

I. HOW TO LOVE THE WIND

Wind extinguishes a candle and energizes fire.

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. This summarizes this author's nonmeek attitude to randomness and uncertainty.

We just don't want to just survive uncertainty, to just about make it. We want to survive uncertainty and, in addition—like a certain class of aggressive Roman Stoics—have the last word. The mission is how to domesticate, even dominate, even conquer, the unseen, the opaque, and the inexplicable.

How?

II. THE ANTIFRAGILE

Some things benefit from shocks; they thrive and grow when exposed to volatility, randomness, disorder, and stressors and love adventure, risk, and uncertainty. Yet, in spite of the ubiquity of the phenomenon, there is no word for the exact opposite of fragile. Let us call it antifragile.

Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better. This property is behind everything that has changed with time: evolution, culture, ideas, revolutions, political systems, technological innovation, cultural and economic success, corporate survival, good recipes (say, chicken soup or steak tartare with a drop of cognac), the rise of cities, cultures, legal systems, equatorial forests, bacterial resistance ... even our own existence as a species on this planet. And antifragility determines the boundary between what is living and organic (or complex), say, the human body, and what is inert, say, a physical object like the stapler on your desk.

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.

It is easy to see things around us that like a measure of stressors and volatility: economic systems, your body, your nutrition (diabetes and many similar modern ailments seem to be associated with a lack of randomness in feeding and the absence of the stressor of occasional starvation), your psyche. There are even financial contracts that are antifragile: they are explicitly designed to benefit from market volatility.

Antifragility makes us understand fragility better. Just as we cannot improve health without reducing disease, or increase wealth without first decreasing losses, antifragility and fragility are degrees on a spectrum.

Nonprediction

By grasping the mechanisms of antifragility we can build a systematic and broad guide to *nonpredictive* decision making under uncertainty in business, politics, medicine, and life in general—anywhere the unknown preponderates, any situation in which there is randomness, unpredictability, opacity, or incomplete understanding of things.

It is far easier to figure out if something is fragile than to predict the occurrence of an event that may harm it. Fragility can be measured; risk is not measurable (outside of casinos or the minds of people who call themselves “risk experts”). This provides a solution to what I’ve called the Black Swan problem—the impossibility of calculating the risks of consequential rare events and predicting their occurrence. Sensitivity to harm from volatility is tractable, more so than forecasting the event that would cause the harm. So we propose to stand our current approaches to prediction, prognostication, and risk management on their heads.

In every domain or area of application, we propose rules for moving from the fragile toward the antifragile, through reduction of fragility or harnessing antifragility. And we can almost always detect antifragility (and fragility) using a simple test of asymmetry: anything that has more upside than downside from random events (or certain shocks) is antifragile; the reverse is fragile.

Deprivation of Antifragility

Crucially, if antifragility is the property of all those natural (and complex) systems that have survived, depriving these systems of volatility, randomness, and stressors will harm them. They will weaken, die, or blow up. We have been fragilizing the economy, our health, political life, education, almost everything ... by suppressing randomness and volatility. Just as spending a month in bed (preferably with an unabridged version of *War and Peace* and access to *The Sopranos*’ entire eighty-six episodes) leads to muscle atrophy, complex systems

are weakened, even killed, when deprived of stressors. Much of our modern, structured, world has been harming us with top-down policies and contraptions (dubbed “Soviet-Harvard delusions” in the book) which do precisely this: an insult to the antifragility of systems.

This is the tragedy of modernity: as with neurotically overprotective parents, those trying to help are often hurting us the most.

If about everything top-down fragilizes and blocks antifragility and growth, everything bottom-up thrives under the right amount of stress and disorder. The process of discovery (or innovation, or technological progress) itself depends on antifragile tinkering, aggressive risk bearing rather than formal education.

Upside at the Expense of Others

Which brings us to the largest fragilizer of society, and greatest generator of crises, absence of “skin in the game.” Some become antifragile at the expense of others by getting the upside (or gains) from volatility, variations, and disorder and exposing others to the downside risks of losses or harm. And such *antifragility-at-the-cost-of-fragility-of-others* is hidden—given the blindness to antifragility by the Soviet-Harvard intellectual circles, this asymmetry is rarely identified and (so far) never taught. Further, as we discovered during the financial crisis that started in 2008, these blowup risks-to-others are easily concealed owing to the growing complexity of modern institutions and political affairs. While in the past people of rank or status were those and only those who took risks, who had the downside for their actions, and heroes were those who did so for the sake of others, today the exact reverse is taking place. We are witnessing the rise of a new class of inverse heroes, that is, bureaucrats, bankers, Davos-attending members of the I.A.N.D. (International Association of Name Droppers), and academics with too much power and no real downside and/or accountability. They game the system while citizens pay the price.

At no point in history have so many non-risk-takers, that is, those with no personal exposure, exerted so much control.

The chief ethical rule is the following: Thou shalt not have antifragility at the expense of the fragility of others.

III. THE ANTIDOTE TO THE BLACK SWAN

I want to live happily in a world I don't understand.

Black Swans (capitalized) are large-scale unpredictable and irregular events of massive consequence—unpredicted by a certain observer, and such unpredictor is generally called the “turkey” when he is both surprised and harmed by these events. 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.

Black Swans hijack our brains, making us feel we “sort of” or “almost” predicted them, because they are retrospectively explainable. We don't realize the role of these Swans in life because of this illusion of predictability. Life is more, a lot more, labyrinthine than shown in our memory—our minds are in the business of turning history into something smooth and linear, which makes us underestimate randomness. But when we see it, we fear it and overreact. Because of this fear and thirst for order, some human systems, by disrupting the invisible or not so visible logic of things, tend to be exposed to harm from Black Swans and almost never get any benefit. You get pseudo-order when you seek order; you only get a measure of order and control when you embrace randomness.

Complex systems are full of interdependencies—hard to detect—and nonlinear responses. “Nonlinear” means that when you double the dose of, say, a medication, or when you double the number of employees in a factory, you don't get twice the initial effect, but rather a lot more or a lot less. Two weekends in Philadelphia are not twice as pleasant as a single one—I've tried. When the response is plotted on a graph, it does not show as a straight line (“linear”), rather as a curve. In such environment, simple causal associations are misplaced; it is hard to see how things work by looking at single parts.

Man-made complex systems tend to develop cascades and runaway chains of reactions that decrease, even eliminate, predictability and cause outsized events. So the modern world may be increasing in

technological knowledge, but, paradoxically, it is making things a lot more unpredictable. Now for reasons that have to do with the increase of the artificial, the move away from ancestral and natural models, and the loss in robustness owing to complications in the design of everything, the role of Black Swans is increasing. Further, we are victims to a new disease, called in this book *neomania*, that makes us build Black Swan-vulnerable systems—“progress.”

An annoying aspect of the Black Swan problem—in fact the central, and largely missed, point—is that the odds of rare events are simply not computable. We know a lot less about hundred-year floods than five-year floods—model error swells when it comes to small probabilities. *The rarer the event, the less tractable, and the less we know about how frequent its occurrence*—yet the rarer the event, the more confident these “scientists” involved in predicting, modeling, and using PowerPoint in conferences with equations in multicolor background have become.

