# Venice Lecture on Fragility and Antifragility


### Introduction

We will be able to detect fragility and model error with a simple heuristic

Heuristics are central tools: a complicated world requires simple solutions

What is complexity?

### Definitions: The Triad

How to (not) predict and make prophecies

What is the opposite of fragile?

Hydra like properties

Why Black Swan "robust" is certainly not sufficient

Robustness, fragility, and antifragility

### DEFINING FRAGILITY

Second order effects matter —ignore the first

The linear breaks from cumulative, the nonlinear from shocks

Story of the grandmother

Story of the king from *Midrash Tehillim*

The convex, the linear, and the concave (negatively convex)

Jensen's inequality

Two types of probability distributions.

The turkey problem

Definition of tail exposures

The heuristic

### TRANSFER OF FRAGILITY & ETHICS

Hammurabi's solution, 3800 years old (at least)

Why solutions are always in the past —neomania

The agency problem and tail exposures

Case of banks

Case of the stock market

Defects inherent in regulation—any regulation

### ROBUSTNESS, RISK AND REDUNDANCY

Redundancy as free option

Definition of the Barbell

Why size makes you weak —but not always

Why decentralization works

Why Italy is an ideal state *thanks* to the weak government

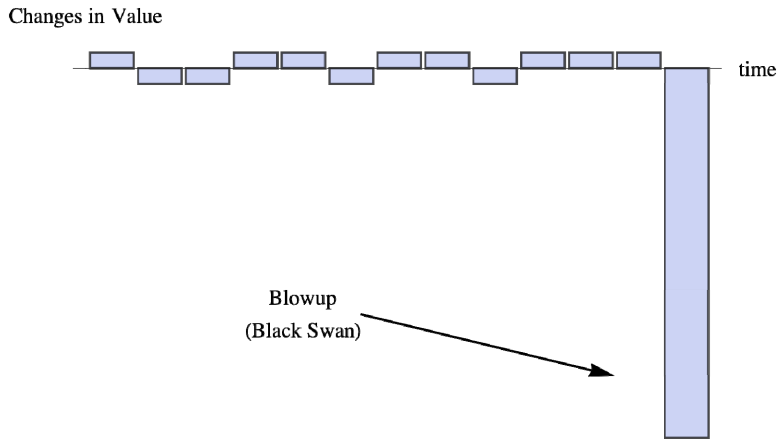


*Figure 1 Fragile variations through time. A representative series. The horizontal axis shows time. This can apply to anything, a health indicator, changes in wealth, your happiness, etc. We can see small (or no) benefits and variations most of the time and occasional large adverse outcomes. Uncertainty can hit in a rather hard way. Notice that the loss can occur at any time and exceed the previous cumulative gains.*

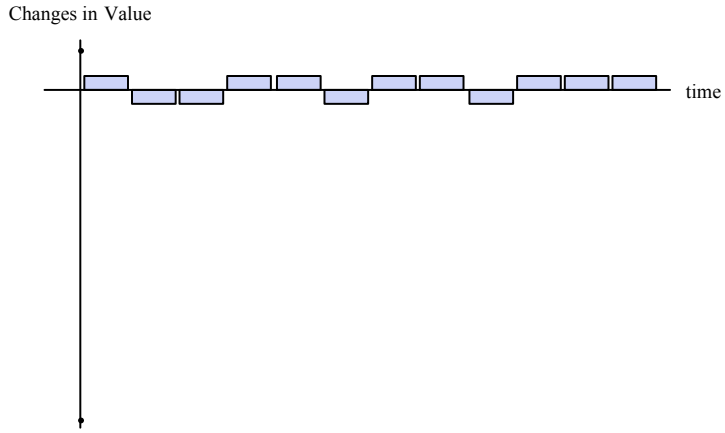


*Figure 2- the Just Robust (but not antifragile)- It experiences small or no variations through time. Never large ones.*

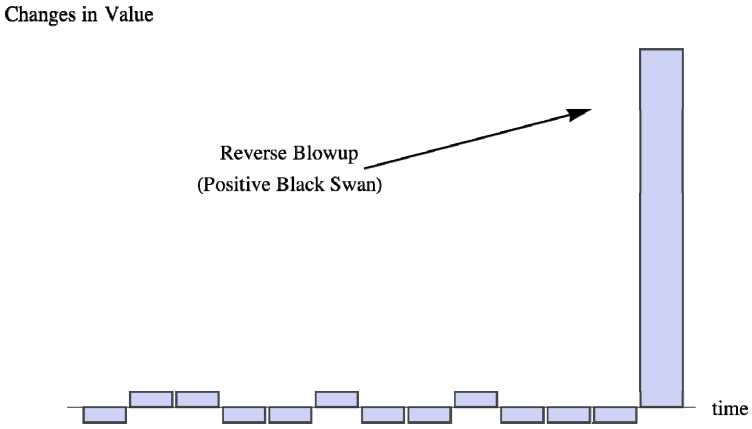


*Figure 3 The antifragile system: uncertainty benefits a lot more than it hurts—the exact opposite of Figure 2.*

