

Schedule for Case Study Presentations

Class 24, April 15, 2019:

- Amanda Devleeschower: Degradation of Mangroves
- Charles Schoonover: Loss of Ecosystem Services of Wetlands
- Tyler French: Extinction of Species

Class 25, April 17, 2019:

- Amy Perez: Sargassum.
- Anthony DeSocio: Population growth and sustainability
- Jessie Lyman: Pollution

Class 26, April 22, 2019:

- Lexi Watson: Plastic Pollution in the Ocean.
- Tasneem Abdur-Rahman: Landfills and Sea Level Rise
- James McCann: Impacts of sea level rise and climate change on the Back Bay National Wildlife Refuge.

Class 27, April 24, 2019:

- Elton Van Buskirk: Invasive Species.
- Zihrije Bohanan: Lionfish
- Dennis Long: Sustainable Cities

Mitigation and Adaptation Studies

Class 23: Developing Options: Mitigating the Degradation of Earth's Life-Support System

Contents

- Sustainability and Policy Making
- Making Choices between Options
- Adaptation to Sea Level Rise
- Accounting for Extremes
- Accounting for Slow Changes
- Coping with Risk and Uncertainty
- Systemic changes versus system improvements
- Change by design

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Planning is impacted by social construct of risk and vulnerability:

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Planning is impacted by social construct of risk and vulnerability:

North Sea countries:

- general perception (based on 2,000 years of cultural heritage): vulnerability to, and risk associated with storm surges is very high and a national/regional problem;
- approach to extreme events:
there is a 1% chance that the 1 in 10,000 years flood happens in this century.
- Approach to SLR: What is the maximum SLR in the 21st century that cannot be excluded?

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- Approach to SLR: What is the maximum SLR in the 21st century that cannot be excluded?

United States:

- general perception: vulnerability to, and risk associated with storm surges is more a local problem and can be addressed ad hoc by (horizontal) evacuation;
- approach to extreme events: there is a 1% chance that the 1 in 100 years flood happens in this year.
- Approach to SLR: What curve should we choose? Definitely not the maximum SLR in the 21st century that cannot be excluded!

Knowing the “worst case:” worst case scenarios almost always fall short of reality

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Paradigm shifts:

- identifying the vulnerabilities and comprehensively assessing the risks
- understanding the worst cases (food, water, heat waves, droughts, storms, sicknesses, social unrest, wars, ...)
- increasing preparedness and general resilience
- having early warning (for extreme events and rapid impacts)

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Preparing for surprises

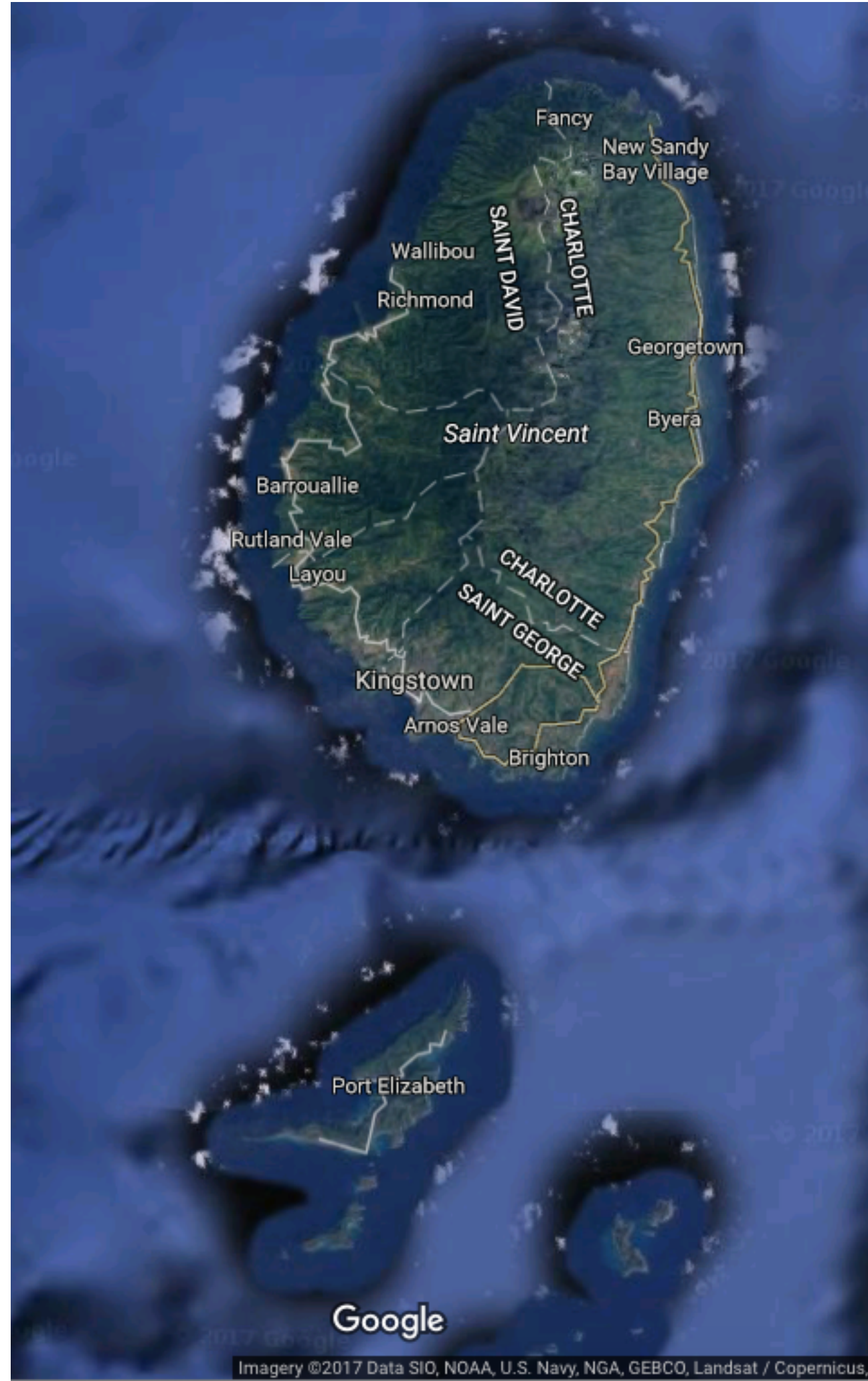
Accounting for Extremes

Preparing for Surprises: Extreme flood in Gauteng, South Africa, November 10-11, 2016

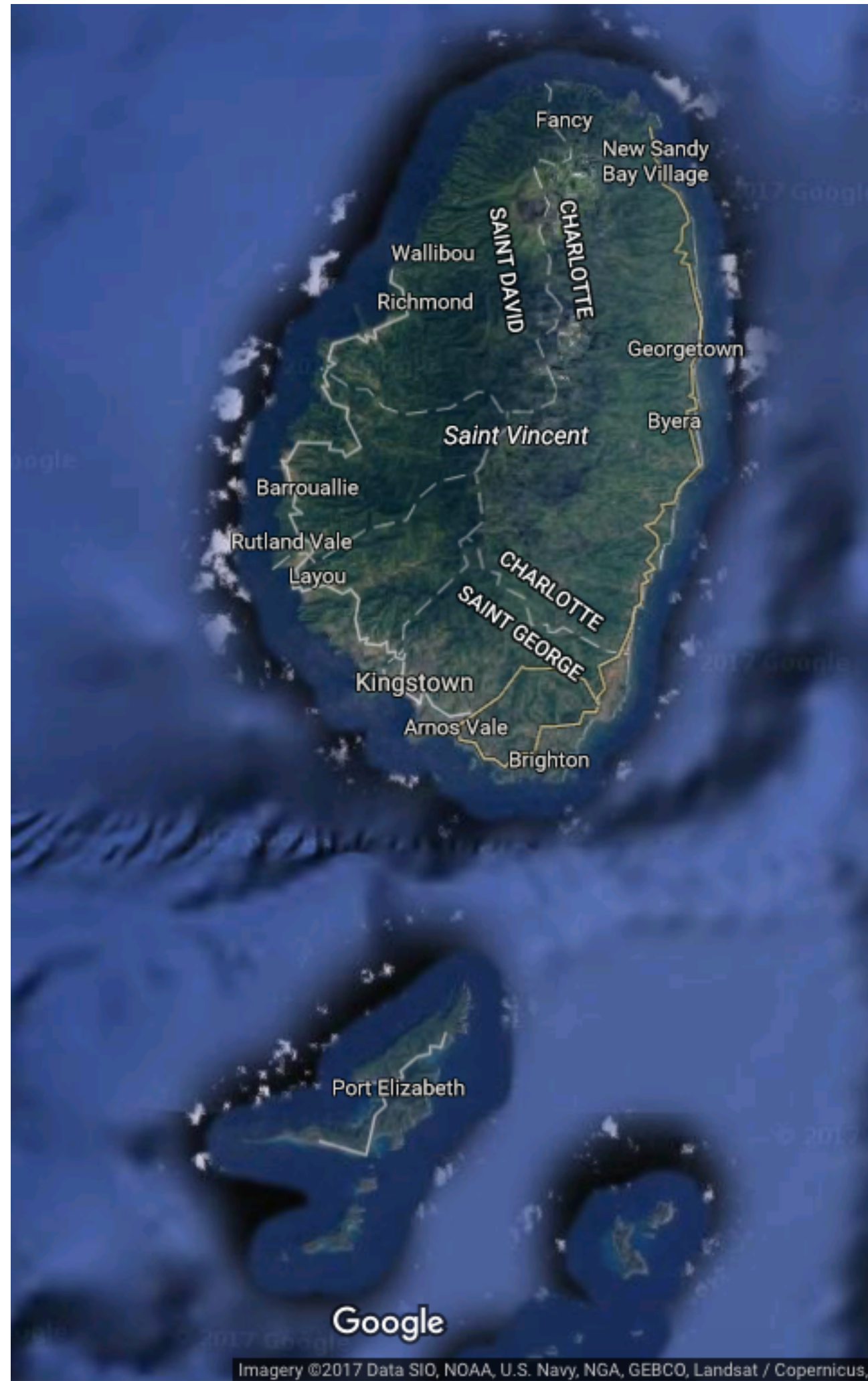


Accounting for Extremes

St Vincent and the Grenadines: Preparing for surprises



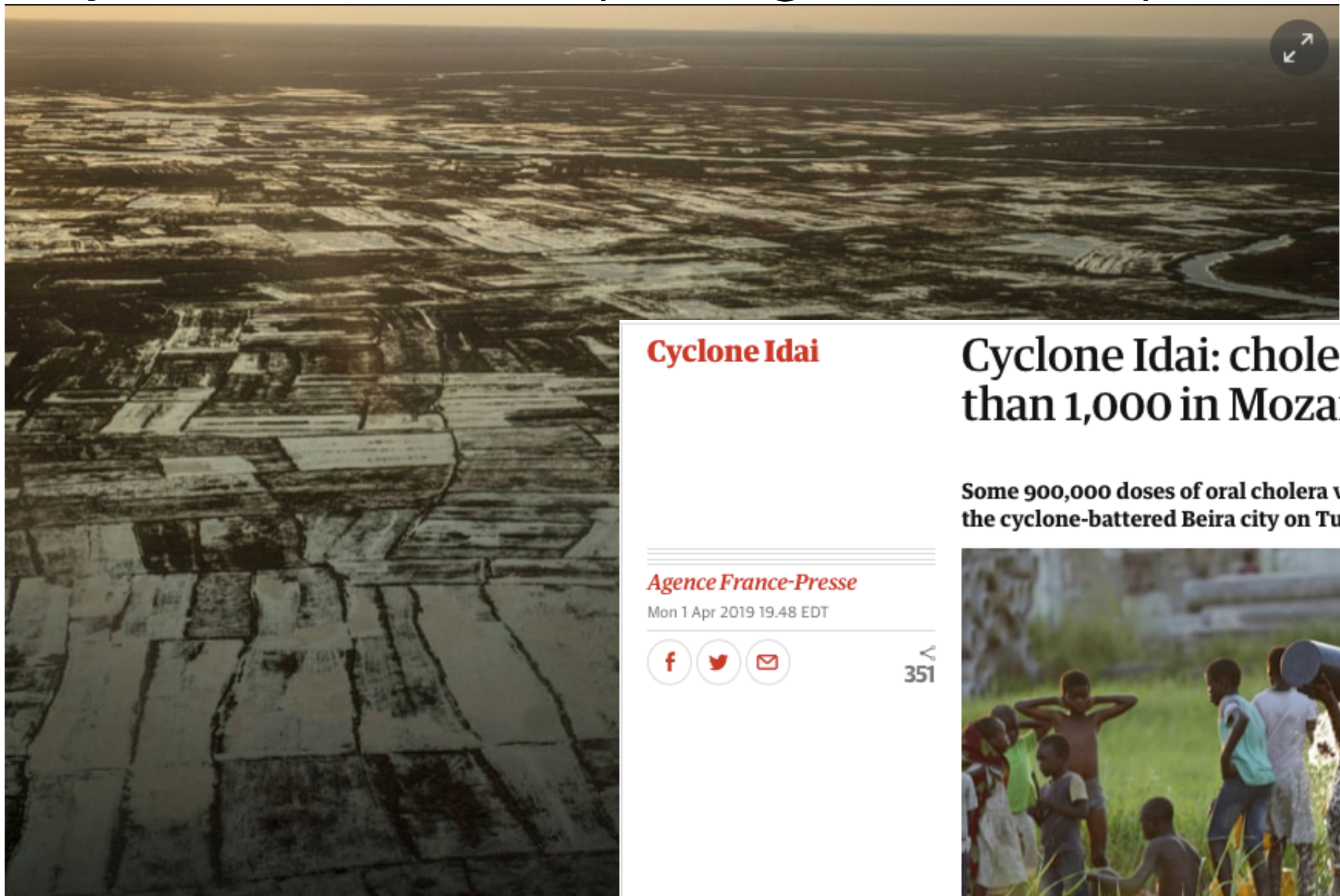
St Vincent and the Grenadines: Preparing for surprises



- Carry out high-resolution LIDAR survey
- Identify possible flood zones and landslide areas under extreme events
- Advice/regulate new constructions to be in safe areas

Accounting for Extremes

Cyclone Idai: Preparing for the impacts



Cyclone Idai

Cyclone Idai: cholera cases rise to more than 1,000 in Mozambique

Some 900,000 doses of oral cholera vaccines were due to arrive in the cyclone-battered Beira city on Tuesday

Agence France-Presse

Mon 1 Apr 2019 19:48 EDT



351



▲ People wash at a watering point in Beira, Mozambique, in the wake of Cyclone Idai. Photog Mukwazhi/AP

Cholera has infected at least 1,052 people in Mozambique's cycl the health ministry said on Monday in a new report, marking a increase from 139 cases reported four days ago.