It is of great help that Mother Nature—thanks to its antifragility—is the best expert at rare events, and the best manager of Black Swans; in its billions of years it succeeded in getting here without much command-and-control instruction from an Ivy League-educated director nominated by a search committee. Antifragility is not just the antidote to the Black Swan; understanding it makes us less intellectually fearful in accepting the role of these events as necessary for history, technology, knowledge, everything.

Robust Is Not Robust Enough

Consider that Mother Nature is not just “safe.” It is aggressive in destroying and replacing, in selecting and reshuffling. When it comes to random events, “robust” is certainly not good enough. In the long run everything with the most minute vulnerability breaks, given the ruthlessness of time—yet our planet has been around for perhaps four billion years and, convincingly, robustness can’t just be it: you need perfect robustness for a crack not to end up crashing the system. Given the unattainability of perfect robustness, we need a mechanism by

which the system regenerates itself continuously by using, rather than suffering from, random events, unpredictable shocks, stressors, and volatility.

The antifragile gains from prediction errors, in the long run. If you follow this idea to its conclusion, then many things that gain from randomness should be dominating the world today—and things that are hurt by it should be gone. Well, this turns out to be the case. We have the illusion that the world functions thanks to programmed design, university research, and bureaucratic funding, but there is compelling—very compelling—evidence to show that this is an illusion, the illusion I call *lecturing birds how to fly*. Technology is the result of antifragility, exploited by risk-takers in the form of tinkering and trial and error, with nerd-driven design confined to the backstage. Engineers and tinkerers develop things while history books are written by academics; we will have to refine historical interpretations of growth, innovation, and many such things.

On the Measurability of (Some) Things

Fragility is quite measurable, risk not so at all, particularly risk associated with rare events.^{[1](#)}

I said that we can estimate, even measure, fragility and antifragility, while we cannot calculate risks and probabilities of shocks and rare events, no matter how sophisticated we get. Risk management as practiced is the study of an event taking place in the future, and only some economists and other lunatics can claim—against experience—to “measure” the future incidence of these rare events, with suckers listening to them—against experience and the track record of such claims. But fragility and antifragility are part of the current property of an object, a coffee table, a company, an industry, a country, a political system. We can detect fragility, see it, even in many cases measure it, or at least measure comparative fragility with a small error while comparisons of risk have been (so far) unreliable. You cannot say with any reliability that a certain remote event or shock is more likely than another (unless you enjoy deceiving yourself), but you can state with a

lot more confidence that an object or a structure is more fragile than another should a certain event happen. You can easily tell that your grandmother is more fragile to abrupt changes in temperature than you, that some military dictatorship is more fragile than Switzerland should political change happen, that a bank is more fragile than another should a crisis occur, or that a poorly built modern building is more fragile than the Cathedral of Chartres should an earthquake happen. And—centrally—you can even make the prediction of which one will last longer.

Instead of a discussion of risk (which is both predictive and sissy) I advocate the notion of fragility, which is not predictive—and, unlike risk, has an interesting word that can describe its functional opposite, the nonsissy concept of antifragility.

To measure antifragility, there is a philosopher's-stone-like recipe using a compact and simplified rule that allows us to identify it across domains, from health to the construction of societies.

We have been unconsciously exploiting antifragility in practical life and, consciously, rejecting it—particularly in intellectual life.

The Fragilista

Our idea is to avoid interference with things we don't understand. Well, some people are prone to the opposite. The fragilista belongs to that category of persons who are usually in suit and tie, often on Fridays; he faces your jokes with icy solemnity, and tends to develop back problems early in life from sitting at a desk, riding airplanes, and studying newspapers. He is often involved in a strange ritual, something commonly called "a meeting." Now, in addition to these traits, he defaults to thinking that what he doesn't see is not there, or what he does not understand does not exist. At the core, he tends to mistake the unknown for the nonexistent.

The fragilista falls for the *Soviet-Harvard delusion*, the (unscientific) overestimation of the reach of scientific knowledge. Because of such delusion, he is what is called a *naive rationalist*, a *rationalizer*, or sometimes just a *rationalist*, in the sense that he believes that the

reasons behind things are automatically accessible to him. And let us not confuse rationalizing with rational—the two are almost always exact opposites. Outside of physics, and generally in complex domains, the reasons behind things have had a tendency to make themselves less obvious to us, and even less to the fragilista. This property of natural things not to advertise themselves in a user's manual is, alas, not much of a hindrance: some fragilistas will get together to write the user's manual themselves, thanks to their definition of "science."

So thanks to the fragilista, modern culture has been increasingly building blindness to the mysterious, the impenetrable, what Nietzsche called the Dionysian, in life.

Or to translate Nietzsche into the less poetic but no less insightful Brooklyn vernacular, this is what our character Fat Tony calls a "sucker game."

In short, the fragilista (medical, economic, social planning) is one who makes you engage in policies and actions, all artificial, in which *the benefits are small and visible, and the side effects potentially severe and invisible*.

There is the medical fragilista who overintervenes in denying the body's natural ability to heal and gives you medications with potentially very severe side effects; the policy fragilista (the interventionist social planner) who mistakes the economy for a washing machine that continuously needs fixing (by him) and blows it up; the psychiatric fragilista who medicates children to "improve" their intellectual and emotional life; the soccer-mom fragilista; the financial fragilista who makes people use "risk" models that destroy the banking system (then uses them again); the military fragilista who disturbs complex systems; the predictor fragilista who encourages you to take more risks; and many more.²

Indeed, the political discourse is lacking a concept. Politicians in their speeches, goals, and promises aim at the timid concepts of "resilience," "solidity," not antifragility, and in the process are stifling the mechanisms of growth and evolution. 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.

Where Simple Is More Sophisticated

A complex system, contrary to what people believe, does not require complicated systems and regulations and intricate policies. The simpler, the better. Complications lead to multiplicative chains of unanticipated effects. Because of opacity, an intervention leads to unforeseen consequences, followed by apologies about the “unforeseen” aspect of the consequences, then to another intervention to correct the secondary effects, leading to an explosive series of branching “unforeseen” responses, each one worse than the preceding one.

Yet simplicity has been difficult to implement in modern life because it is against the spirit of a certain brand of people who seek sophistication so they can justify their profession.

Less is more and usually more effective. Thus I will produce a small number of tricks, directives, and interdicts—how to live in a world we don’t understand, or, rather, how to *not be afraid* to work with things we patently don’t understand, and, more principally, in what manner we should work with these. Or, even better, how to dare to look our ignorance in the face and not be ashamed of being human—be aggressively and proudly human. But that may require some structural changes.

What I propose is a road map to modify our man-made systems to let the simple—and natural—take their course.

But simplicity is not so simple to attain. 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.*

Heuristics are simplified rules of thumb that make things simple and easy to implement. But their main advantage is that the user knows that they are not perfect, just expedient, and is therefore less fooled by their powers. They become dangerous when we forget that.