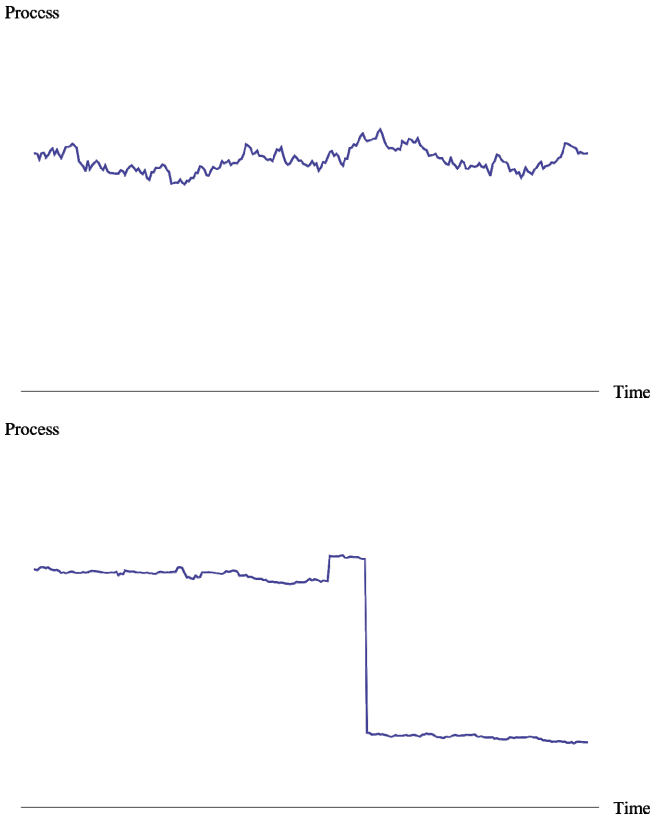


*Figure 4- Comparison between noisy systems (top) and pseudo-stabilized ones (at bottom). Overintervening to stabilize causes a switch from one to the other*

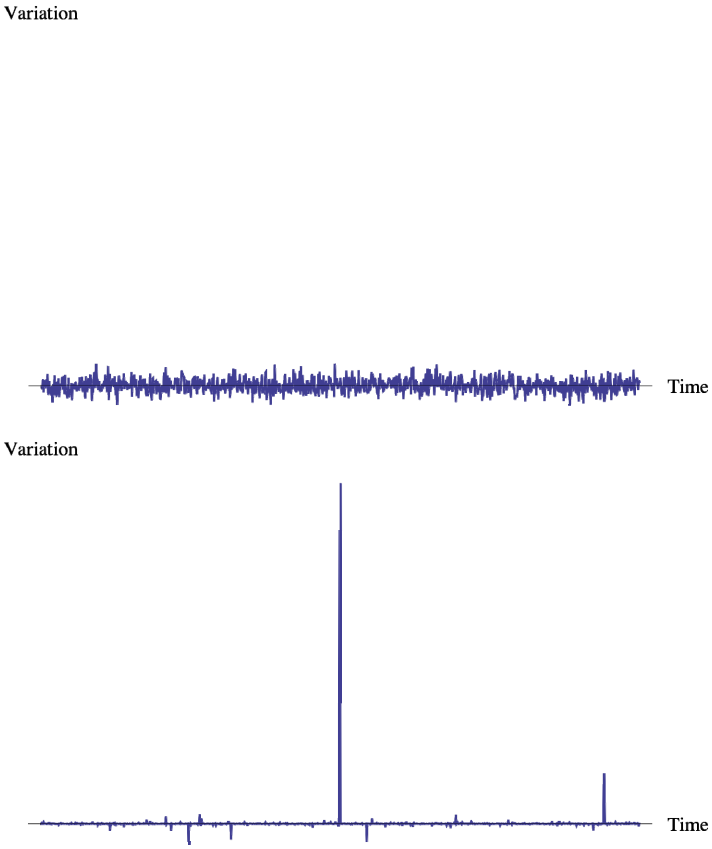


*Figure 5 –Another way to view the difference between Mediocristan (thin tails) and Extremistan (fat tails). The top and bottom graphs have about the same total variations, except that the bottom one has "hot and cold", or "when it rains it pours" properties, while the top graph has continuous volatility.*