The new data represents on average more than 200 cases of new each day.



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Inequality and development

Why were the people worst affected by Cyclone Idai so badly prepared?

Antonio Matimbe

Global development is supported by

BILL & MELINDA GATES foundation

About this content

Antonio Matimbe works for World Vision Mozambique

Wed 3 Apr 2019 02:00 EDT



256



Cyclone Idai: 3 million in urgent need

In Mozambique, Malawi, and Zimbabwe, at least 3 million people have been affected by Cyclone Idai. When emergencies happen, the world turns to WFP. The agency oversees the delivery of all food, supplies and staff for the entire aid community during times of crisis.

SECOND EDITION

WITH A NEW SECTION: "ON ROBUSTNESS & FRAGILITY"

NEW YORK TIMES BESTSELLER

THE BLACK SWAN

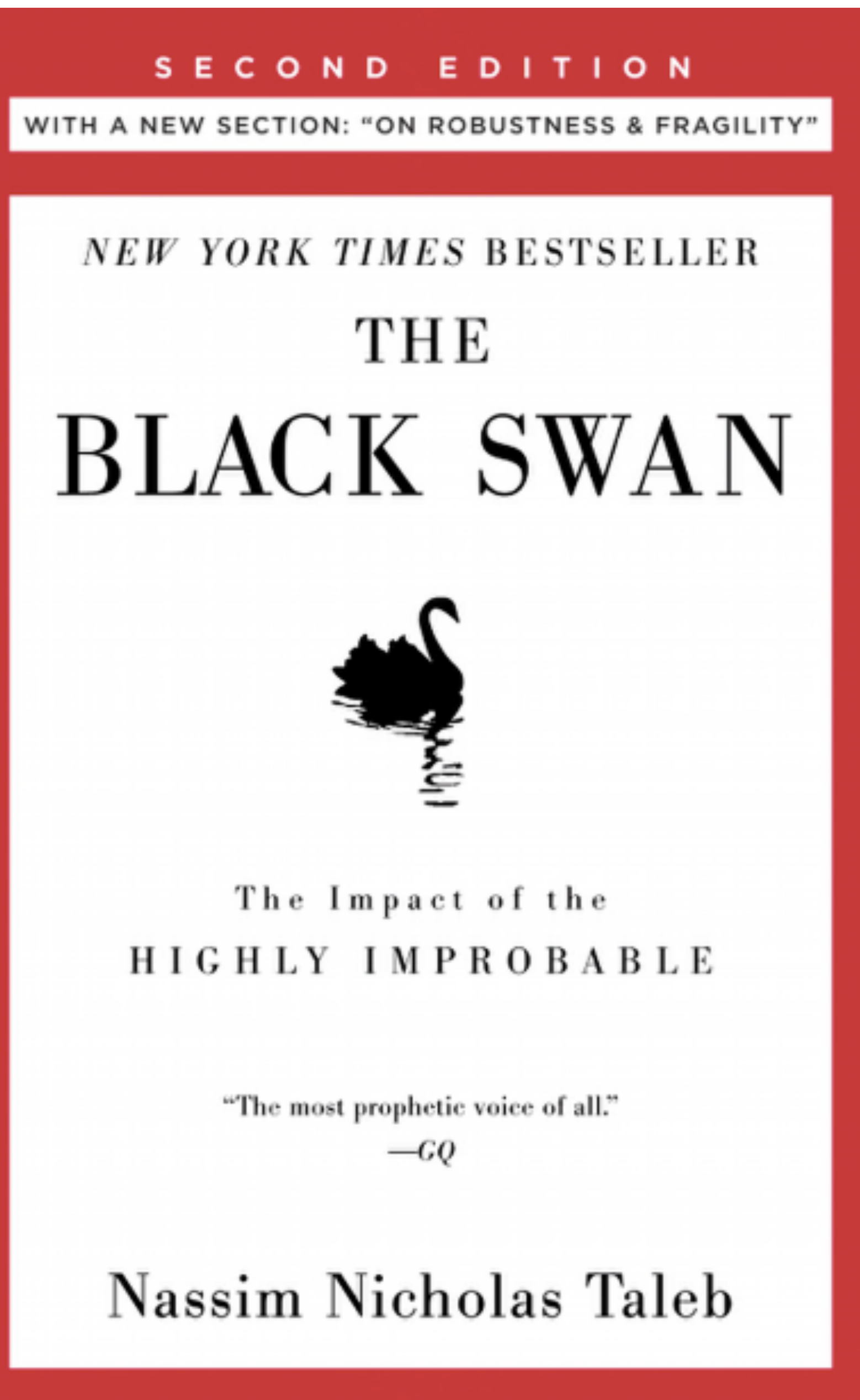


The Impact of the
HIGHLY IMPROBABLE

"The most prophetic voice of all."

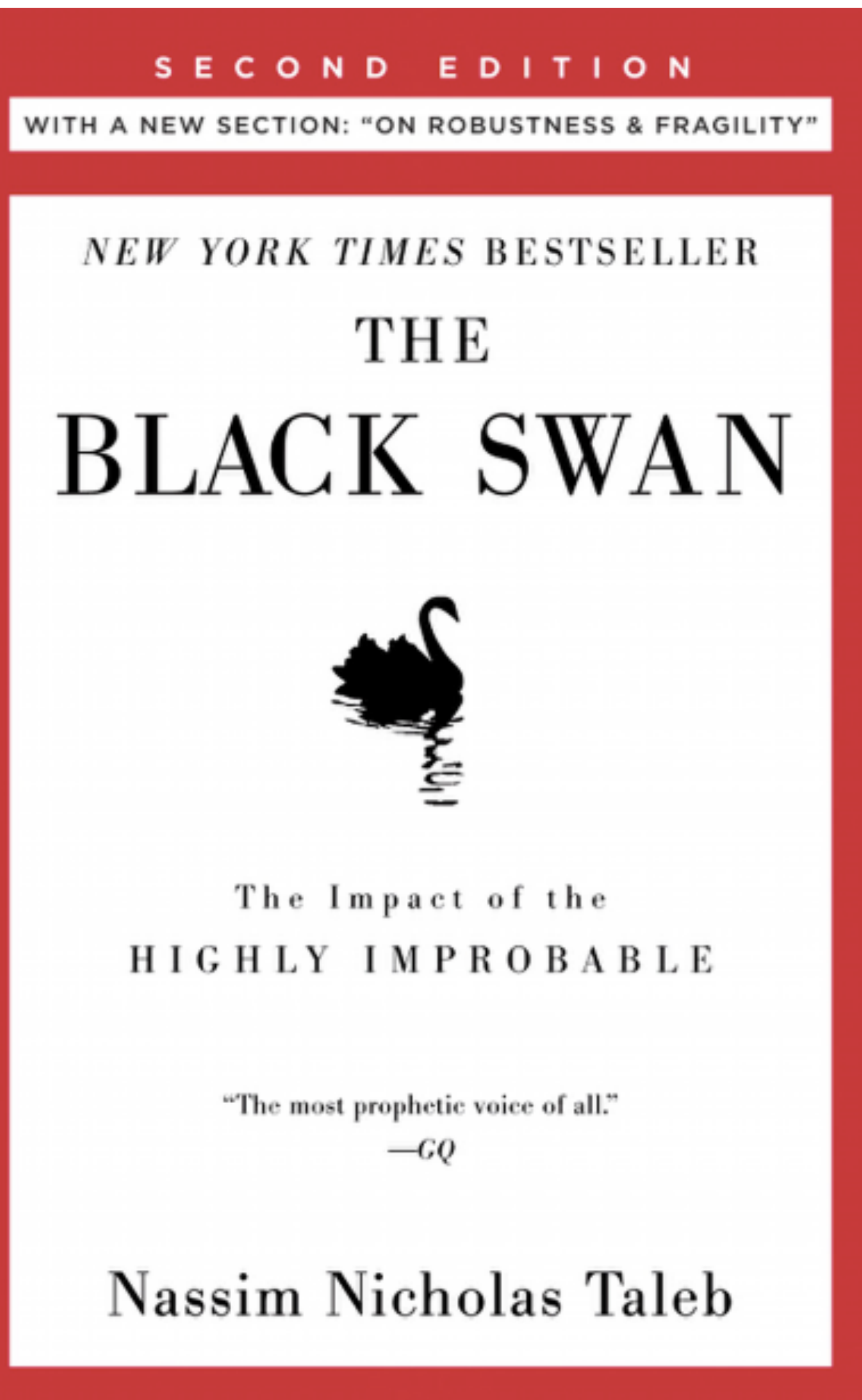
—GQ

Nassim Nicholas Taleb



Black Swan (and capitalize it) is an event with the following three attributes:

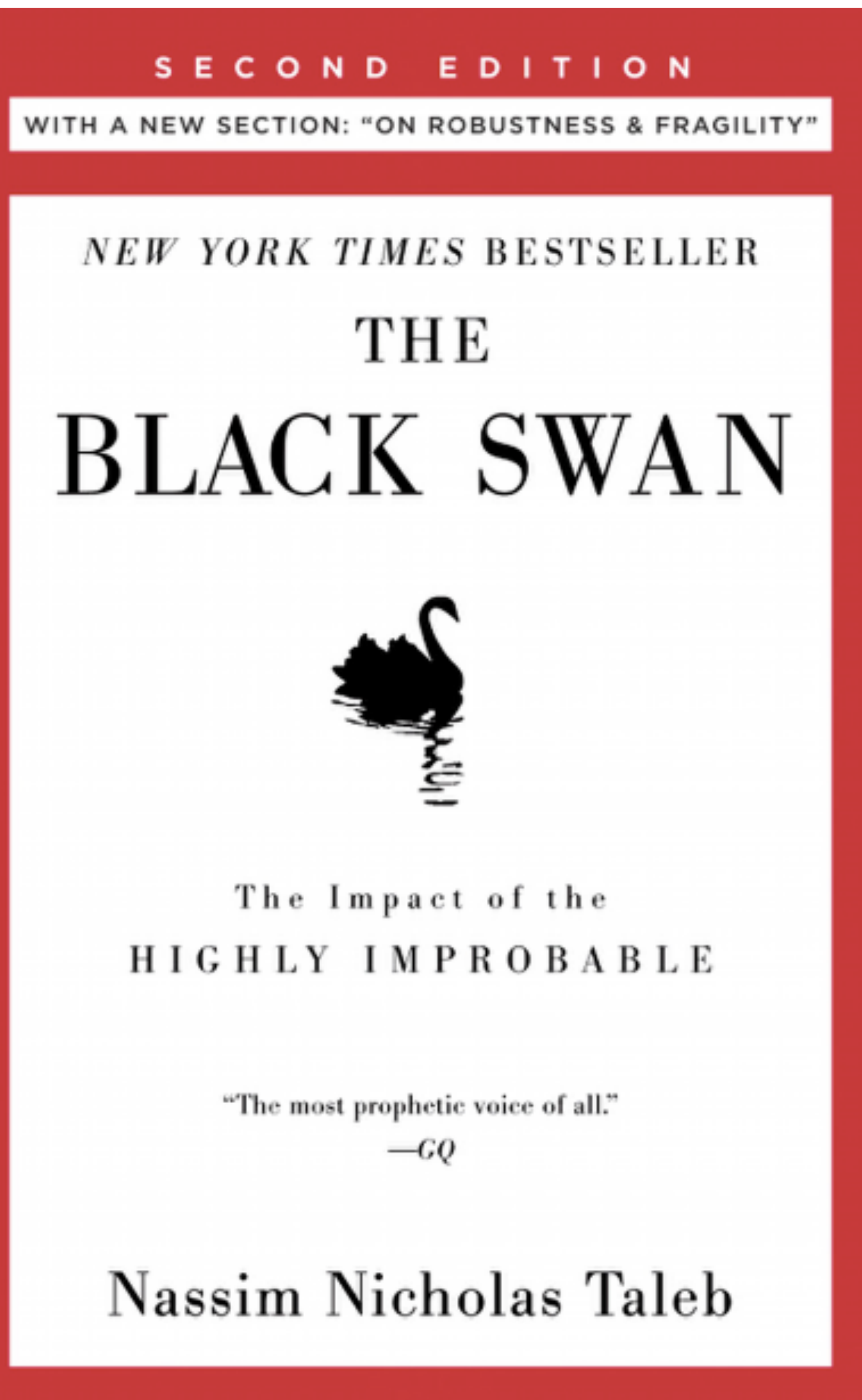
- First, it is an outlier, as it lies outside the realm of regular expectations, because nothing in the past can convincingly point to its possibility.
- Second, it carries an extreme impact (unlike the bird).
- Third, in spite of its outlier status, human nature makes us concoct explanations for its occurrence after the fact, making it explainable and predictable.