IV. THIS BOOK

The journey to this idea of antifragility was, if anything, nonlinear.

I suddenly realized one day that fragility—which had been lacking a technical definition—could be expressed as *what does not like volatility*, and that *what does not like volatility* does not like randomness, uncertainty, disorder, errors, stressors, etc. Think of anything fragile, say, objects in your living room such as the glass frame, the television set, or, even better, the china in the cupboards. If you label them “fragile,” then you necessarily want them to be left alone in peace, quiet, order, and predictability. A fragile object would not possibly benefit from an earthquake or the visit of your hyperactive nephew. Further, everything that does not like volatility does not like stressors, harm, chaos, events, disorder, “unforeseen” consequences, uncertainty, and, critically, time.

And antifragility flows—sort of—from this explicit definition of fragility. It likes volatility et al. It also likes time. And there is a powerful and helpful link to nonlinearity: everything nonlinear in response is either fragile or antifragile to a certain source of randomness.

The strangest thing is that this obvious property that *anything fragile hates volatility*, and vice versa, has been sitting completely outside the scientific and philosophical discourse. Completely. And the study of the sensitivity of things to volatility is the strange business specialty in which I spent most of my adult life, two decades—I know it is a strange specialty, I promise to explain later. My focus in that profession has been on identifying items that “love volatility” or “hate volatility”; so all I had to do was expand the ideas from the financial domain in which I had been focused to the broader notion of decision making under uncertainty across various fields, from political science to medicine to dinner plans.³

And in that strange profession of people who work with volatility, there were two types. First category, academics, report-writers, and commentators who study future events and write books and papers; and, second category, practitioners who, instead of studying future events, try to understand how things react to volatility (but practitioners

are usually too busy practicing to write books, articles, papers, speeches, equations, theories and get honored by Highly Constipated and Honorable Members of Academies). The difference between the two categories is central: as we saw, it is much easier to understand if something is harmed by volatility—hence fragile—than try to forecast harmful events, such as these oversized Black Swans. But only practitioners (or people who do things) tend to spontaneously get the point.

The (Rather Happy) Disorder Family

One technical comment. We keep saying that fragility and antifragility mean potential gain or harm from exposure to *something* related to volatility. What is that something? Simply, membership in the extended disorder family.

The Extended Disorder Family (or Cluster): (i) uncertainty, (ii) variability, (iii) imperfect, incomplete knowledge, (iv) chance, (v) chaos, (vi) volatility, (vii) disorder, (viii) entropy, (ix) time, (x) the unknown, (xi) randomness, (xii) turmoil, (xiii) stressor, (xiv) error, (xv) dispersion of outcomes, (xvi) unknowledge.

It happens that uncertainty, disorder, and the unknown are completely equivalent in their effect: antifragile systems benefit (to some degree) from, and the fragile is penalized by, almost all of them—even if you have to find them in separate buildings of the university campuses and some philosophaster who has never taken real risks in his life, or, worse, never had a life, would inform you that “they are *clearly* not the same thing.”

Why item (ix), time? Time is functionally similar to volatility: the more time, the more events, the more disorder. Consider that if you can suffer limited harm and are antifragile to small errors, time brings the kind of errors or reverse errors that end up benefiting you. This is simply what your grandmother calls experience. The fragile breaks with time.

Only One Book

This makes this book my central work. I've had only one master idea, each time taken to its next step, the last step—this book—being more like a big jump. I am reconnected to my “practical self,” my soul of a practitioner, as this is a merger of my entire history as practitioner and “volatility specialist” combined with my intellectual and philosophical interests in randomness and uncertainty, which had previously taken separate paths.

My writings are not stand-alone essays on specific topics, with beginnings, ends, and expiration dates; rather, they are nonoverlapping chapters from that central idea, a main corpus focused on uncertainty, randomness, probability, disorder, and what to do in a world we don't understand, a world with unseen elements and properties, the random and the complex; that is, decision making under opacity. The corpus is called *Incerto* and is constituted (so far) of a trilogy plus philosophical and technical addenda. The rule is that the distance between a random chapter of one book, say, *Antifragile*, and another random chapter of another, say, *Fooled by Randomness*, should be similar to the one between chapters of a long book. The rule allows the corpus to cross domains (by shifting across science, philosophy, business, psychology, literature, and autobiographical segments) without lapsing into promiscuity.

So the relationship of this book to *The Black Swan* would be as follows: in spite of the chronology (and the fact that this book takes the Black Swan idea to its natural and prescriptive conclusion), *Antifragile* would be the main volume and *The Black Swan* its backup of sorts, and a theoretical one, perhaps even its junior appendix. Why? Because *The Black Swan* (and its predecessor, *Fooled by Randomness*) were written to convince us of a dire situation, and worked hard at it; this one starts from the position that one does not need convincing that (a) Black Swans dominate society and history (and people, because of ex post rationalization, think themselves capable of understanding them); (b) as a consequence, we don't quite know what's going on, particularly under severe nonlinearities; so we can get to practical business right away.

No Guts, No Belief

To accord with the practitioner's ethos, the rule in this book is as follows: I eat my own cooking.

I have only written, in every line I have composed in my professional life, about things I have done, and the risks I have recommended that others take or avoid were risks I have been taking or avoiding myself. I will be the first to be hurt if I am wrong. When I warned about the fragility of the banking system in *The Black Swan*, I was betting on its collapse (particularly when my message went unheeded); otherwise I felt it would not have been ethical to write about it. That personal stricture applies to every domain, including medicine, technical innovation, and simple matters in life. It does not mean that one's personal experiences constitute a sufficient sample to derive a conclusion about an idea; it is just that one's personal experience gives the stamp of authenticity and sincerity of opinion. Experience is devoid of the cherry-picking that we find in studies, particularly those called "observational," ones in which the researcher finds past patterns, and, thanks to the sheer amount of data, can therefore fall into the trap of an invented narrative.

Further, in writing, I feel corrupt and unethical if I have to look up a subject in a library as part of the writing itself. This acts as a filter—it is the only filter. If the subject is not interesting enough for me to look it up *independently*, for my own curiosity or purposes, and I have not done so before, then I should not be writing about it at all, period. It does not mean that libraries (physical and virtual) are not acceptable; it means that they should not be the *source* of any idea. Students pay to write essays on topics for which they have to derive knowledge from a library as a self-enhancement exercise; a professional who is compensated to write and is taken seriously by others should use a more potent filter. Only distilled ideas, ones that sit in us for a long time, are acceptable—and those that come from reality.

It is time to revive the not well-known philosophical notion of *doxastic commitment*, a class of beliefs that go beyond talk, and to which we are committed enough to take personal risks.

If You See Something

Modernity has replaced ethics with legalese, and the law can be gamed with a good lawyer.

So I will expose the transfer of fragility, or rather the theft of antifragility, by people “arbitraging” the system. These people will be named by name. Poets and painters are free, *liberi poetae et pictores*, and there are severe moral imperatives that come with such freedom. 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, say, after half a bottle of wine, differently from the way they do in print. Their writing is certifiably fake, fake. And many of the problems of society come from the argument “other people are doing it.” So if I call someone a dangerous ethically challenged fragilista in private after the third glass of Lebanese wine (white), I will be obligated to do so here.

