are trying to convince yourself to do something. Obvious decisions (robust to error) require no more than a single reason. Likewise the French army had a heuristic to reject excuses for absenteeism for more than one reason, like death of grandmother, cold virus, and being bitten by a boar. If someone attacks a book or idea using more than one argument, you

know it is not real: nobody says “he is a criminal, he killed many people, and he also has bad table manners and bad breath and is a very poor driver.”

- “A philosopher should be known for one single idea, not more”

- Likewise when I am told that someone has three hundred academic papers and twenty-two honorary doctorates, but no other single compelling contribution or main idea behind it, I avoid him like the bubonic plague.

- “Time has sharp teeth that destroy everything,” declaimed the sixth-century (B.C.) poet Simonides of Ceos,

- Elsa Triolet (“time burns but leaves no ashes”).

- additive approach to the future (failure to subtract the fragile rather than add to destiny).

- This, simply, as a rule, tells you why things that have been around for a long time are not “aging” like persons, but “aging” in reverse. Every year that passes without extinction doubles the additional life expectancy.† This is an indicator of some robustness. The robustness of an item is proportional to its life!

- He had, as a child, visited both the Great Pyramid (fifty-seven hundred years old), and the Berlin Wall (twelve years old), and correctly guessed that the former would outlive the latter.

- Effectively my answer would be to make them read the classics. The future is in the past. Actually there is an Arabic proverb to that effect: he who does not have a past has no future.

- “fractal” entails both jaggedness and a form of self-similarity in things (Mandelbrot preferred “self-affinity”), such as trees spreading into branches that look like small trees, and smaller and smaller branches that look like a slightly modified, but recognizable, version of the whole. These fractals induce a certain wealth of detail based on a small number of rules of repetition of nested patterns.

- So I follow the Lindy effect as a guide in selecting what to read: books that have been around for ten years will be around for ten more; books that have been around for two millennia should be around for quite a bit of time, and so forth.

- Of the fields I am familiar with, such as literature, finance, and economics, I can pretty much ascertain that the prizes given to those under forty are the best reverse indicator of value (much like the belief—well tested—by traders that companies that get hyped up for their potential and called “best” on the cover of magazines or in books such as Good to Great are about to underperform and one can derive an abnormal profit by shorting their stock). The worst effect of these prizes is penalizing those who don’t get them and debasing the field by turning it into an athletic competition.

- Amateurs in any discipline are the best, if you can connect with them. Unlike dilettantes, career professionals are to knowledge what prostitutes are to love.

- I explained that I would expect the future to be populated with wall-to-wall bookshelves, the device called the telephone, artisans, and such, using the notion that most technologies that

are now twenty-five years old should be around in another twenty-five years—once again, most, not all.* But the fragile should disappear, or be weakened.

- Now, what is fragile? The large, optimized, overreliant on technology, overreliant on the so-called scientific method instead of age-tested heuristics. Corporations that are large today should be gone, as they have always been weakened by what they think is their strength: size, which is the enemy of corporations as it causes disproportionate fragility to Black Swans.

- City-states and small corporations are more likely to be around, even thrive. The nation-state, the currency-printing central bank, these things called economics departments, may stay nominally, but they will have their powers severely eroded. In other words, what we saw in the left column of the Triad should be gone—alas to be replaced by other fragile items.

- I surmise that those human technologies such as writing and reading that have survived are like the tile to the dog, a match between natural friends, because they correspond to something deep in our nature.

- If something that makes no sense to you (say, religion—if you are an atheist—or some age-old habit or practice called irrational); if that something has been around for a very, very long time, then, irrational or not, you can expect it to stick around much longer, and outlive those who call for its demise.

- Simple, quite simple decision rules and heuristics emerge from this chapter. Via negativa, of course (by removal of the unnatural): only resort to medical techniques when the health payoff is very large (say, saving a life) and visibly exceeds its potential harm, such as incontrovertibly needed surgery or lifesaving medicine (penicillin). It is the same as with government intervention. This is squarely Thalesian, not Aristotelian (that is, decision making based on payoffs, not knowledge). For in these cases medicine has positive asymmetries—convexity effects—and the outcome will be less likely to produce fragility. Otherwise, in situations in which the benefits of a particular medicine, procedure, or nutritional or lifestyle modification appear small—say, those aiming for comfort—we have a large potential sucker problem (hence putting us on the wrong side of convexity effects). Actually, one of the unintended side benefits of the theorems that Raphael Douady and I developed in our paper mapping risk detection techniques (in Chapter 19) is an exact link between (a) nonlinearity in exposure or dose-response and (b) potential fragility or antifragility.