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Black Swan logic makes what you don't know far more relevant than what you do know.*

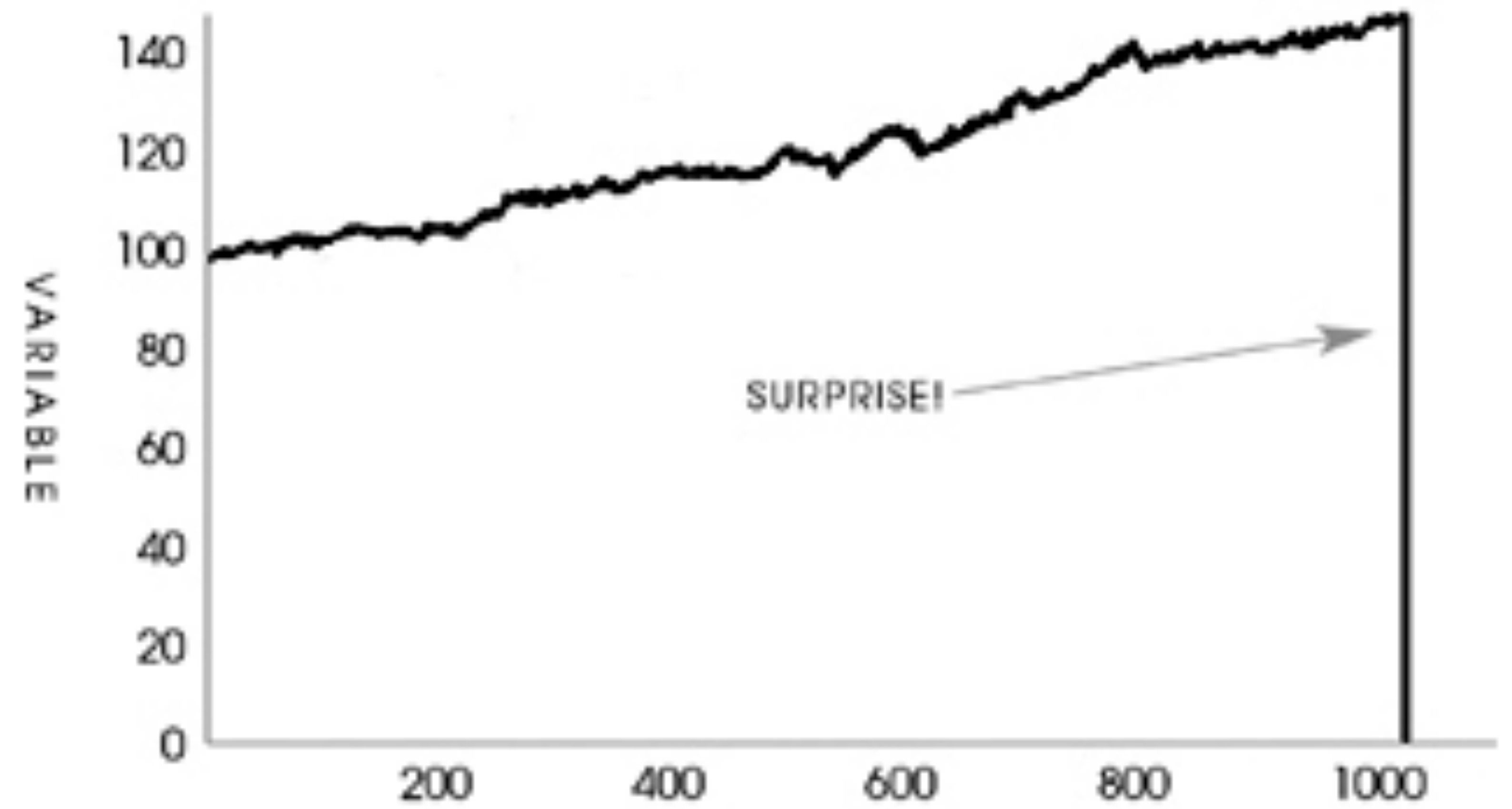
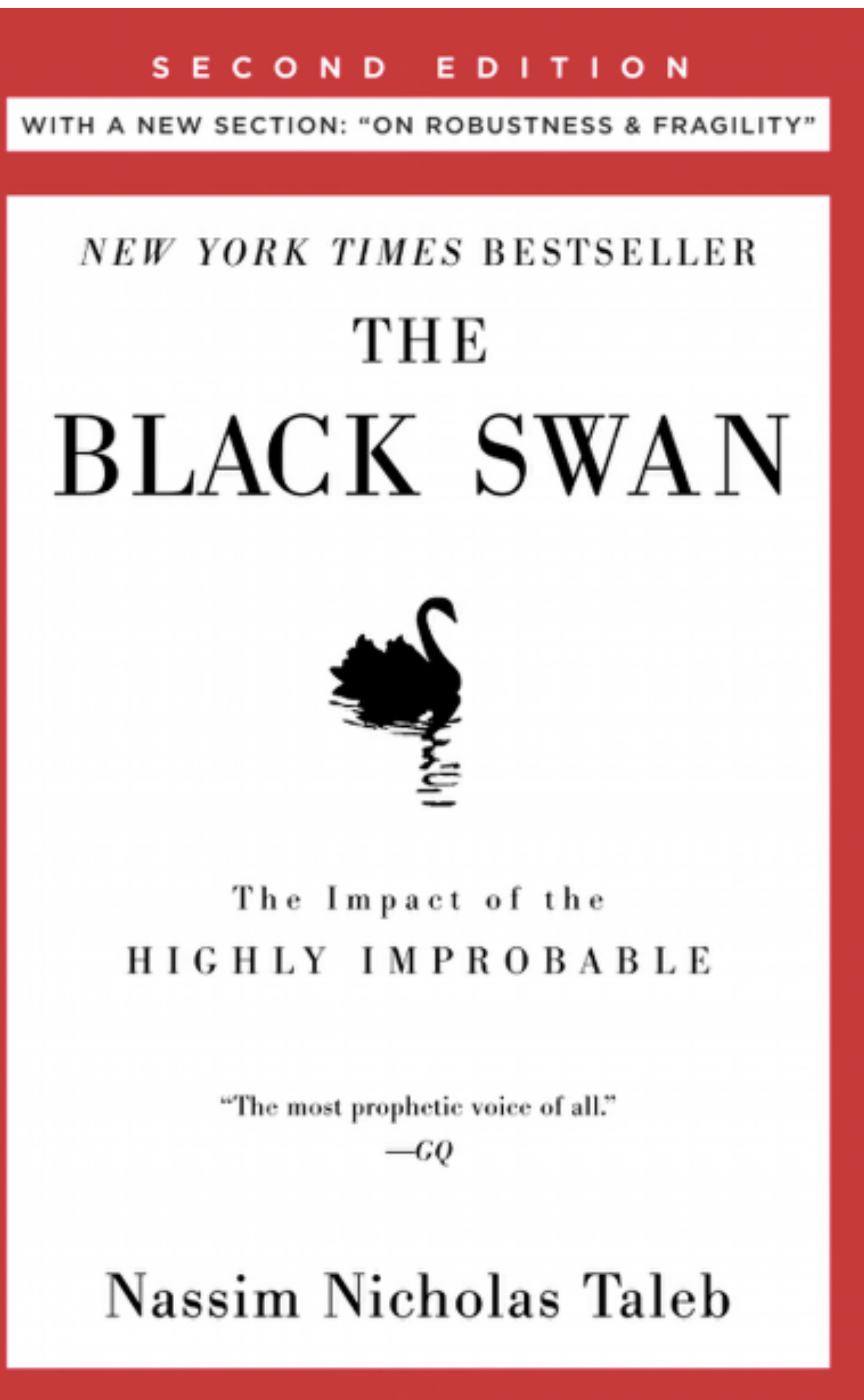


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Black Swan logic makes what you don't know far more relevant than what you do know.*

The inability to predict outliers implies the inability to predict the course of history, given the share of these events in the dynamics of events.



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NEW YORK TIMES BESTSELLER

THE BLACK SWAN



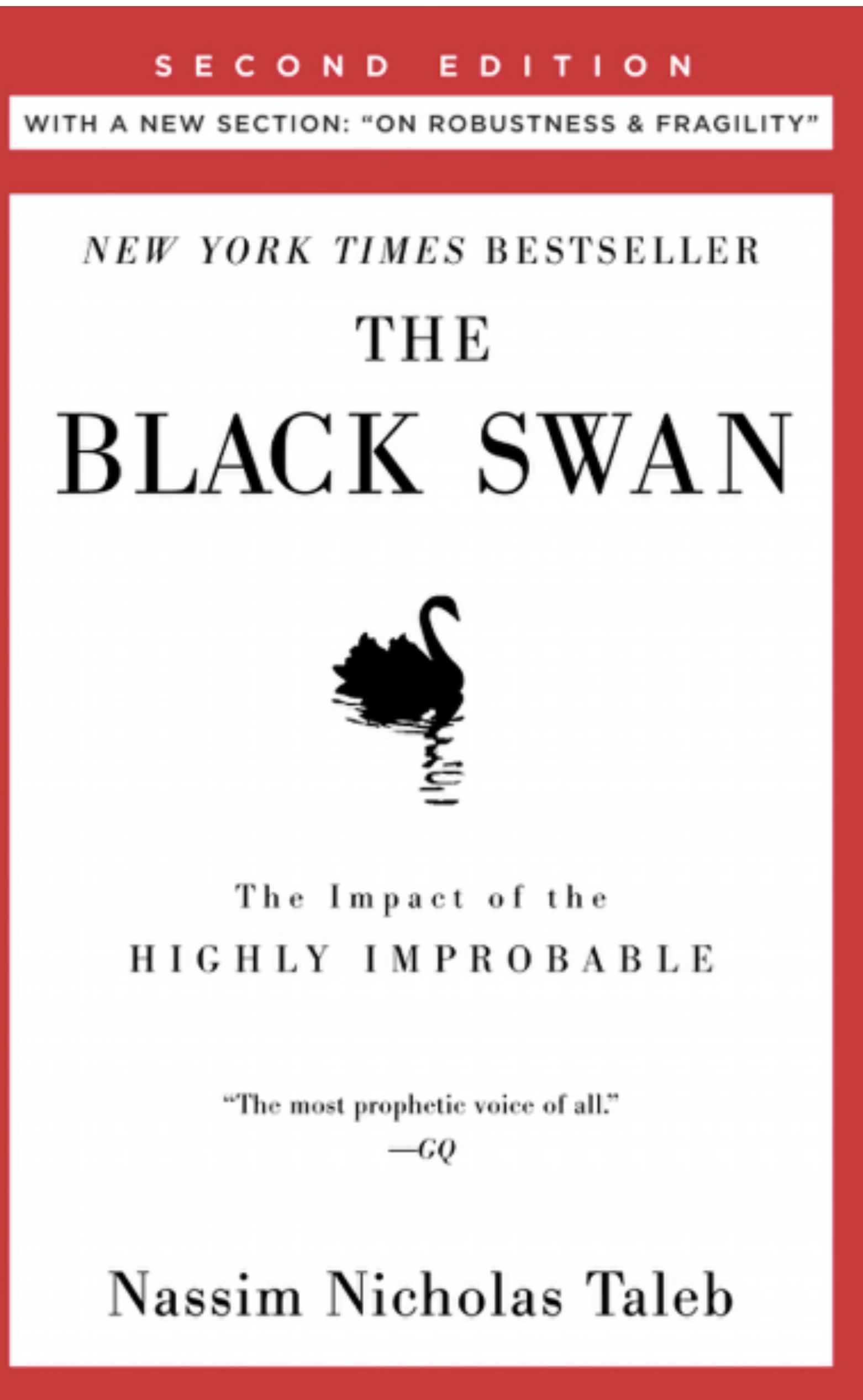
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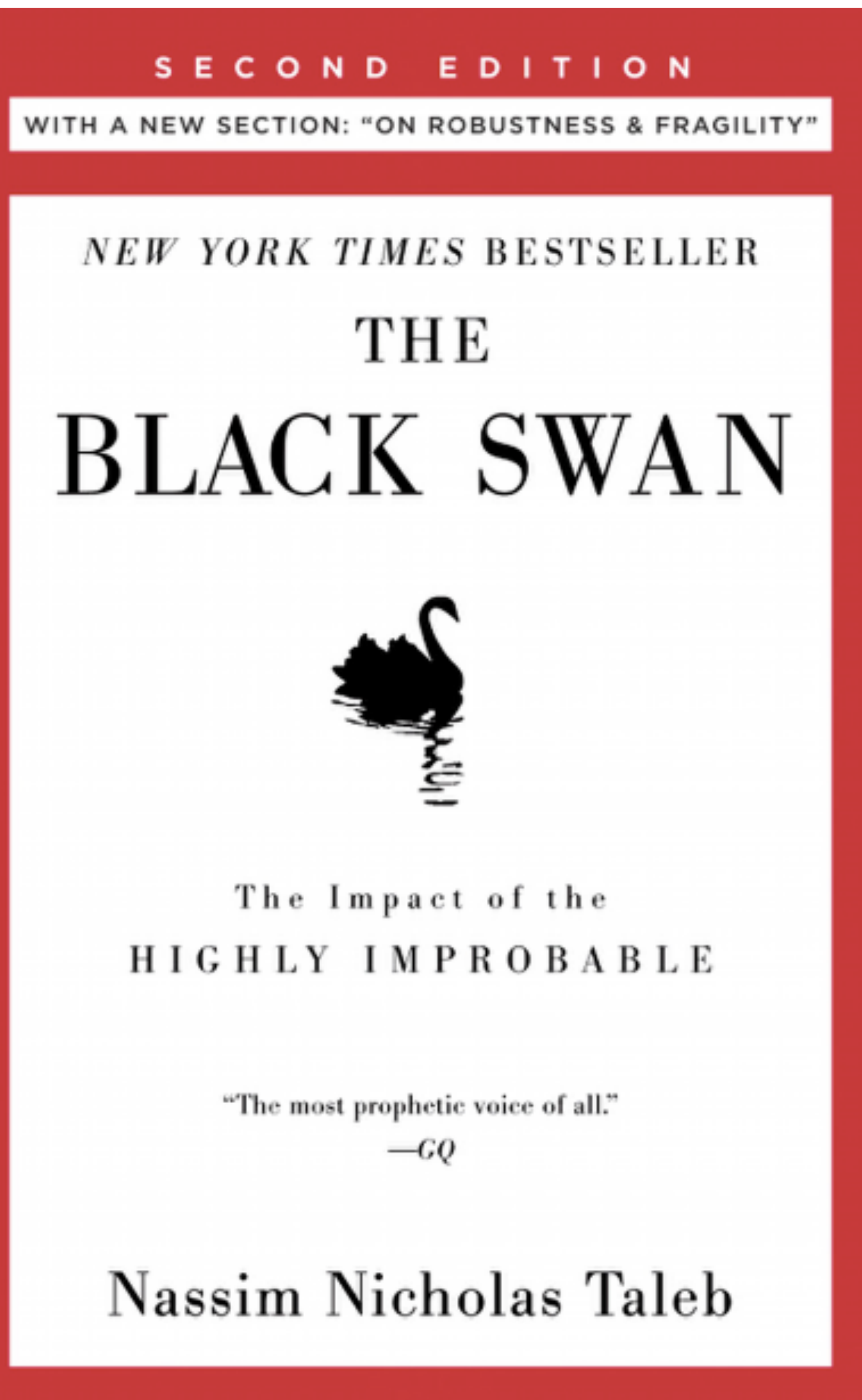
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Systems can be:
●Mediocristan