Calling people and institutions fraudulent in print when they are not (yet) called so by others carries a cost, but is too small to be a deterrent. After the mathematical scientist Benoît Mandelbrot read the galleys of *The Black Swan*, a book dedicated to him, he called me and quietly said: “In what language should I say ‘good luck’ to you?” I did not need any luck, it turned out; I was antifragile to all manner of attacks: the more attacks I got from the Central Fragilista Delegation, the more my message spread as it drove people to examine my arguments. I am now ashamed of not having gone further in calling a spade a spade.

Compromising is condoning. The only modern dictum I follow is one by George Santayana: *A man is morally free when ... he judges the world, and judges other men, with uncompromising sincerity.* This is not just an aim but an obligation.

Defossilizing Things

Second ethical point.

I am obligated to submit myself to the scientific process simply because I require it from others, but no more than that. When I read empirical claims in medicine or other sciences, I like these claims to go through the peer-review mechanism, a fact-checking of sorts, an examination of the rigor of the approach. Logical statements, or those backed by mathematical reasoning, on the other hand, do not require such a mechanism: they can and must stand on their own legs. So I publish technical footnotes for these books in specialized and academic outlets, and nothing more (and limit them to statements that require proofs or more elaborate technical arguments). But for the sake of authenticity and to avoid careerism (the debasing of knowledge by turning it into a competitive sport), I ban myself from publishing anything outside of these footnotes.

After more than twenty years as a transactional trader and businessman in what I called the “strange profession,” I tried what one calls an academic career. And I have something to report—actually that was the driver behind this idea of antifragility in life and the dichotomy between the *natural* and the alienation of the *unnatural*. Commerce is fun, thrilling, lively, and natural; academia as currently professionalized is none of these. And for those who think that academia is “quieter” and an emotionally relaxing transition after the volatile and risk-taking business life, a surprise: when in action, new problems and scares emerge every day to displace and eliminate the previous day’s headaches, resentments, and conflicts. A nail displaces another nail, with astonishing variety. But academics (particularly in social science) seem to distrust each other; they live in petty obsessions, envy, and icy-cold hatreds, with small snubs developing into grudges, fossilized over time in the loneliness of the transaction with a computer screen and the immutability of their environment. Not to mention a level of envy I have almost never seen in business.... My experience is that money and transactions purify relations; ideas and abstract matters like “recognition” and “credit” warp them, creating an atmosphere of perpetual rivalry. I grew to find people greedy for credentials nauseating, repulsive, and untrustworthy.

Commerce, business, Levantine souks (though not large-scale markets and corporations) are activities and places that bring out the best in people, making most of them forgiving, honest, loving, trusting, and open-minded. As a member of the Christian minority in the Near East, I can vouch that commerce, particularly small commerce, is the door to tolerance—the only door, in my opinion, to any form of tolerance. It beats rationalizations and lectures. Like antifragile tinkering, mistakes are small and rapidly forgotten.

I want to be happy to be human and be in an environment in which other people are in love with their fate—and never, until my brush with academia, did I think that that environment was a certain form of commerce (combined with solitary scholarship). The biologist-writer and libertarian economist Matt Ridley made me feel that it was truly the Phoenician trader in me (or, more exactly, the Canaanite) that was the intellectual.^{[4](#)}

V. ORGANIZATION

Antifragile is composed of seven books and a notes section.

Why “books”? The novelist and essayist Rolf Dobelli’s first reaction upon reading my ethics and *via negativa* chapters, which I supplied separately, was that each should be a separate book and published as a short or medium-length essay. Someone in the business of “summarizing” books would have to write four or five separate descriptions. But I saw that they were not stand-alone essays at all; each deals with the applications of a central idea, going either deeper or into different territories: evolution, politics, business innovation, scientific discovery, economics, ethics, epistemology, and general philosophy. So I call them books rather than sections or parts. Books to me are not expanded journal articles, but reading experiences; and the academics who tend to read in order to cite in their writing—rather than read for enjoyment, curiosity, or simply because they like to read—tend to be frustrated when they can’t rapidly scan the text and summarize it in one sentence that connects it to some existing discourse in which they have been involved. Further, the essay is the polar opposite of the textbook—mixing autobiographical musings and parables with more philosophical and scientific investigations. I write about probability with my entire soul and my entire experiences in the risk-taking business; I write with my scars, hence my thought is inseparable from autobiography. The personal essay form is ideal for the topic of incertitude.

The sequence is as follows.

The Appendix to this prologue presents the Triad as a table, a comprehensive map of the world along the fragility spectrum.

[Book I, *The Antifragile: An Introduction*](#), presents the new property and discusses evolution and the organic as the typical antifragile system. It also looks at the tradeoff between the antifragility of the collective and the fragility of the individual.

[Book II, *Modernity and the Denial of Antifragility*](#), describes what happens when we starve systems—mostly political systems—of volatility. It discusses this invention called the nation-state, as well as

the idea of harm done by the healer, someone who tries to help you and ends up harming you very badly.

[Book III, *A Nonpredictive View of the World*](#), introduces Fat Tony and his intuitive detection of fragility and presents the foundational asymmetry of things grounded in the writings of Seneca, the Roman philosopher and doer.

[Book IV, *Optionality, Technology, and the Intelligence of Antifragility*](#), presents the mysterious property of the world, by which a certain asymmetry is behind things, rather than human “intelligence,” and how optionality drove us here. It is opposed to what I call the Soviet-Harvard method. And Fat Tony argues with Socrates about how we do things one cannot quite explain.

[Book V, *The Nonlinear and the Nonlinear* \(sic\)](#), is about the philosopher’s stone and its opposite: how to turn lead into gold, and gold into lead. Two chapters constitute the central technical section—the plumbing of the book—mapping fragility (as nonlinearity, more specifically, convexity effects) and showing the edge coming from a certain class of convex strategies.

[Book VI, *Via Negativa*](#), shows the wisdom and effectiveness of subtraction over addition (acts of omission over acts of commission). This section introduces the notion of convexity effects. Of course the first application is to medicine. I look at medicine only from an epistemological, risk-management approach—and it looks different from there.

[Book VII, *The Ethics of Fragility and Antifragility*](#), grounds ethics in transfers of fragility, with one party getting the benefits and the other one the harm, and points out problems arising from absence of skin in the game.

The end of the book consists of graphs, notes, and a technical appendix.

The book is written at three levels.

First, the literary and philosophical, with parables and illustrations but minimal if any technical arguments, except in [Book V](#) (the philosopher’s stone), which presents the convexity arguments. (The enlightened reader is invited to skip [Book V](#), as the ideas are distilled elsewhere.)

Second, the appendix, with graphs and more technical discussion, but no elaborate derivations.

Third, the backup material with more elaborate arguments, all in the form of technical papers and notes (don't mistake my illustrations and parables for proof; remember, a personal essay is not a scientific document, but a scientific document is a scientific document). All these backup documents are gathered as a freely available electronic technical companion.