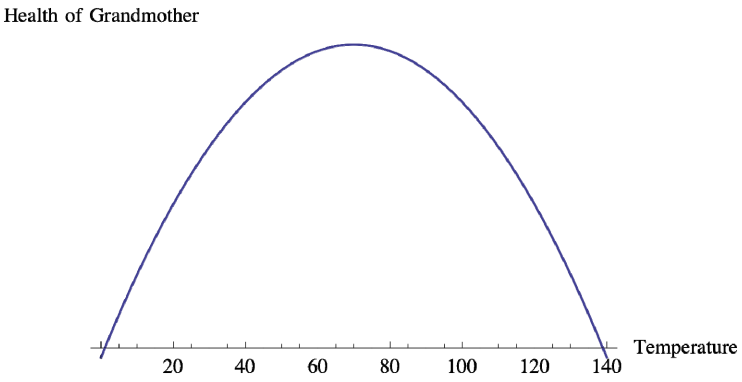


*Figure 6* ***Fragility****: Health as a function of temperature curves inward. A combination of 0 and 140 degrees (F) is worse for your grandmother's health than just 70 degrees. In fact almost* ***any*** *combination averaging 70 degrees is worse than just 70 degrees. This is a definition of negative convexity effects.*

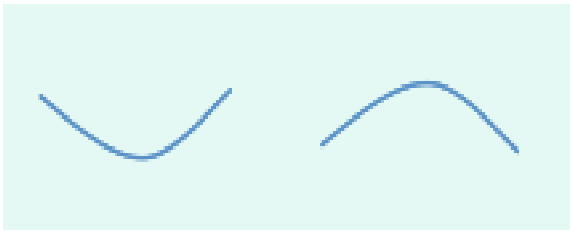

*Figure 7 The different types of nonlinearities. The convex (left) and the concave (right). The convex curves outward, the concave inward.*

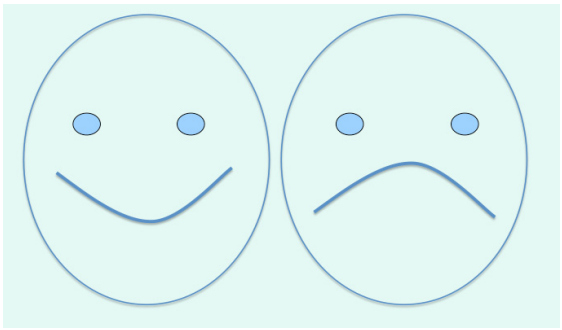

Figure 8 *A better way to understand convexity and concavity. What curves inwards looks like a smile —and what curves outwards makes a sad face. The convex (left) is antifragile, the concave (right) is fragile (has negative convexity effects).*

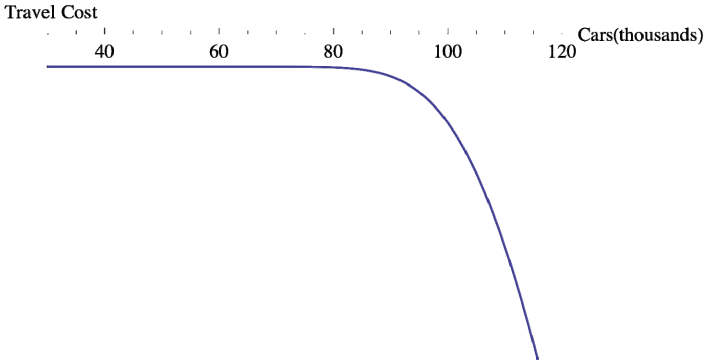


*Figure 9- Traffic is fragile —dispersion matters more than the average. The graph (vertical) shows how the author's travel time (and travel costs) to JFK depend, beyond a certain point, nonlinearly on the number of cars. We show travel costs as curving inward, just as in the grandmother's graph.*