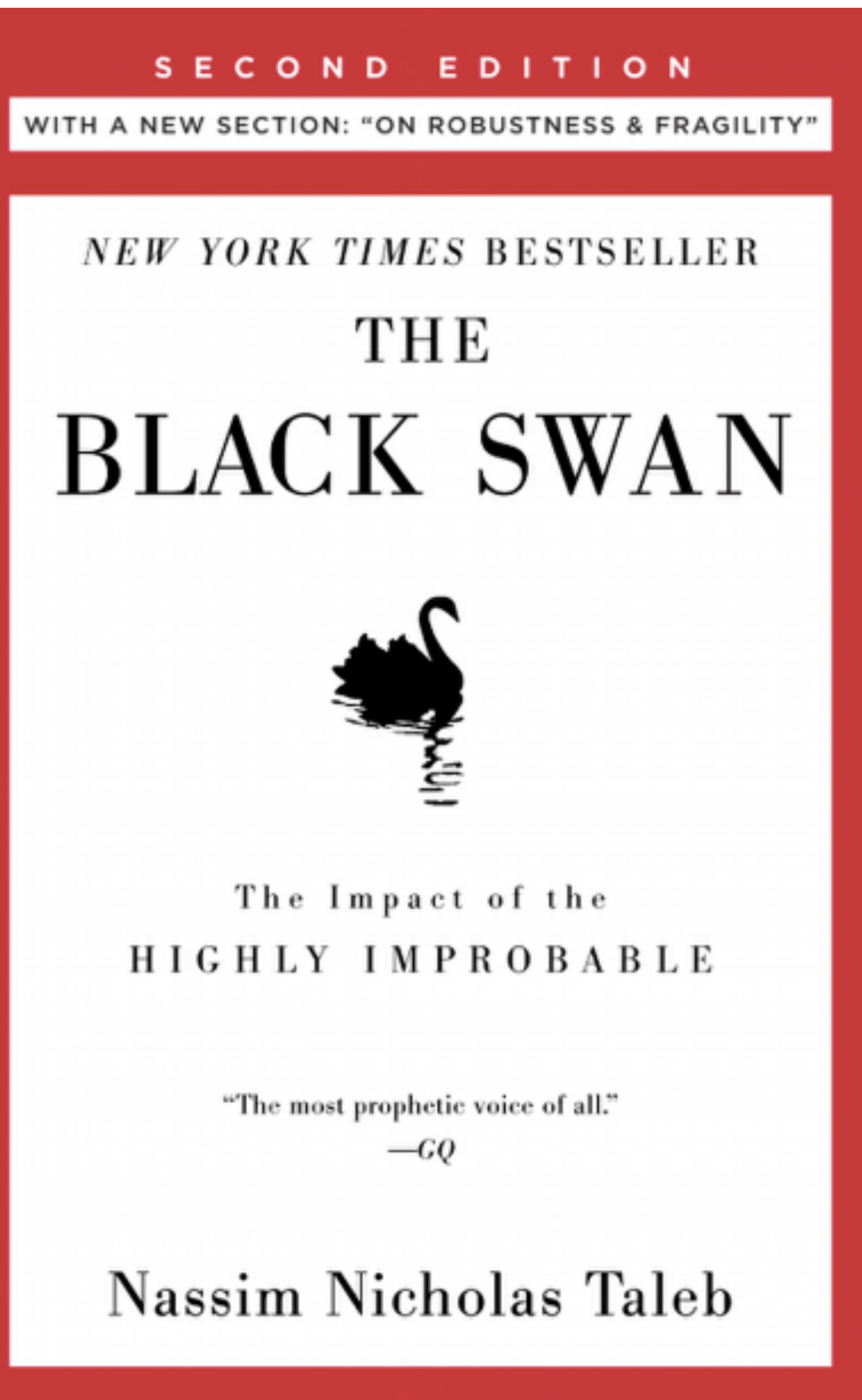




Systems can be:

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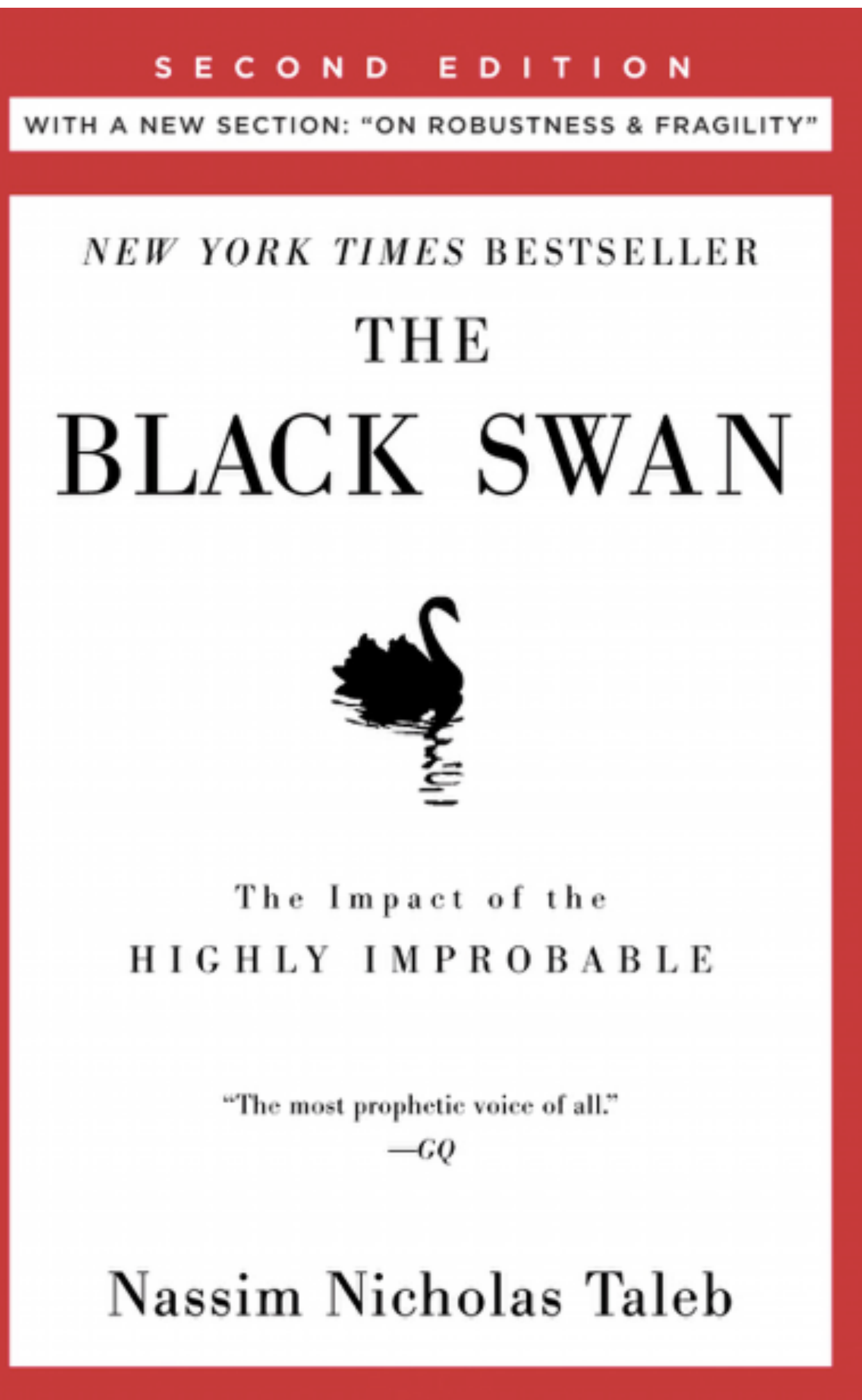
Mediocristan example: weight of a person



Systems can be:

- Mediocristan
- Extremistan

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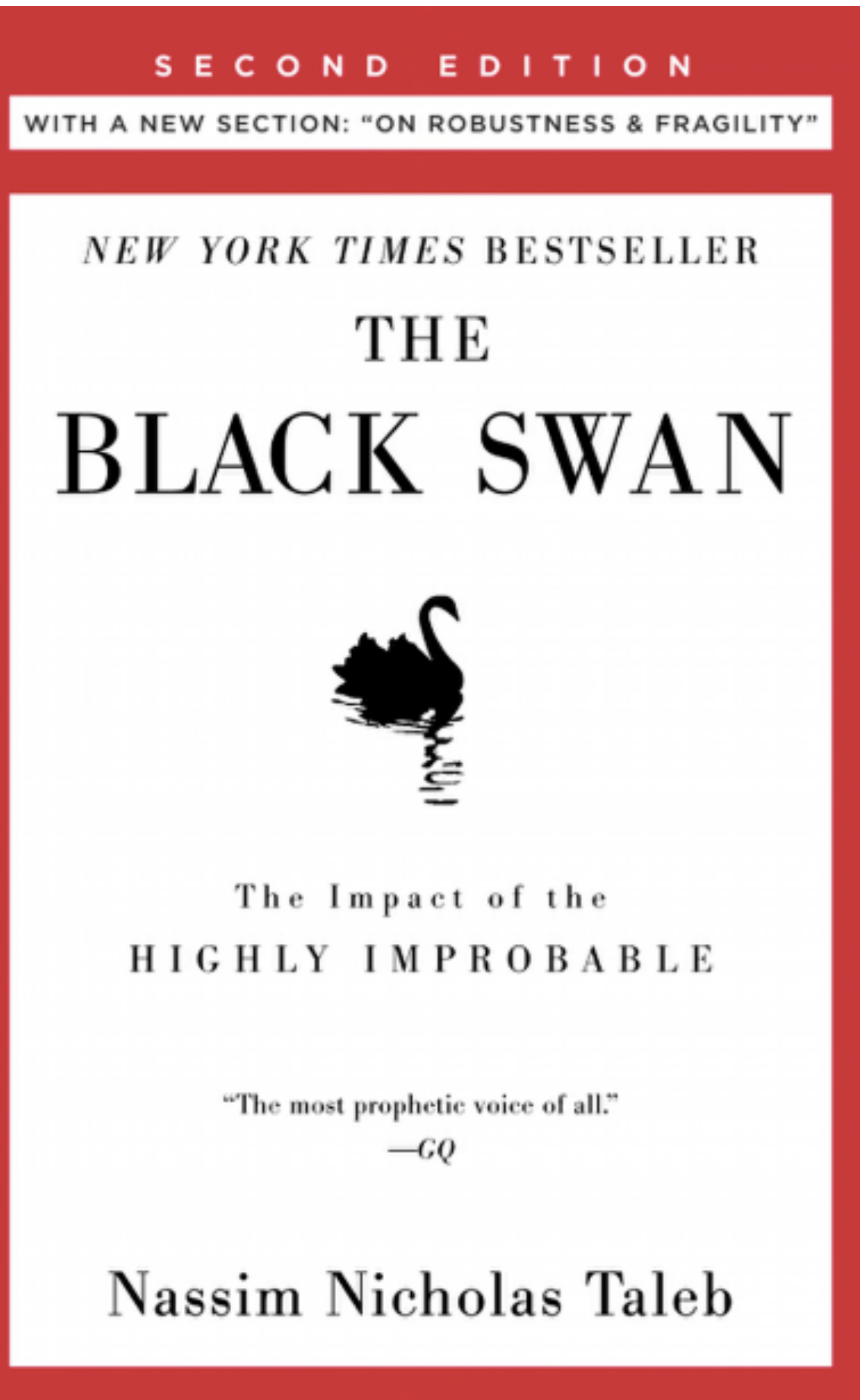


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Extremistan example: wealth of a person



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- Mediocristan
- Extremistan

Mediocristan example: weight of a person

Extremistan example: wealth of a person

Extremistan:

- economic system: 2008 crash
- social system: 1st world war
- political system: Donald Trump
- Technology: Internet, ?