- As usual, the solution is simple, an extension of via negativa and Fat Tony's don't-be-a-sucker rule: the non-natural needs to prove its benefits, not the natural—according to the statistical principle outlined earlier that nature is to be considered much less of a sucker than humans. In a complex domain, only time—a long time—is evidence.

- The "do you have evidence" fallacy, mistaking evidence of no harm for no evidence of harm, is similar to the one of misinterpreting NED (no evidence of disease) for evidence of no disease. This is the same error as mistaking absence of evidence for evidence of absence, the one that tends to affect smart and educated people, as if education made people more confirmatory in their responses and more liable to fall into simple logical errors.

- The problem is of course that these researchers did not have a clear idea of where the burden of empirical evidence lies (the difference between naive or pseudo empiricism and rigorous empiricism)—the onus is on the doctors to show us why reducing fever is good, why eating breakfast before engaging in activity is healthy (there is no evidence), or why bleeding patients is the best alternative (they've stopped doing so).

- Now we can see the pattern: iatrogenics, being a cost-benefit situation, usually results from the treacherous condition in which the benefits are small, and visible—and the costs very large, delayed, and hidden. And of course, the potential costs are much worse than the cumulative gains.

- The philosopher's stone explained that the volatility of an exposure can matter more than its average—the difference is the "convexity bias." If you are antifragile (i.e., convex) to a given substance, then you are better off having it randomly distributed, rather than provided steadily.

- People with a variety of lung diseases, including acute respiratory distress syndrome, used to be put on mechanical ventilators. The belief was that constant pressure and volume were desirable—steadiness seemed a good idea. But the reaction of the patient is nonlinear to the pressure (convex over an initial range, then concave above it), and he suffers from such regularity. Further, people with very sick lungs cannot take high pressure for a long time—while they need a lot of volume. J. F. Brewster and his associates figured out that dispensing higher pressure on occasion, and low pressure at other times, allowed them to provide a lot more volume to the lungs for a given mean pressure and thus decrease patient mortality. An additional benefit is that an occasional spike in pressure helps to open up collapsed alveoli. Actually, that's how our lungs function when healthy: with variations and "noise" rather than steady airflow. Humans are antifragile to lung pressure. And this arises directly from the nonlinearity of the response since as we saw everything convex is antifragile, up to a certain dosage.

- And, talking about radiation, few wonder why, after hundreds of million of years of having our skins exposed to sun rays, we suddenly need so much protection from them—is it that our exposure is more harmful than before because of changes in the atmosphere, or populations living in an environment mismatching the pigmentation of their skin—or rather, that makers of sun protection products need to make some profits?

- But the reasoning does not hold in an informational dimension in which food is not just a source of energy; it conveys information about the environment (like stressors). The ingestion of food combined with one's activity brings about hormonal cascades (or something similar that conveys information), causing cravings (hence consumption of other foods) or changes in the way your body burns the energy, whether it needs to conserve fat and burn muscle, or vice versa. Complex systems have feedback loops, so what you "burn" depends on what you consume, and how you consume it.

- What men have done with top-down, command-and-control science has been exactly the reverse: interventions with negative convexity effects, i.e., the achievement of small certain gains through exposure to massive potential mistakes. Our record of understanding risks in

complex systems (biology, economics, climate) has been pitiful, marred with retrospective distortions (we only understand the risks after the damage takes place, yet we keep making the mistake), and there is nothing to convince me that we have gotten better at risk management.

- Simply, humans should not be given explosive toys (like atomic bombs, financial derivatives, or tools to create life).

- what Mother Nature does is rigorous until proven otherwise; what humans and science do is flawed until proven otherwise.

- When it comes to narratives, the brain seems to be the last province of the theoretician-charlatan.

- I just want to understand as little as possible to be able to look at regularities of experience.

- The Greek term pharmakon is ambiguous, as it can mean both “poison” and “cure” and has been used as a pun to warn against iatrogenics by the Arab doctor Ruhawi.