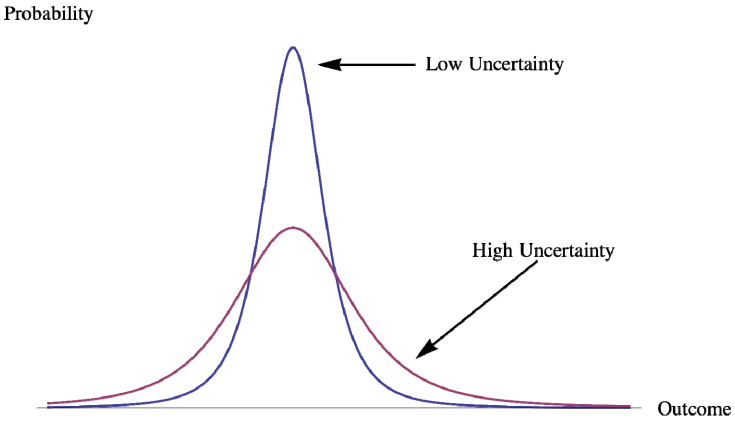


*Figure 10- Case 1, the Symmetric. Injecting uncertainty in the system makes us move from one bell-shape —the first, with narrow possible spate of outcomes—to the second, a lower peak but more spread out. So it causes an increase of both positive and negative surprises, both positive and negative Black Swans.*

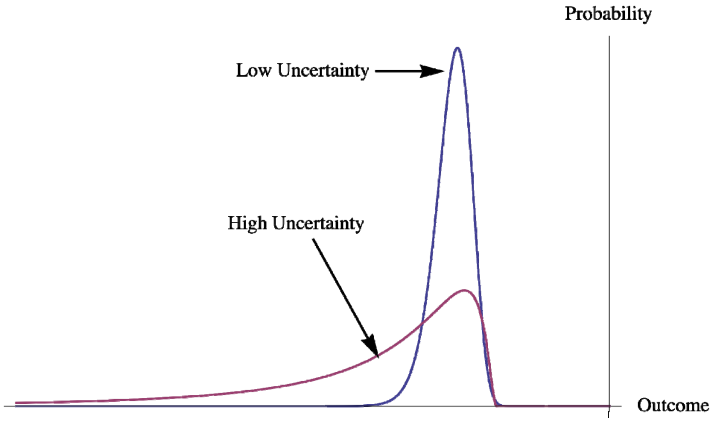


*Figure 11- Case 2, Limited gains, larger losses. Fragile, prone to negative asymmetries, negative convexity effects (for example, projects). Increasing uncertainty in the system causes an augmentation of mostly (sometimes only) negative outcomes, just negative Black Swans.*

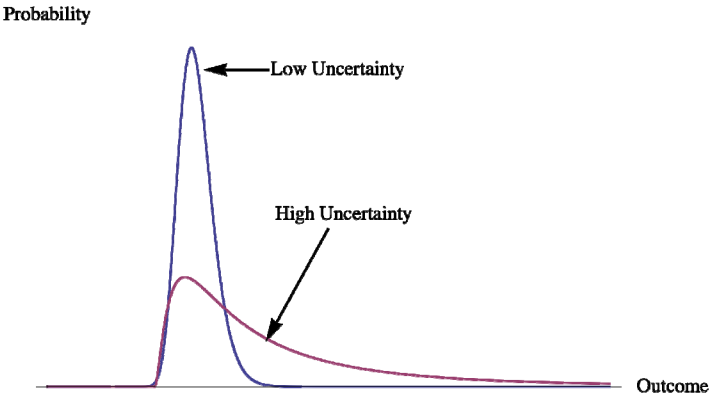


*Figure 12- Case 3, Limited losses, unlimited benefits. Antifragile, prone to positive asymmetries, positive convexity effects. Increasing randomness and uncertainty in the system raise the probability of very favorable*

*outcomes, and accordingly expands the expected payoff. Note that it is the EXACT opposite of figure x {previous}, which means that discovery is, mathematically, exactly like an anti-airplane delay.*

**APPENDIX: The Triad**

*Table 1 The Triad*

| | FRAGILE | ROBUST | ANTI FRAGILE |
|---|---|---|---|
| **Mythology -Greek** | Sword of Damocles, Rock of Tantalus | Phoenix | Hydra |
| **Black Swan** | Exposed to negative Black Swans | | Exposed to positive Black Swans |
| **Ways of Thinking** | Modernity | Medieval Europe | Ancient Mediterranean |
| **Ethics** | The weak | The magnificent | The strong |
| **Mathematics (functional)** | Nonlinear-Concave | Linear | Nonlinear-Convex |
| **Mathematics (probability)** | Left-Skewed (or negative skewed) | Low volatility | Righ-Skewed (or positive skewed) |
| **Knowledge** | Explicit | Tacit | Tacit with convexity |
| **Epistemology** | True-False | | Sucker-Nonsucker |
| **Life and Thinking** | Tourist Personal and intellectual | | Flâneur with a large private library |
| **Financial dependence** | Corporate employment | Niche worker, minimum wage earner | F** you money |
| **Biological & Economic Systems** | Efficiency | Redundancy | Degeneracy (functional redundancy) |
| **Science/Technology** | Directed Research | Opportunistic research | Aggressive Tinkering (convex bricolage) |
| **Errors** | Hates mistakes | Mistakes are just information | Loves mistakes |
| **Ancient Culture (Nietzsche)** | Apollonian | Dionysian | Mixture of Apollonian and Dionysian |
| **Learning** | Classroom | Real life, *pathemata mathemata* | Real life and library |
| **Human Body** | Mollification, atrophy, "aging", sarcopenia | Recovery | Hypertrophy, Hormesis, Mithridatism |
| **Political Systems** | Nation-State; Centralized | | City-State; Decentralized |
| | Post-agricultural | | Nomadic and hunter- |