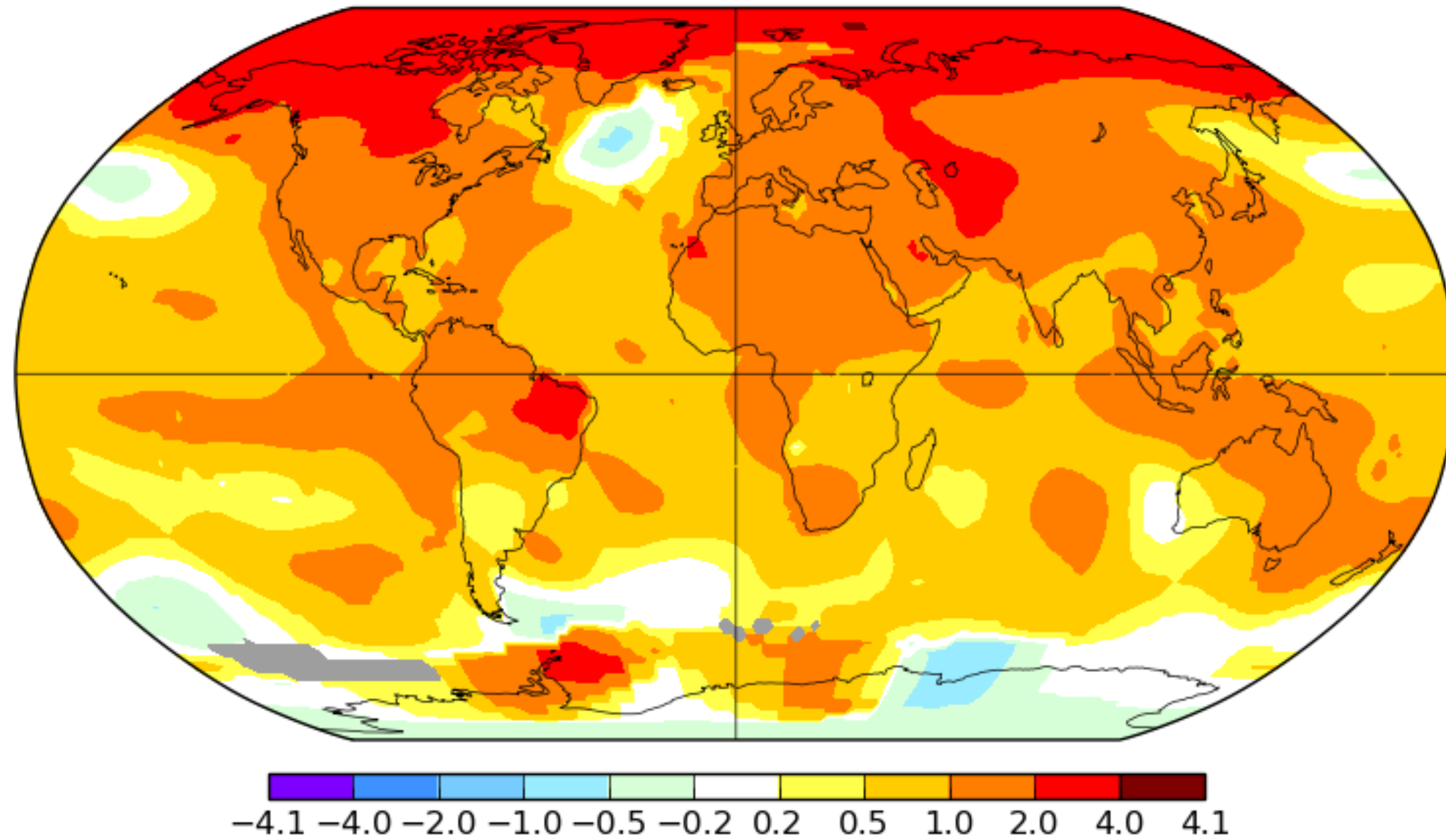
Account for Extremes

Changes in the dynamics impact the extremes

Annual J-D 2016

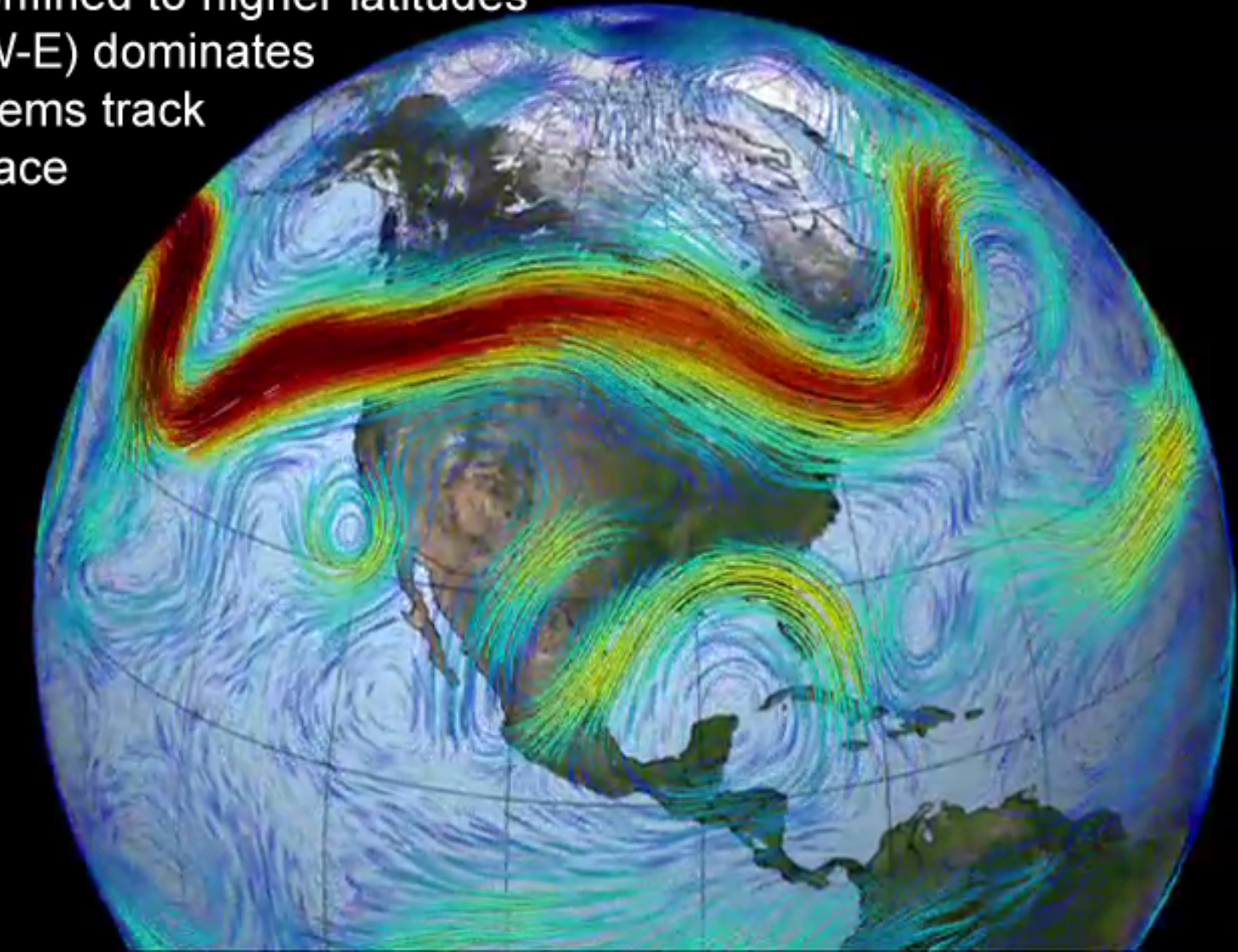
L-OTI(°C) Anomaly vs 1901-2000

0.99



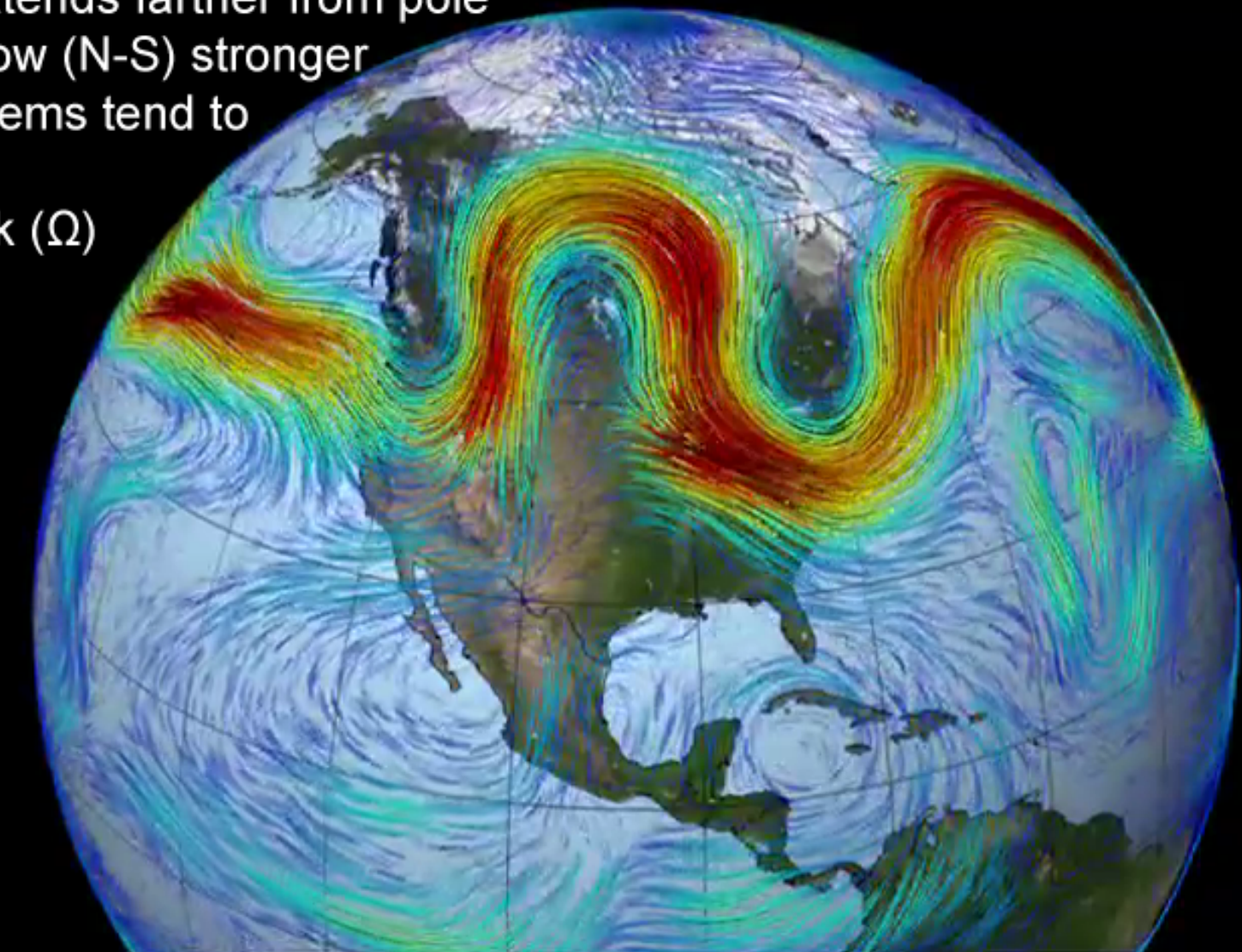
Strong Jet Stream

- jet stream confined to higher latitudes
- zonal flow (W-E) dominates
- weather systems track quickly at surface



Weak Jet Stream

- jet stream extends farther from pole
- meridional flow (N-S) stronger
- weather systems tend to stall
- Omega Block (Ω)