- In short, it exhibits some variability. Like everything in life. This random variability is often mistaken for information, hence leading to intervention.

- Alas, all these biases lead to action, almost never inaction.

- the use of mathematics in social science is like interventionism. Those who practice it professionally tend to use it everywhere except where it can be useful.

- (primitive societies are largely free of cardiovascular disease, cancer, dental cavities, economic theories, lounge music, and other modern ailments);

- Overreaction is beneficial in an ancestral environment.

- We saw that iatrogenics comes from the intervention bias, via positiva, the propensity to want to do something, causing all the problems we’ve discussed.

- So there are many hidden jewels in via negativa applied to medicine. For instance, telling people not to smoke seems to be the greatest medical contribution of the last sixty years.

- Ennius wrote, “The good is mostly in the absence of bad”; Nimium boni est, cui nihil est mali.

- We know we can cure many cases of diabetes by putting people on a very strict starvation-style diet, shocking their system—in fact the mechanism had to have been known heuristically for a long time since there are institutes and sanatoria for curative starvation in Siberia.

- It has been shown that many people benefit from the removal of products that did not exist in their ancestral habitat: sugars and other carbohydrates in unnatural format, wheat products (those with celiac disease, but almost all of us are somewhat ill-adapted to this new addition to the human diet), milk and other cow products (for those of non–Northern European origin who did not develop lactose tolerance), sodas (both diet and regular), wine (for those of Asian origin who do not have the history of exposure), vitamin pills, food supplements, the family doctor, headache medicine and other painkillers.

- (Aside from the point that the citrus our ancestors ingested was not sweet, they never ingested carbohydrates without large, very large quantities of fiber. Eating an orange or an apple is not biologically equivalent to drinking orange or apple juice.)

- From such examples, I derived the rule that what is called “healthy” is generally unhealthy, just as “social” networks are antisocial, and the “knowledge”-based economy is typically ignorant.

- Note that medical iatrogenics is the result of wealth and sophistication rather than poverty and artlessness, and of course the product of partial knowledge rather than ignorance.

- Few have considered that money has its own iatrogenics, and that separating some people from their fortune would simplify their lives and bring great benefits in the form of healthy stressors.

- When I see pictures of my friend the godfather of the Paleo ancestral lifestyle, Art De Vany, who is extremely fit in his seventies (much more than most people thirty years younger than him), and those of the pear-shaped billionaires Rupert Murdoch or Warren Buffett or others in the same age group, I am invariably hit with the following idea. If true wealth consists in worriless sleeping, clear conscience, reciprocal gratitude, absence of envy, good appetite, muscle strength, physical energy, frequent laughs, no meals alone, no gym class, some physical labor (or hobby), good bowel movements, no meeting rooms, and periodic surprises, then it is largely subtractive (elimination of iatrogenics).

- And it seems to me that human nature does, deep down, know when to resort to the solace of religion, and when to switch to science.

- Jensen’s inequality: irregularity has its benefits in some areas; regularity has its detriments. Where Jensen’s inequality applies, irregularity might be medicine.

- the Greek Orthodox church has, depending on the severity of the local culture, almost two hundred days of fasting per year; and these are harrowing fasts.

- I wonder how people can accept that the stressors of exercise are good for you, but do not transfer to the point that food deprivation can have the same effect. But scientists are in the process of discovering the effects of episodic deprivation of some, or all, foods. Somehow, evidence shows, we get sharper and fitter in response to the stress of the constraint.

- Valter Longo, for instance, noted that prisoners in concentration camps got less sick in the first phase of food restriction, then broke down later. He tried the result experimentally and found out that mice, in the initial phases of starvation, can withstand high doses of chemotherapy without visible side effects. Scientists use the narrative that starvation causes the expression of a gene coding a protein called SIRT, SIRT1, or sirtuin, which brings longevity and other effects. The antifragility of humans manifests itself in the response with up-regulation of some genes in response to hunger.

- We live to produce information, or improve on it. Nietzsche had the Latin pun aut liberi, aut libri—either children or books, both information that carries through the centuries.

- And the agency problem, is of course, an asymmetry.

- For heroism is the exact inverse of the agency problem: someone elects to bear the disadvantage

- In traditional societies, a person is only as respectable and as worthy as the downside he (or, more, a lot more, than expected, she) is willing to face for the sake of others.