¹ Outside of casinos and some narrowly defined areas such as man-made situations and constructions.

² Hayek did not take his idea about organic price formation into risk and fragility. For Hayek, bureaucrats were inefficient, not fragilistas. This discussion starts with fragility and antifragility, and gets us as a side discussion into organic price formation.

³ The technical term I used for “hates volatility” was “short vega” or “short gamma,” meaning “harmed should volatility increase,” and “long vega” or “long gamma” for things that benefit. In the rest of the book we will use “short” and “long” to describe negative and positive exposures, respectively. It is critical that I never believed in our ability to forecast volatility, as I just focused on how things react to it.

⁴ Once again, please, no, *itisnotresilience*. I am used to facing, at the end of a conference lecture, the question “So what is the difference between robust and antifragile?” or the more unenlightened and even more irritating “Antifragile is resilient, no?” The reaction to my answer is usually “Ah,” with the look “Why didn't you say that before?” (of course I had said that before). Even the initial referee of the scientific article I wrote on defining and detecting antifragility entirely missed the point, conflating antifragility and robustness—and that was the scientist who pored over my definitions. It is worth re-explaining the following: the robust or resilient is neither harmed nor helped by volatility and disorder, while the antifragile benefits from them. But it takes some effort for the concept to sink in. A lot of things people call robust or resilient are just robust or resilient, the other half are antifragile.

APPENDIX: THE TRIAD, OR A MAP OF THE WORLD AND THINGS ALONG THE THREE PROPERTIES

Now we aim—after some work—to connect in the reader’s mind, with a single thread, elements seemingly far apart, such as Cato the Elder, Nietzsche, Thales of Miletus, the potency of the system of city-states, the sustainability of artisans, the process of discovery, the onesidedness of opacity, financial derivatives, antibiotic resistance, bottom-up systems, Socrates’ invitation to overrationalize, how to lecture birds, obsessive love, Darwinian evolution, the mathematical concept of Jensen’s inequality, optionality and option theory, the idea of ancestral heuristics, the works of Joseph de Maistre and Edmund Burke, Wittgenstein’s antirationalism, the fraudulent theories of the economics establishment, tinkering and bricolage, terrorism exacerbated by death of its members, an apologia for artisanal societies, the ethical flaws of the middle class, Paleo-style workouts (and nutrition), the idea of medical iatrogenics, the glorious notion of the magnificent (*megalopsychon*), my obsession with the idea of convexity (and my phobia of concavity), the late-2000s banking and economic crisis, the misunderstanding of redundancy, the difference between tourist and flâneur, etc. All in one single—and, I am certain, simple—thread.

How? We can begin by seeing how things—just about anything that matters—can be mapped or classified into three categories, what I call the Triad.

Things Come in Triples

In the Prologue, we saw that the idea is to focus on fragility rather than predicting and calculating future probabilities, and that fragility and antifragility come on a spectrum of varying degrees. The task here is to build a map of exposures. (This is what is called “real-world solution,” though only academics and other non-real-world operators use the expression “real-world solution” instead of simply “solution.”)

The Triad classifies items in three columns along the designation

FRAGILE ROBUST ANTIFRAGILE

Recall that the fragile wants tranquility, the antifragile grows from disorder, and the robust doesn’t care too much. The reader is invited to navigate the Triad to see how the ideas of the book apply across domains. Simply, in a given subject, when you discuss an item or a policy, the task is to find in which category of the Triad one should put it and what to do in order to improve its condition. For example: the centralized nation-state is on the far left of the Triad, squarely in the fragile category, and a decentralized system of city-states on the far right, in the antifragile one. By getting the characteristics of the latter, we can move away from the undesirable fragility of the large state. Or look at errors. On the left, in the fragile category, the mistakes are rare and large when they occur, hence irreversible; to the right the mistakes are small and benign, even reversible and quickly overcome. They are also rich in information. So a certain system of tinkering and trial and error would have the attributes of antifragility. 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.

Or take the health category. Adding is on the left, removing to the right. *Removing* medication, or some other unnatural stressor—say, gluten, fructose, tranquilizers, nail polish, or some such substance—by trial and error is more robust than *adding* medication, with unknown side effects, unknown in spite of the statements about “evidence” and shmevidence.

As the reader can see, the map uninhibitedly spreads across domains and human pursuits, such as culture, health, biology, political systems, technology, urban organization, socioeconomic life, and other matters of more or less direct interest to the reader. I have even

managed to merge decision making and *flâneur* in the same breath. So a simple method would lead us to both a risk-based political philosophy and medical decision-making.

The Triad in Action

Note that fragile and antifragile here are relative terms, not quite absolute properties: one item to the right of the Triad is more antifragile than another to the left. For instance, artisans are more antifragile than small businesses, but a rock star will be more antifragile than any artisan. Debt always puts you on the left, fragilizes economic systems. And things are antifragile up to a certain level of stress. Your body benefits from some amount of mishandling, but up to a point—it would not benefit too much from being thrown down from the top of the Tower of Babel.

The Golden Robust: Further, the *robust* here in the middle column is not equivalent to Aristotle's "golden middle" (commonly mislabeled the "golden mean"), in the way that, say, generosity is the middle between profligacy and stinginess—it can be, but it is not necessarily so. Antifragility is desirable in general, but not always, as there are cases in which antifragility will be costly, extremely so. Further, it is hard to consider robustness as always desirable—to quote Nietzsche, one can die from being immortal.

Finally, by now the reader, grappling with a new word, might ask too much from it. If the designation *antifragile* is rather vague and limited to specific sources of harm or volatility, and up to a certain range of exposure, it is no more and no less so than the designation *fragile*. Antifragility is relative to a given situation. A boxer might be robust, hale when it comes to his physical condition, and might improve from fight to fight, but he can easily be emotionally fragile and break into tears when dumped by his girlfriend. Your grandmother might have opposite qualities, fragile in build but equipped with a strong personality. I remember the following vivid image from the Lebanese civil war: A diminutive old lady, a widow (she was dressed in black), was chastising militiamen from the enemy side for having caused the

shattering of the glass in her window during a battle. They were pointing their guns at her; a single bullet would have terminated her but they were visibly having a bad moment, intimidated and scared by her. She was the opposite of the boxer: physically fragile, but not fragile in character.

Now the Triad.

Click [here](#) for a larger image of this table.