| | FRAGILE | ROBUST | ANTI FRAGILE |
|---|---|---|---|
| | Modern Settlements | | gatherer tribes |
| **Knowledge** | Academia | Expertise | Erudition |
| **Decision Making** | Model-based probabilistic decision making | Heuristic-based decision making | Convex heuristics |
| **Thinkers** | Plato, Aristotle, Averroes | Menodotus, Popper, Hayek, Nietzsche, Wittgenstein, John Gray | Nobody comes to mind explicitly, perhaps Hegel's *sublation* |
| **Economic Life** | Economists | Anthropologists | Religion |
| **Economic Life** | Bureaucrats | | Entrepreneurs |
| **Reputation (profession)** | Academic, Corporate executive, Pope, Bishop, Politician | Postal employee, Truck driver, train conductor | Artist, Writer |
| **Reputation (class)** | Middle Class | Minimum wage persons | Bohemian, aristocracy, old money |
| **Medicine** | Additive treatment (give medication) | | Subtractive treatment (remove items from consumption, say carbs, etc.) |
| **Philosophy/Science** | Rationalism | Empiricism | Skeptical, subtractive empiricism |
| | Separable | | Holistic |
| **Economic Life** | | Owner operated | |
| **Finance** | Short Option | | Long Option |
| **Knowledge** | Positive Science | Negative Science | Art |
| **Stress** | Chronic stressors | | Acute stressors |
| **Decision Making** | Acts of commission | | Acts of omission ("missed opportunity") |
| **Literature** | E-Reader | Book | Oral Tradition |
| **Business** | Industry | Small Business | Artisan |
| **Food** | Food Companies | | Restaurants |
| **Finance** | Debt | Equity | Venture Capital |
| **Finance** | Public Debt | Private debt with no bailout | Convertible |
| **General** | Large | Small but specialized | Small but not specialized |
| **General** | Monomodal | | Barbell |

| | FRAGILE | ROBUST | ANTI FRAGILE |
|---|---|---|---|
| | | | |
| **Legal System** | Statutory law, Legal Code | | Common Law, equity |
| **Regulation** | Code of regulations | | Heuristic regulations |
| **Finance** | Banks, Hedge funds managed by economists. | Hedge Funds (some) | Hedge Funds (some) |
| **Business** | Agency Problem | | Principal Operated |
| **Noise-Signal** | Signal only | | Stochastic resonance |
| **Education** | Soccer mom | | Barbell: Parental library, street fights |
| **Physical Activities** | Organized sports. gym machines | | Street fights |
| **Urbanism** | Robert Moses, Le Corbusier | | Jane Jacobs |

### *ANTIFRAGILITY* BOOK COVER

In *The Black Swan* Taleb outlined a problem, in *Antifragility* he offers a definitive solution: how to gain from disorder and chaos and while being protected from fragilities and adverse events. For what he calls the "antifragile" is one step beyond robust, as it benefits from adversity, uncertainty and stressors, just as human bones get stronger when subjected to stress and tension.

Taleb stands uncertainty on its head, making it desirable, and proposing that things be built in an *antifragile* manner. Extremely ambitious and multidisciplinary, *Antifragility* provides a blueprint of how to behave —and thrive— in a world we don't understand and too uncertain for us to even try to understand. He who is not antifragile will perish. Why is the city state better than the nation state, why is debt bad for you, and why is everything modern bound to fail? The book spans innovation by trial and error, health, biology, medicine, life decisions, politics, foreign policy, urban planning, war, personal finance, and economic systems. But, most of all, in the middle of his indictment of modernism, the voice and recipes of the ancient wisdom from Phoenician, Roman, Greek, and Medieval sources is heard loud of clear..