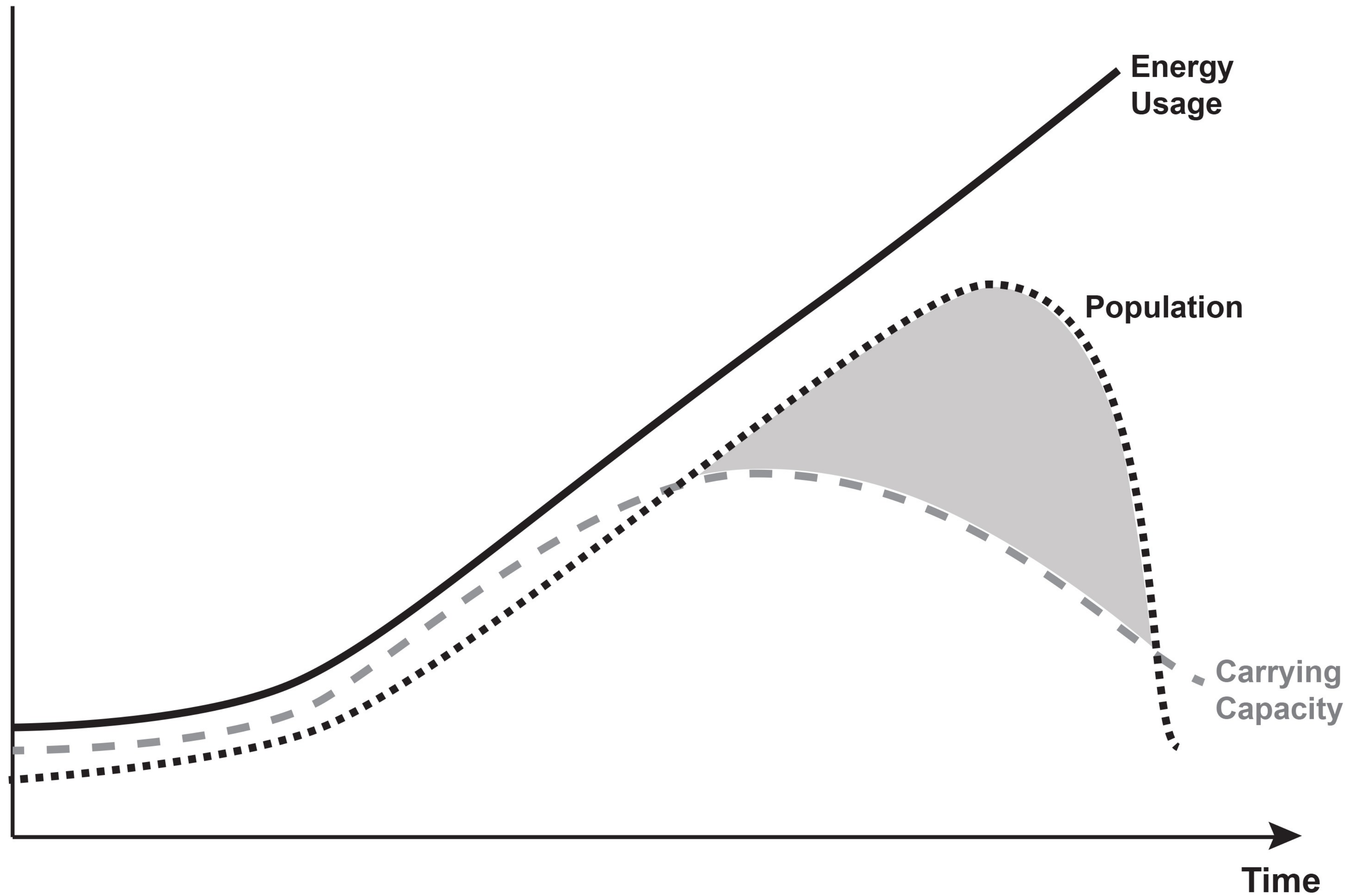


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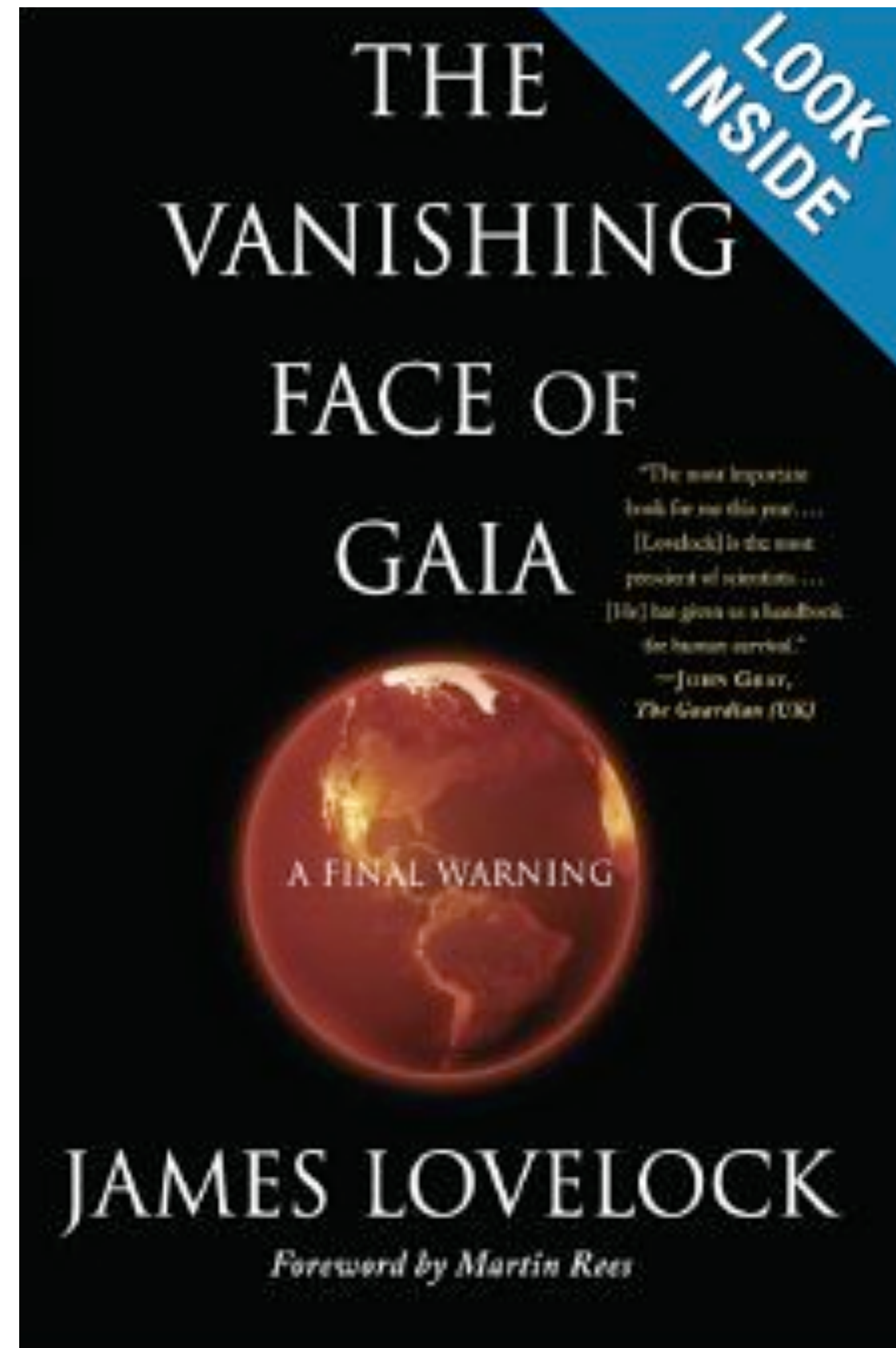


- Science is focused on avoiding Type I errors (false positives)
- Society is impacted by this focus
- Type II errors (false negatives) are critical in times of unsustainability and rapid changes

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Lovelock (and many others):

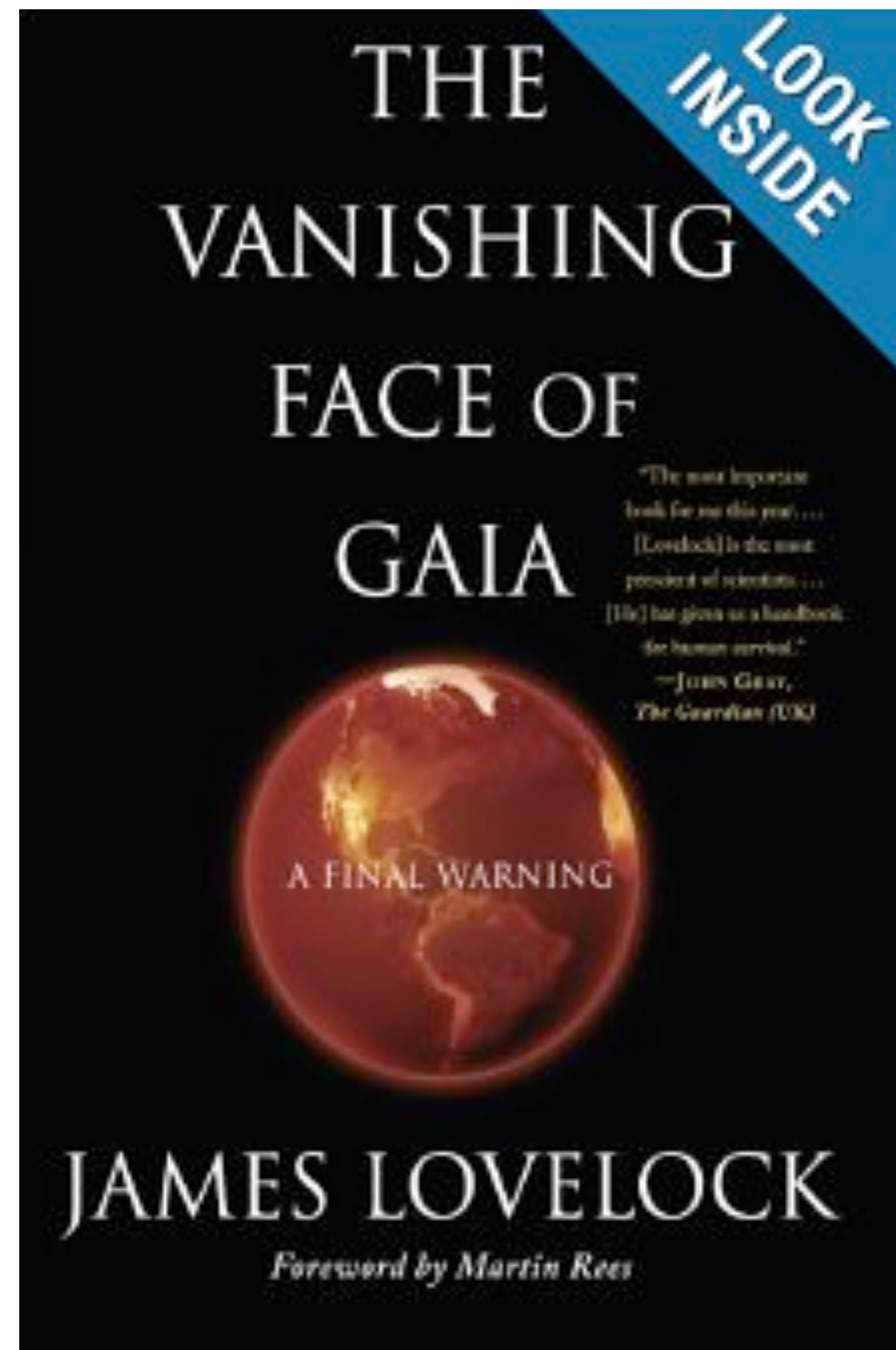
- Planet is on a run-away path; could reach a warm state (5°C warmer) already in 2050



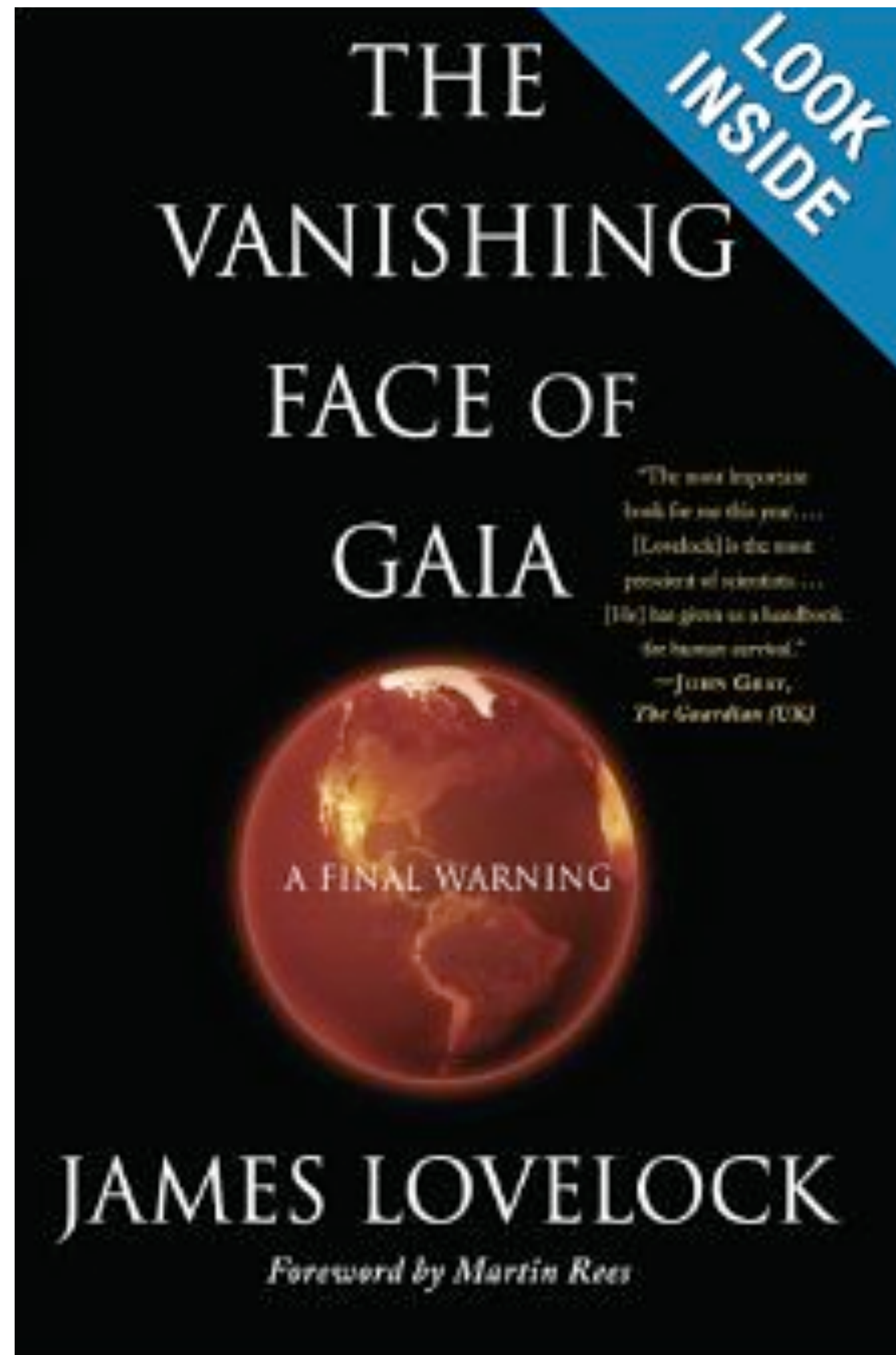
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- Carrying capacity of the planet would be reduced significantly; to 1 Billion?
- Recommendation: look for the lifeboats