TABLE 1 • THE CENTRAL TRIAD: THREE TYPES OF EXPOSURE			
	FRAGILE	ROBUST	ANTIFRAGILE
<i>Mythology—Greek</i>	Sword of Damocles, Rock of Tantalus	Phoenix	Hydra
<i>Mythology—New York and Brooklyn</i>	Dr. John	Nero Tulip	Fat Tony, Yevgenia Krasnova *
<i>Black Swan</i>	Exposed to negative Black Swans		Exposed to positive Black Swans
<i>Businesses</i>	New York: Banking system		Silicon Valley: "Fail fast," "Be foolish"
<i>Biological & economic systems</i>	Efficiency, optimized	Redundancy	Degeneracy (functional redundancy)
<i>Errors</i>	Hates mistakes	Mistakes are just information	Loves mistakes (since they are small)
<i>Errors</i>	Irreversible, large (but rare) errors, blowups		Produces reversible, small errors
<i>Science/technology</i>	Directed research	Opportunistic research	Stochastic tinkering (antifragile tinkering or bricolage)

<i>Dichotomy event-exposure</i>	Studying events, measuring their risks, statistical properties of events	Studying exposure to events, statistical properties of exposures	Modifying exposure to events
<i>Science</i>	Theory	Phenomenology	Heuristics, practical tricks
<i>Human body</i>	Mollification, atrophy, "aging," sarcopenia	Mithridatization, recovery	Hormesis, hypertrophy
<i>Ways of thinking</i>	Modernity	Medieval Europe	Ancient Mediterranean
<i>Human relationships</i>	Friendship	Kinship	Attraction
<i>Ancient culture (Nietzsche)</i>	Apollonian	Dionysian	Balanced mixture of Apollonian and Dionysian
<i>Ethics</i>	The weak	The magnificent	The strong
<i>Ethics</i>	System without skin in the game	System with skin in the game	System with soul in the game
<i>Regulation</i>	Rules	Principles	Virtue
<i>Systems</i>	Concentrated sources of randomness		Distributed sources of randomness
<i>Mathematics (functional)</i>	Nonlinear-concave, or concave-convex	Linear, or convex-concave	Nonlinear-convex
<i>Mathematics (probability)</i>	Left-skewed (or negative skewed)	Low volatility	Right-skewed (or positive skewed)
<i>Option Trading</i>	Short volatility, gamma, vega	Flat volatility	Long volatility, "gamma," "vega"
<i>Knowledge</i>	Explicit	Tacit	Tacit with convexity

<i>Epistemology</i>	True-False		Sucker-Nonsucker
<i>Life and thinking</i>	Tourist, personal and intellectual		Flâneur with a large private library
<i>Financial dependence</i>	Corporate employment, Tantalized class	Dentist, dermatologist, niche worker, minimum-wage earner	Taxi driver, artisan, prostitute, f*** you money
<i>Learning</i>	Classroom	Real life, pathemata mathemata	Real life and library
<i>Political systems</i>	Nation-state; centralized		Collection of city-states; decentralized
<i>Social system</i>	Ideology		Mythology
	Post-agricultural modern settlements		Nomadic and hunter-gatherer tribes
<i>Knowledge</i>	Academia	Expertise	Erudition
<i>Science</i>	Theory	Phenomenology	Evidence-based phenomenology
<i>Psychological well-being</i>	Post-traumatic stress		Post-traumatic growth
<i>Decision making</i>	Model-based probabilistic decision making	Heuristic-based decision making	Convex heuristics
<i>Thinkers</i>	Plato, Aristotle, Averroes	Early Stoics, Menodotus of Nicomedia, Popper, Burke, Wittgenstein, John Gray	Roman Stoics, Nietzsche, Nietzsche perhaps Hegel [sublation], Jaspers

<i>Economic life</i>	Econophasters cults	Anthropologists	Religion
<i>Economic life (effect on economic life)</i>	Bureaucrats		Entrepreneurs
<i>Reputation (profession)</i>	Academic, corporate executive, pope, bishop, politician	Postal employee, truck driver, train conductor	Artist, writer
<i>Reputation (class)</i>	Middle class	Minimum-wage persons	Bohemian, aristocracy, old money
<i>Medicine</i>	<i>Via positiva</i> Additive treatment (give medication)		<i>Via negativa</i> Subtractive treatment (remove items from con- sumption, say cigarettes, carbs, etc.)
<i>Philosophy/ science</i>	Rationalism	Empiricism	Skeptical, subtractive empiricism
	Separable		Holistic
<i>Economic life</i>		Owner operated	
<i>Finance</i>	Short option		Long option
<i>Knowledge</i>	Positive science	Negative science	Art
<i>Stress</i>	Chronic stressors		Acute stressors, with recovery
<i>Decision making</i>	Acts of commission		Acts of omission ("missed opportunity")
<i>Literature</i>	E-reader	Book	Oral tradition
<i>Business</i>	Industry	Small business	Artisan
<i>Food</i>	Food companies		Restaurants
<i>Finance</i>	Debt	Equity	Venture capital

<i>Finance</i>	Public debt	Private debt with no bailout	Convertible
<i>General</i>	Large	Small but specialized	Small but not specialized
<i>General</i>	Monomodal		Barbell
<i>Risk taking</i>	Markowitz	Kelly criterion	Kelly criterion using finite bets
<i>Legal system</i>	Statutory law, legal code		Common law, equity
<i>Regulation</i>	Code of regulations		Heuristic regulations
<i>Finance</i>	Banks, hedge funds managed by econophasters	Hedge funds (some)	Hedge funds (some)
<i>Business</i>	Agency problem		Principal operated
<i>Noise-signal</i>	Signal only		Stochastic resonance, simulated annealing
<i>Model error</i>	Concave to errors		Convex to errors
<i>Education</i>	Soccer mom	Street life	Barbell: parental library, street fights
<i>Physical training</i>	Organized sports, gym machines		Street fights
<i>Urbanism</i>	Robert Moses, Le Corbusier		Jane Jacobs

* Dr. John, Nero Tulip, Fat Tony, and Yevgenia Krasnova are characters in *The Black Swan*. Nero Tulip is also a character in *Fooled by Randomness*.

CHAPTER 1

Between Damocles and Hydra

*Please cut my head off—How by some magic, colors become
colors—How to lift weight in Dubai*

HALF OF LIFE HAS NO NAME

You are in the post office about to send a gift, a package full of champagne glasses, to a cousin in Central Siberia. As the package can be damaged during transportation, you would stamp “fragile,” “breakable,” or “handle with care” on it (in red). Now what is the exact opposite of such situation, the exact opposite of “fragile”?

Almost all people answer that the opposite of “fragile” is “robust,” “resilient,” “solid,” or something of the sort. But the resilient, robust (and company) are items that neither break nor improve, so you would not need to write anything on them—have you ever seen a package with “robust” in thick green letters stamped on it? Logically, the exact opposite of a “fragile” parcel would be a package on which one has written “please mishandle” or “please handle carelessly.” Its contents would not just be unbreakable, but would benefit from shocks and a wide array of trauma. The fragile is the package that would be *at best* unharmed, the robust would be *at best* and *at worst* unharmed. And the opposite of fragile is therefore what is *at worst* unharmed.

We gave the appellation “antifragile” to such a package; a neologism was necessary as there is no simple, noncompound word in the *Oxford English Dictionary* that expresses the point of reverse fragility. 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.



FIGURE 1. A package begging for stressors and disorder. Credit: Giotto Enterprise and George Nasr.