- A half-man (or, rather, half-person) is not someone who does not have an opinion, just someone who does not take risks for it.

- If you take risks and face your fate with dignity, there is nothing you can do that makes you small; if you don't take risks, there is nothing you can do that makes you grand, nothing. And when you take risks, insults by half-men (small men, those who don't risk anything) are similar to barks by nonhuman animals: you can't feel insulted by a dog.

- Hammurabi's code—now about 3,800 years old—identifies the need to reestablish a symmetry of fragility, spelled out as follows: If a builder builds a house and the house collapses and causes the death of the owner of the house—the builder shall be put to death. If it causes the death of the son of the owner of the house, a son of that builder shall be put to death. If it causes the death of a slave of the owner of the house—he shall give to the owner of the house a slave of equal value. It looks like they were much more advanced 3,800 years ago than we are today.

- First, never get on a plane if the pilot is not on board. Second, make sure there is also a copilot.

- The first heuristic addresses the asymmetry in rewards and punishment, or transfer of fragility between individuals. Ralph Nader has a simple rule: people voting for war need to have at least one descendant (child or grandchild) exposed to combat. For the Romans, engineers needed to spend some time under the bridge they built—something that should be required of financial engineers today. The English went further and had the families of the engineers spend time with them under the bridge after it was built.

- anyone producing a forecast or making an economic analysis needs to have something to lose from it, given that others rely on those forecasts (to repeat, forecasts induce risk taking; they are more toxic to us than any other form of human pollution).

- The second heuristic is that we need to build redundancy, a margin of safety, avoiding optimization, mitigating (even removing) asymmetries in our sensitivity to risk.

- I am stating here that I find it profoundly unethical to talk without doing, without exposure to harm, without having one's skin in the game, without having something at risk. You express your opinion; it can hurt others (who rely on it), yet you incur no liability. Is this fair?

- Note that in traditional societies even those who fail—but have taken risks—have a higher status than those who are not exposed.

- For Publilius Syrus, he who does not stop a crime is an accomplice. (I've stated my own version of this in the prologue, which needs to be reiterated: if you see fraud and don't say fraud, you are a fraud.)

- If someone drives a school bus blindfolded, and has an accident, he either exits the gene pool the old-fashioned way, or, if for some reason he is not harmed by the accident, he will incur enough penalties to be prevented from driving other people ever again. The problem is that the journalist Thomas Friedman is still driving the bus. There is no penalty for opinion makers who harm society. And this is a very bad practice.

- When you look at the actual history of someone's activities, instead of what thoughts he will deliver after the facts, things become crystal clear. The option is gone. Reality removes the uncertainty, the imprecision, the vagueness, the self-serving mental biases that make us appear more intelligent. Mistakes are costly, no longer free, but being right brings actual rewards.

- I want predictors to have visible scars on their body from prediction errors, not distribute these errors to society.

- An academic is not designed to remember his opinions because he doesn't have anything at risk from them.

- Never ask anyone for their opinion, forecast, or recommendation. Just ask them what they have—or don't have—in their portfolio.

- Look at it again, the way we looked at entrepreneurs. They are usually wrong and make "mistakes"—plenty of mistakes. They are convex. So what counts is the payoff from success.

- Suckers try to win arguments, nonsuckers try to win.

- Yet the biological world evolves by survival, not opinions and "I predicted" and "I told you so." Evolution dislikes the confirmation fallacy, endemic in society.

- it is not ideas that survive, but people who have the right ones, or societies that have the correct heuristics, or the ones, right or wrong, that lead them to do the good thing.

- Behavior called "irrational" can be good if it is harmless.

- On April 29, 711, the armies of the Arab commander Tarek crossed the Strait of Gibraltar from Morocco into Spain with a small army (the name Gibraltar is derived from the Arabic Jabal Tarek, meaning "mount of Tarek"). Upon landing, Tarek had his ships put to the fire. He then made a famous speech every schoolchild memorized during my school days that I translate loosely: "Behind you is the sea, before you, the enemy. You are vastly outnumbered. All you have is sword and courage." And Tarek and his small army took control of Spain. The same heuristic seems to have played out throughout history,

- My childhood role model was the French adventurer and writer André Malraux.