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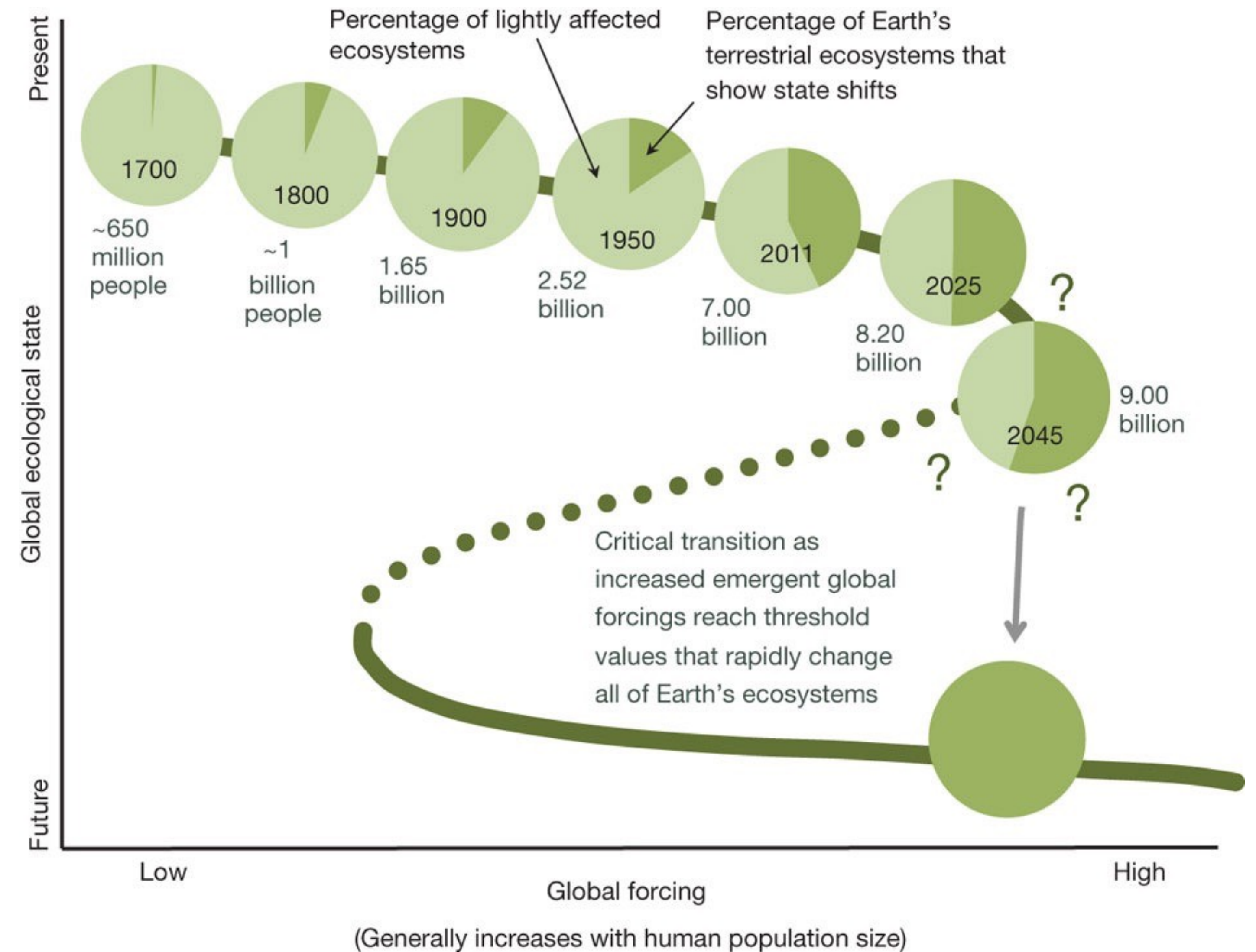
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Jem Bendell:

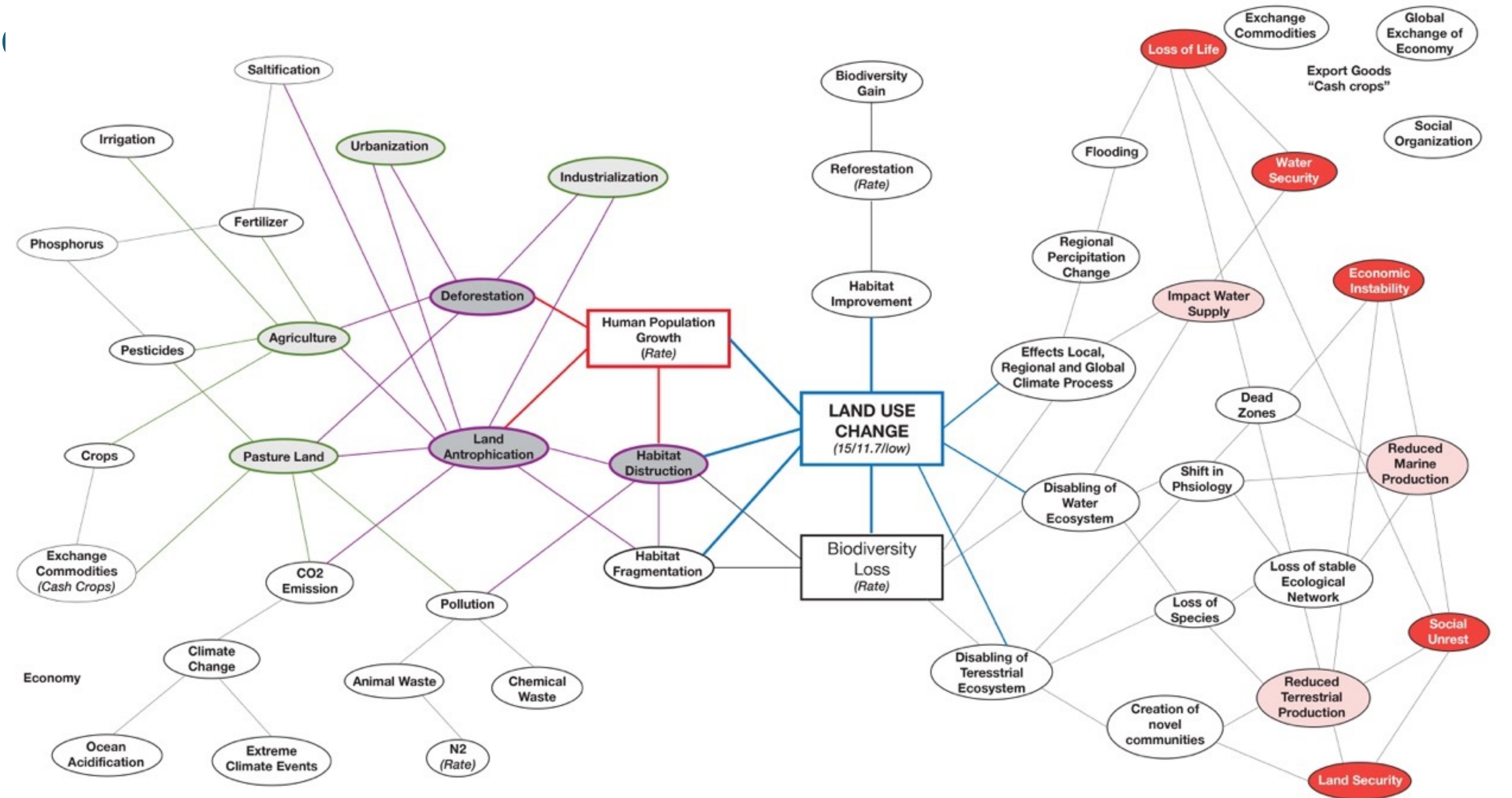
- Deep Adaptation
- Who do we want to be after the total social collapse?

Crossing thresholds could lead to systemic changes ...

Crossing thresholds could lead to systemic changes ...



Adaptation to Slow (Global) Change



Adaptation to Slow (Global) Change

theguardian.com

Mitigation a... HotBot.com... Fitbit Dashb... Sign In EECS Facul... Tiwah — To... Input const www.un

Soil Opinion

We're treating soil like dirt. It's a fatal mistake, as our lives depend on it

George Monbiot

War, pestilence, even climate change, are trifles by comparison. Destroy the soil and we all starve



While it now seems that ploughing of any kind is incompatible with the protection of the soil, there are plenty of means of farming without it.' Photograph: Lester Lefkowitz/Corbis

To keep up with global food demand, the UN estimates, **6m hectares (14.8m acres) of new farmland will be needed every year**. Instead, **12m hectares a year are lost through soil degradation**. We wreck it, then move on, trashing rainforests and other precious habitats as we go.

- 2.6 billion people depend directly on agriculture, but 52% of the land used for agriculture is moderately or severely affected by soil degradation.
- Land degradation affects 1,5 billion people globally.
- Arable land loss estimated at 30 to 35 times the historical rate.
- Due to drought and desertification each year 12 million hectares are lost (23 hectares/minute!), where 20 million tons of grain could have been grown.
- 74% of the poor (42% of the very and 32% of the moderately poor) are directly affected by land degradation globally.

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SUSTAINABILITY

Only 60 Years of Farming Left If Soil Degradation Continues

Generating three centimeters of top soil takes 1,000 years, and if current rates of degradation continue all of the world's top soil could be gone within 60 years, a senior UN official said

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and 32% of the affected by land

No-Till Farming Pros and Cons

The agricultural industry is converting to this new and (on the surface, at least) better method.

By the MOTHER EARTH NEWS editors
May/June 1984

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Herbicides are often used in no-till farming to kill a cover crop before a cash crop is planted in the spring.

PHOTO: U.S. DEPARTMENT OF AGRICULTURE

Slideshow

To many people, no-till farming appears to be a tremendous step forward for agriculture. At a time when fertile topsoil is being worn away by wind and water at rates that are figured in tons per acre per year, a drastic new soil-conservation measure is certainly in order. And as you're about to see, no-till *does* preserve topsoil, but this advantage doesn't come without certain trade-offs. As it's currently practiced in the U.S., no-till farming might more appropriately be called no-till/chemical agriculture.

Content Tools

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In the first paragraph of the landmark 1943 book *Plowman's Folly*, Edward H. Faulkner said, "The truth is that no one has ever advanced a scientific reason for plowing." Nonetheless, 40 years after that publication cracked the foundations of agricultural science, most farmers still plow. Why?

... no-till does preserve topsoil, but this advantage doesn't come without certain trade-offs. As it's currently practiced in the U.S., no-till farming might more appropriately be called no-till/chemical agriculture.

UN: Growing threat to food from decline in biodiversity

By Matt McGrath
Environment correspondent

🕒 22 February 2019 | 🗨️

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The plants, animals, and micro-organisms that are the bedrock of food production are in decline, according to a UN study.

UN: Growing threat to food from decline in biodiversity

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The plants, animals, and micro-organisms that are the bedrock of food production are in decline, according to a UN study.

Cultured lab meat may make climate change worse

By Matt McGrath
Environment correspondent

🕒 19 February 2019 | 🗨️

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Growing meat in the laboratory may do more damage to the climate in the long run than meat from cattle, say scientists.

Consequences for future generations ...

Adaptation to Slow (Global) Change

Consequences for future generations ...

... deep cuts in global emissions from energy, transport and food are needed to keep temperature rises in check and an analysis has shown this means the new generation will have lifetime carbon budgets almost 90% lower than someone born in 1950

Carbon footprints

Climate crisis: today's children face lives with tiny carbon footprints

Next generation must keep their own carbon levels at a fraction of their grandparents' in order to prevent catastrophe

Damian Carrington
Environment editor

@dpcarrington
Wed 10 Apr 2019
01.30 EDT



1816



▲ Young climate activists Greta Thunberg, centre, and Luisa Neubauer, left, marching against climate change in Berlin. Photograph: Carsten Koall/Getty Images

Global emissions of CO₂ need to decline precipitously over the next few decades, if the world is to meet the Paris Agreement goals of limiting global warming to “well below 2C” and, ideally, below 1.5C.

CarbonBrief

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FEATURES

10 April 2019 6:30

Analysis: Why children must emit eight times less CO₂ than their grandparents

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ZEKE HAUSFATHER

10.04.2019 | 6:30am

FEATURES

Analysis: Why children must emit eight times less CO₂ than their grandparents

Credit: Julie Johnson via Unsplash.

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Risk Reduction

Lack of thorough Risk Assessments ...

Politics Opinion

The 13 impossible crises that humanity now faces George Monbiot



From Trump to climate change, this multiheaded crisis presages collapse. And there's no hope of exiting the 'other side' if political alternatives are shut down



📷 Viggo Mortensen as The Man and Kodi Smit-McPhee as The Boy in the 2009 film The Road. Photograph: Dimension Films/Supplied by LMK

Advertisement



One of the peculiarities of this complex, multiheaded crisis is that there appears to be no “other side” on to which we might emerge. It is hard to imagine a realistic scenario in which governments lose the capacity for total surveillance and drone strikes; in which billionaires forget how to manipulate public opinion; in which a broken EU reconvenes; in which climate breakdown unhappens, species return from extinction and the soil comes back to the land. These are not momentary crises, but appear to presage permanent collapse.