To see how alien the concept is to our minds, repeat the experiment and ask around at the next gathering, picnic, or pre-riot congregation what's the antonym of fragile (and specify insistently that you mean the *exact reverse*, something that has opposite properties and payoff). The likely answers will be, aside from robust: unbreakable, solid, well-built, resilient, strong, something-proof (say, waterproof, windproof, rustproof)—unless they've heard of this book. Wrong—and it is not just individuals but branches of knowledge that are confused by it; this is a mistake made in every dictionary of synonyms and antonyms I've found.

Another way to view it: since the opposite of *positive* is *negative*, not *neutral*, the opposite of positive fragility should be negative fragility (hence my appellation “antifragility”), not neutral, which would just convey robustness, strength, and unbreakability. Indeed, when one writes things down mathematically, antifragility is fragility with a negative sign in front of it.^{[1](#)}

This blind spot seems universal. There is no word for “antifragility” in the main known languages, modern, ancient, colloquial, or slang. Even Russian (Soviet version) and Standard Brooklyn English don't seem to have a designation for antifragility, conflating it with robustness.^{[2](#)}

Half of life—the interesting half of life—we don't have a name for.

PLEASE BEHEAD ME

If we have no common name for antifragility, we can find a mythological equivalence, the expression of historical intelligence through potent metaphors. In a Roman recycled version of a Greek myth, the Sicilian tyrant Dionysius II has the fawning courtier Damocles enjoy the luxury of a fancy banquet, but with a sword hanging over his head, tied to the ceiling with a single hair from a horse's tail. A horse's hair is the kind of thing that eventually breaks under pressure, followed by a scene of blood, high-pitched screams, and the equivalent of ancient ambulances. Damocles is fragile—it is only a matter of time before the sword strikes him down.

In another ancient legend, this time the Greek recycling of an ancient Semitic and Egyptian legend, we find Phoenix, the bird with splendid colors. Whenever it is destroyed, it is reborn from its own ashes. It always returns to its initial state. Phoenix happens to be the ancient symbol of Beirut, the city where I grew up. According to legend, Berytus (Beirut's historical name) has been destroyed seven times in its close to five-thousand-year history, and has come back seven times. The story seems cogent, as I myself saw the eighth episode; central Beirut (the ancient part of the city) was completely destroyed for the eighth time during my late childhood, thanks to the brutal civil war. I also saw its eighth rebuilding.

But Beirut was, in its latest version, rebuilt in even better shape than the previous incarnation—and with an interesting irony: the earthquake of A.D. 551 had buried the Roman law school, which was discovered, like a bonus from history, during the reconstruction (with archeologists and real estate developers trading public insults). That's not Phoenix, but something else beyond the robust. Which brings us to the third mythological metaphor: Hydra.

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.

The sword of Damocles represents the side effect of power and success: you cannot rise and rule without facing this continuous danger—someone out there will be actively working to topple you. And like the sword, the danger will be silent, inexorable, and discontinuous. It will fall abruptly after long periods of quiet, perhaps at the very moment one has gotten used to it and forgotten about its existence. Black Swans will be out there to get you as you now have much more to lose, a cost of success (and growth), perhaps an unavoidable penalty of excessive success. At the end, what matters is the strength of the string—not the wealth and power of the dining party. But, luckily, this is an identifiable, measurable, and tractable vulnerability, for those who want to listen. The entire point of the Triad is that in many situations we can measure the strength of the string.

Further, consider how toxic such growth-followed-by-a-fall can be to society, as the fall of the dining guest, in response to the fall of the sword of Damocles, will bring what we now call collateral damage, harming others. For instance, the collapse of a large institution will have effects on society.

Sophistication, a certain brand of sophistication, also brings fragility to Black Swans: as societies gain in complexity, with more and more “cutting edge” sophistication in them, and more and more specialization, they become increasingly vulnerable to collapse. This idea has been brilliantly—and convincingly—adumbrated by the archeologist Joseph Tainter. But it does not have to be so: it is so only for those unwilling to go the extra step and understand the matrix of reality. To counter success, you need a high offsetting dose of robustness, even high doses of antifragility. You want to be Phoenix, or possibly Hydra. Otherwise the sword of Damocles will get you.

On the Necessity of Naming

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. We will have ample discussions of the point particularly with the potent notion of the *apophatic* (what cannot be explicitly said, or directly described, in our current vocabulary); so for now, take this curious phenomenon.

In *Through the Language Glass*, the linguist Guy Deutscher reports that many primitive populations, without being color-blind, have verbal designations for only two or three colors. But when given a simple test, they can successfully match strings to their corresponding colors. They are capable of detecting the differences between the various nuances of the rainbow, but they do not express these in their vocabularies. These populations are culturally, though not biologically, color-blind.

Just as we are intellectually, not organically, antifragility-blind. To see the difference just consider that you need the name “blue” for the construction of a narrative, but not when you engage in action.

It is not well known that many colors we take for granted had no name for a long time, and had no names in the central texts in Western culture. Ancient Mediterranean texts, both Greek and Semitic, also had a reduced vocabulary of a small number of colors polarized around the dark and the light—Homer and his contemporaries were limited to about three or four main colors: black, white, and some indeterminate part of the rainbow, often subsumed as red, or yellow.

I contacted Guy Deutscher. He was extremely generous with his help and pointed out to me that the ancients even lacked words for something as elementary as blue. This absence of the word “blue” in ancient Greek explains the recurring reference by Homer to the “wine-dark sea” (*oinopa ponton*), which has been quite puzzling to readers (including this one).

Interestingly, it was the British Prime Minister William Gladstone who first made this discovery in the 1850s (and was unfairly and thoughtlessly reviled for it by the usual journalists). Gladstone, quite an erudite, wrote, during his interregnum between political positions, an impressive seventeen-hundred-page treatise on Homer. In the last section, Gladstone announced this limitation of color vocabulary, attributing our modern sensitization to many more nuances of color to a cross-generational training of the eye. But regardless of these variations of color in the culture of the time, people were shown to be able to identify the nuances—unless physically color-blind.

Gladstone was impressive in many respects. Aside from his erudition, force of character, respect for the weak, and high level of energy, four very attractive attributes (respect for the weak being, after intellectual courage, the second most attractive quality to this author), he showed remarkable prescience. He figured out what few in his day dared to propose: that the *Iliad* corresponds to a true story (the city of Troy had not been discovered yet). In addition, even more prescient and of great relevance to this book, he was insistent upon a balanced fiscal budget: fiscal deficits have proven to be a prime source of fragility in social and economic systems.

PROTO-ANTIFRAGILITY

There have been names for two starter-antifragility concepts, with two precursor applications that cover some special cases of it. These are mild aspects of antifragility and limited to the medical field. But they are a good way to start.

According to legend, Mithridates IV, king of Pontus in Asia Minor, while hiding after his father's assassination, got himself some protection against poisoning by ingesting sub-lethal doses of toxic material in progressively larger quantities. He later incorporated the process into a complicated religious ritual. But this immunity got him in trouble a bit later as his attempt to take his own life by poisoning failed, "having fortified himself against the drugs of others." So he had to ask for the services of an ally military commander to give him a blow with a sword.