- Prophecy is a pledge of belief, little else. A prophet is not someone who first had an idea; he is the one to first believe in it—and take it to its conclusion.

- Smith is even suspicious of their economic performance as he writes: “Joint-stock companies for foreign trade have seldom been able to maintain the competition against private adventurers.”

- Have you noticed that while corporations sell you junk drinks, artisans sell you cheese and wine?

- A rule then hit me: with the exception of, say, drug dealers, small companies and artisans tend to sell us healthy products, ones that seem naturally and spontaneously needed; larger ones—including pharmaceutical giants—are likely to be in the business of producing wholesale iatrogenics, taking our money, and then, to add insult to injury, hijacking the state thanks to their army of lobbyists. Further, anything that requires marketing appears to carry such side effects. You certainly need an advertising apparatus to convince people that Coke brings them “happiness”—and it works.

- Marketing is bad manners—and I rely on my naturalistic and ecological instincts. Say you run into a person during a boat cruise. What would you do if he started boasting of his accomplishments, telling you how great, rich, tall, impressive, skilled, famous, muscular, well educated, efficient, and good in bed he is, plus other attributes? You would certainly run away (or put him in contact with another talkative bore to get rid of both of them). It is clearly much better if others (preferably someone other than his mother) are the ones saying good things about him, and it would be nice if he acted with some personal humility. Actually this is not at all far-fetched. As I was writing this book, I overheard on a British Air flight a gentleman explain to the flight attendant less than two seconds into the conversation (meant to be about whether he liked cream and sugar in his coffee) that he won the Nobel Prize in Medicine “and Physiology” in addition to being the president of a famous monarchal academy. The flight attendant did not know what the Nobel was, but was polite, so he kept repeating “the Nobel Prize” hoping that she would wake up from her ignorance. I turned around and recognized him, and the character suddenly deflated. As the saying goes, it is hardest to be a great man to one’s chambermaid. And marketing beyond conveying information is insecurity.

- As a trader I never trusted transactions with “representatives” of institutions; pit traders are bound by their bonds, and I’ve never known a single self-employed trader over a two-decade-long career who did not live up to his handshake. Only a sense of honor can lead to commerce. Any commerce.

- (we saw with the powers of subtraction that if we stopped the industry from existing by, say, banning cigarettes, then everything else done by medicine becomes a footnote).

- “Nero, you sucker. Don’t be fooled by money. These are just numbers. Being self-owned is a state of mind.”

- There is a phenomenon called the treadmill effect, similar to what we saw with neomania: you need to make more and more to stay in the same place. Greed is antifragile—though not its victims.

- In a story well argued throughout the centuries, Demades the Athenian condemned a man who traded in funeral goods on the grounds that he could only derive profits by the death of

the great many people. Montaigne, rephrasing the argument made by Seneca in his De beneficiis, argued that we would then be obligated to condemn every single professional. According to him, the merchant only thrives by the debauchery of youth, the farmer by the dearness of grain, the architect by the ruin of buildings, lawyers and officers of justice by the suits and contentions of men. A physician takes no pleasure in the health of even his friends, a soldier does not wish for the peace of his country, etc. And, even worse, should we go into people's inner and private thoughts and motivations, we would see that their wishes and hopes are almost invariably at someone else's expense.

- Then a heuristic came to mind. I surreptitiously asked a host sitting next to me if the fellow had anything to gain from his argument:

- One should give more weight to witnesses and opinions when they present the opposite of a conflict of interest. A pharmacist or an executive of Big Pharma who advocates starvation and via negativa methods to cure diabetes would be more credible than another one who favors the ingestion of drugs.

- The Tragedy of Big Data. The more variables, the more correlations that can show significance in the hands of a "skilled" researcher. Falsity grows faster than information; it is nonlinear (convex) with respect to data.

- Everything gains or loses from volatility. Fragility is what loses from volatility and uncertainty.

- Every sentence in the book was a derivation, an application, or an interpretation of the short maxim. Some details and extensions can be counterintuitive and elaborate, particularly when it comes to decision making under opacity, but at the end everything flows from it.

- It so happens that everything nonlinear is convex or concave, or both, depending on the intensity of the stressor. We saw the link between convexity and liking volatility. So everything likes or hates volatility up to a point. Everything.

- Ethics is largely about stolen convexities and optionality.

- The glass is dead; living things are long volatility. The best way to verify that you are alive is by checking if you like variations. Remember that food would not have a taste if it weren't for hunger; results are meaningless without effort, joy without sadness, convictions without uncertainty, and an ethical life isn't so when stripped of personal risks.

- Rational flâneur (or just flâneur): Someone who, unlike a tourist, makes a decision opportunistically at every step to revise his schedule (or his destination) so he can imbibe things based on new information obtained. In research and entrepreneurship, being a flâneur is called "looking for optionality." A non-narrative approach to life.

- Barbell Strategy: A dual strategy, a combination of two extremes, one safe and one speculative, deemed more robust than a "monomodal" strategy; often a necessary condition for antifragility. For instance, in biological systems, the equivalent of marrying an accountant and having an occasional fling with a rock star; for a writer, getting a stable sinecure and writing without the pressures of the market during spare time. Even trial and error are a form of barbell.

- Iatrogenics: Harm done by the healer, as when the doctor's interventions do more harm than good.

- Thalesian versus Aristotelian: The Thalesian focuses on exposure, payoff from decision; the Aristotelian focuses on logic, the True-False distinction. For Fat Tony, the problem is all about sucker-nonsucker, or risks and rewards.

- Turkey and Inverse Turkey: The turkey is fed by the butcher for a thousand days, and every day the turkey pronounces with increased statistical confidence that the butcher "will never hurt it"—until Thanksgiving, which brings a Black Swan revision of belief for the turkey. The inverse turkey error is the mirror confusion, not seeing opportunities—pronouncing that one has evidence that someone digging for gold or searching for cures will "never find" anything.

- Doxastic Commitment, or "Soul in the Game": You must only believe predictions and opinions by those who committed themselves to a certain belief, and had something to lose, in a way to pay a cost in being wrong.

- Agency Problem: Situation in which the manager of a business is not the true owner, so he follows a strategy that cosmetically seems to be sound, but in a hidden way benefits him and makes him antifragile at the expense (fragility) of the true owners or society. When he is right, he collects large benefits; when he is wrong, others pay the price. Typically this problem leads to fragility, as it is easy to hide risks. It also affects politicians and academics. A major source of fragility.

- Hammurabi Risk Management: The idea that a builder has more knowledge than the inspector and can hide risks in the foundations where they can be most invisible; the remedy is to remove the incentive in favor of delayed risk.

- Via negativa: In theology and philosophy, the focus on what something is not, an indirect definition. In action, it is a recipe for what to avoid, what not to do—subtraction, not addition, say, in medicine.

- Lindy Effect: A technology, or anything nonperishable, increases in life expectancy with every day of its life—unlike perishable items (such as humans, cats, dogs, and tomatoes). So a book that has been a hundred years in print is likely to stay in print another hundred years.

- Example: x is the intensity of an earthquake on some scale in some specific area, f(x) is the number of persons dying from it. We can easily see that f(x) can be made more predictable than x (if we force people to stay away from a specific area or build to some standards, etc.).

- One can become antifragile to x without understanding x, through convexity of f(x).

- It is often easier to modify f(x) than to get better knowledge of x. (In other words, robustification rather than forecasting Black Swans.)

- Economic models are extremely fragile to assumptions, in the sense that a slight alteration in these assumptions can, as we will see, lead to extremely consequential differences in the results. And, to make matters worse, many of these models are "back-fit" to assumptions, in

the sense that the hypotheses are selected to make the math work, which makes them ultrafragile and ultrafragilizing.

- Probability Matching: The idea of comparative advantage has an analog in probability: if you sample from an urn (with replacement) and get a black ball 60 percent of the time, and a white one the remaining 40 percent, the optimal strategy, according to textbooks, is to bet 100 percent of the time on black. The strategy of betting 60 percent of the time on black and 40 percent on white is called “probability matching” and considered to be an error in the decision-science literature (which I remind the reader is what was used by Triffat in Chapter 10). People’s instinct to engage in probability matching appears to be sound, not a mistake. In nature, probabilities are unstable (or unknown), and probability matching is similar to redundancy, as a buffer. So if the probabilities change, in other words if there is another layer of randomness, then the optimal strategy is probability matching.