The method named *Antidotum Mithridatium*, celebrated by Celsus, the ancient world's famous doctor, had to be rather fashionable in Rome, since about a century later it brought some complication to the emperor Nero's attempts at matricide. Nero had been obsessed with the idea of killing his mother, Agrippina, who, to make things more colorful, was Caligula's sister (and, even more colorful, was the alleged lover of the philosopher Seneca, more on whom later). But a mother tends to know her son rather well and predict his actions, particularly when he is her only child—and Agrippina knew something about poison, as she might have used the method to kill at least one of her husbands (I said things were quite colorful). So, suspecting that Nero had a contract on her, she got herself Mithridatized against the poisons that would have been available to her son's underlings. Like Mithridates, Agrippina eventually died by more mechanical methods as her son (supposedly) had assassins slay her, thus providing us with the small but meaningful lesson that one cannot be robust against everything. And, two thousand years later, nobody has found a method for us to get "fortified" against swords.

Let us call Mithridatization the result of an exposure to a small dose of a substance that, over time, makes one immune to additional, larger

quantities of it. It is the sort of approach used in vaccination and allergy medicine. It is not quite antifragility, still at the more modest level of robustness, but we are on our way. And we already have a hint that perhaps being deprived of poison makes us fragile and that the road to robustification starts with a modicum of harm.

Now consider a case when the poisonous substance, in some dose, makes you better off overall, one step up from robustness. Hormesis, a word coined by pharmacologists, is when a small dose of a harmful substance is actually beneficial for the organism, acting as medicine. A little bit of an otherwise offending substance, not too much, acts to benefit the organism and make it better overall as it triggers some overreaction. This was not interpreted at the time in the sense of “gains from harm” so much as “harm is dose dependent” or “medicine is dose dependent.” The interest to scientists has been in the nonlinearity of the dose-response.

Hormesis was well known by the ancients (and like the color blue was known but not expressed). But it was only in 1888 that it was first “scientifically” described (though still not given a name) by a German toxicologist, Hugo Schulz, who observed that small doses of poison stimulate the growth of yeast while larger doses cause harm. Some researchers hold that the benefits of vegetables may not be so much in what we call the “vitamins” or some other rationalizing theories (that is, ideas that seem to make sense in narrative form but have not been subjected to rigorous empirical testing), but in the following: plants protect themselves from harm and fend off predators with poisonous substances that, ingested by us in the right quantities, may stimulate our organisms—or so goes the story. Again, limited, low-dose poisoning triggers healthy benefits.

Many claim that caloric restriction (permanent or episodic) activates healthy reactions and switches that, among other benefits, lengthen life expectancy in laboratory animals. We humans live too long for researchers to test if such restriction increases our life expectancy (if the hypothesis is true, then the subjects of the test would outlive the researchers). But it looks like such restriction makes humans healthier (and may also improve their sense of humor). But since abundance would bring the opposite effect, this episodic caloric restriction can be also interpreted as follows: too much regular food is bad for you, and depriving humans of the stressor of hunger may make them live less than their full potential; so all hormesis seems to be doing is

reestablishing the natural dosage for food and hunger in humans. In other words, hormesis is the norm, and its absence is what hurts us.

Hormesis lost some scientific respect, interest, and practice after the 1930s because some people mistakenly associated it with homeopathy. The association was unfair, as the mechanisms are extremely different. Homeopathy is based on other principles, such as the one that minute, highly diluted parts of the agents of a disease (so small they can hardly be perceptible, hence cannot cause hormesis) can help cure us of the disease itself. Homeopathy has shown little empirical backing and because of its testing methodologies belongs today to alternative medicine, while hormesis, as a phenomenon, has ample scientific evidence to back it up.

But the larger point is that we can now see that depriving systems of stressors, vital stressors, is not necessarily a good thing, and can be downright harmful.

DOMAIN INDEPENDENCE IS DOMAIN DEPENDENT

This idea that systems may need some stress and agitation has been missed by those who grasp it in one area and not in another. 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.

I had a vivid illustration of domain dependence in the driveway of a hotel in the pseudocity of Dubai. A fellow who looked like a banker had a uniformed porter carry his luggage (I can instantly tell if someone is a certain type of banker with minimal cues as I have physical allergies to them, even affecting my breathing). About fifteen minutes later I saw the banker lifting free weights at the gym, trying to replicate natural exercises using kettlebells as if he were swinging a suitcase. Domain dependence is pervasive.

Further, the problem is not just that Mithridatization and hormesis can be known in (some) medical circles and missed in other applications such as socioeconomic life. Even within medicine, some get it here and miss it there. The same doctor might recommend exercise so you “get tougher,” and a few minutes later write a prescription for antibiotics in response to a trivial infection so you “don’t get sick.”

Another expression of domain dependence: ask a U.S. citizen if some semi-governmental agency with a great deal of independence (and no interference from Congress) should control the price of cars, morning newspapers, and Malbec wine, as its domain of specialty. He would jump in anger, as it appears to violate every principle the country stands for, and call you a Communist post-Soviet mole for even suggesting it. OK. Then ask him if that same government agency should control foreign exchange, mainly the rate of the dollar against the euro and the Mongolian tugrit. Same reaction: this is not France.

Then very gently point out to him that the Federal Reserve Bank of the United States is in the business of controlling and managing the price of another good, another price, called the lending rate, the interest rate in the economy (and has proved to be good at it). The libertarian presidential candidate Ron Paul was called a crank for suggesting the abolition of the Federal Reserve, or even restricting its role. But he would also have been called a crank for suggesting the creation of an agency to control other prices.

Imagine someone gifted in learning languages but unable to transfer concepts from one tongue to another, so he would need to relearn “chair” or “love” or “apple pie” every time he acquires a new language. He would not recognize “house” (English) or “casa” (Spanish) or “byt” (Semitic). We are all, in a way, similarly handicapped, unable to recognize the same idea when it is presented in a different context. It is as if we are doomed to be deceived by the most superficial part of things, the packaging, the gift wrapping. This is why we don’t see antifragility in places that are obvious, too obvious. It is not part of the accepted way of thinking about success, economic growth, or innovation that these may result only from overcompensation against stressors. Nor do we see this overcompensation at work elsewhere. (And domain dependence is also why it has been difficult for many researchers to realize that uncertainty, incomplete understanding, disorder, and volatility are members of the same close family.)

This lack of translation is a mental handicap that comes with being a human; and we will only start to attain wisdom or rationality when we make an effort to overcome and break through it.

Let us get deeper into overcompensation.

¹ Just as concavity is convexity with a negative sign in front of it and is sometimes called anticonvexity.

² I checked in addition to Brooklyn English most Indo-European languages, both ancient (Latin, Greek) and modern branches: Romance (Italian, French, Spanish, Portuguese), Slavic (Russian, Polish, Serbian, Croatian), Germanic (German, Dutch, Afrikaans), and Indo-Iranian (Hindi, Urdu, Farsi). It is also absent from non-Indo-European families such as Semitic (Arabic, Hebrew, Aramaic) and Turkic (Turkish).