Resilience

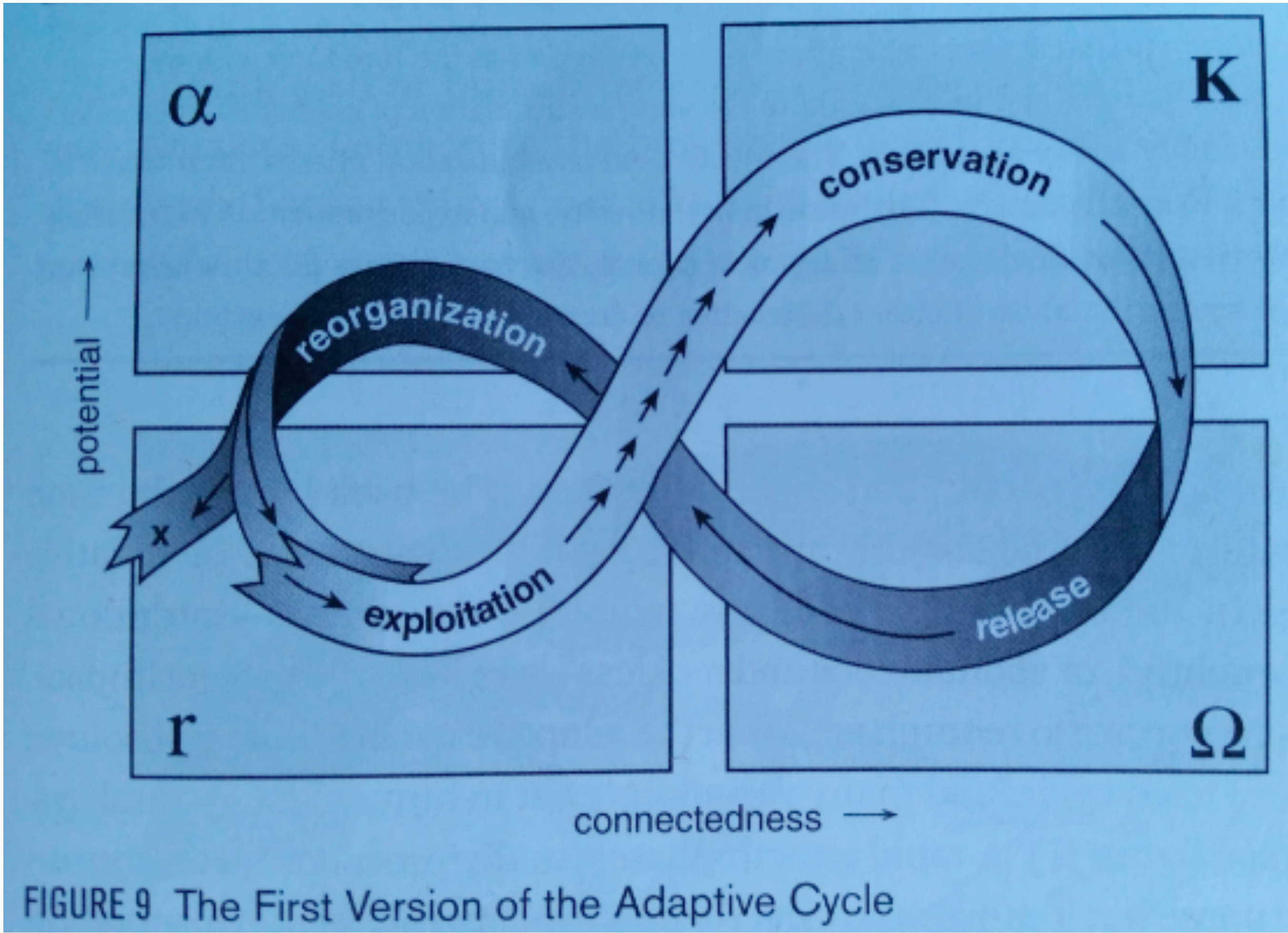


FIGURE 9 The First Version of the Adaptive Cycle

Walker and Salt, 2006

Resilient Thinking, four phases:
 r: rapid growth
 K: conservation
 Ω : release phase
 α : reorganization phase

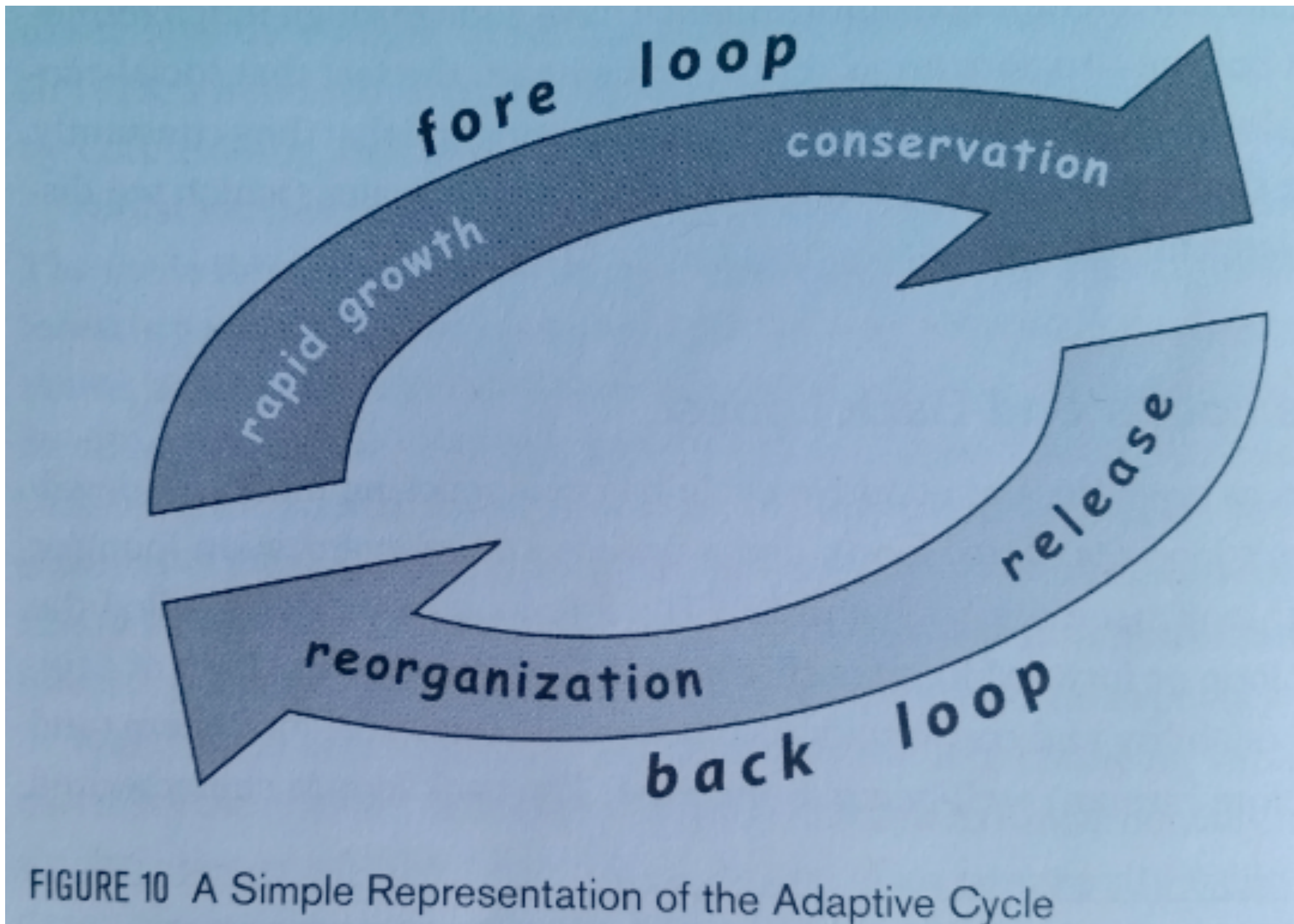
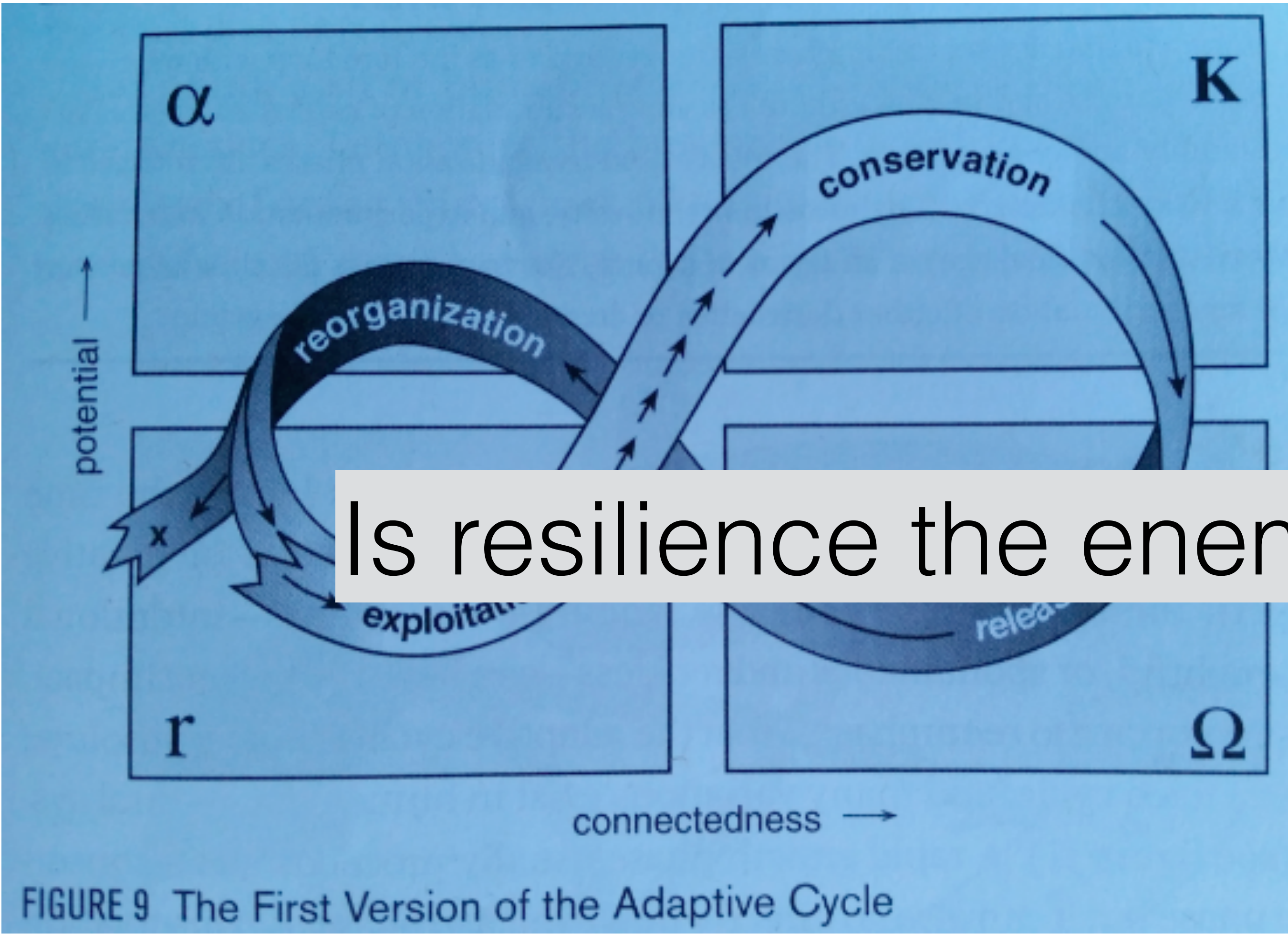


FIGURE 10 A Simple Representation of the Adaptive Cycle

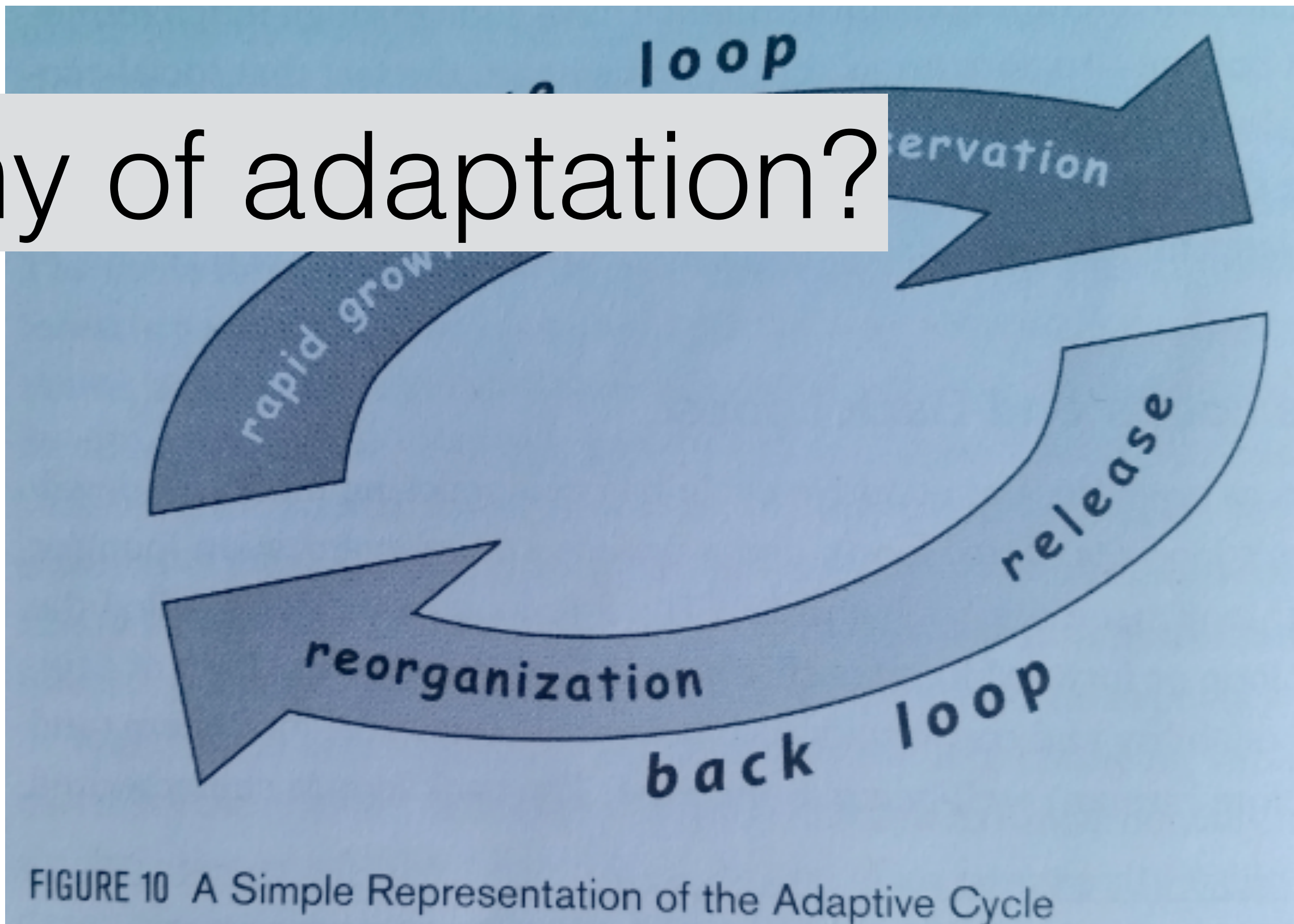
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Is resilience the enemy of adaptation?



Walker and Salt, 2006



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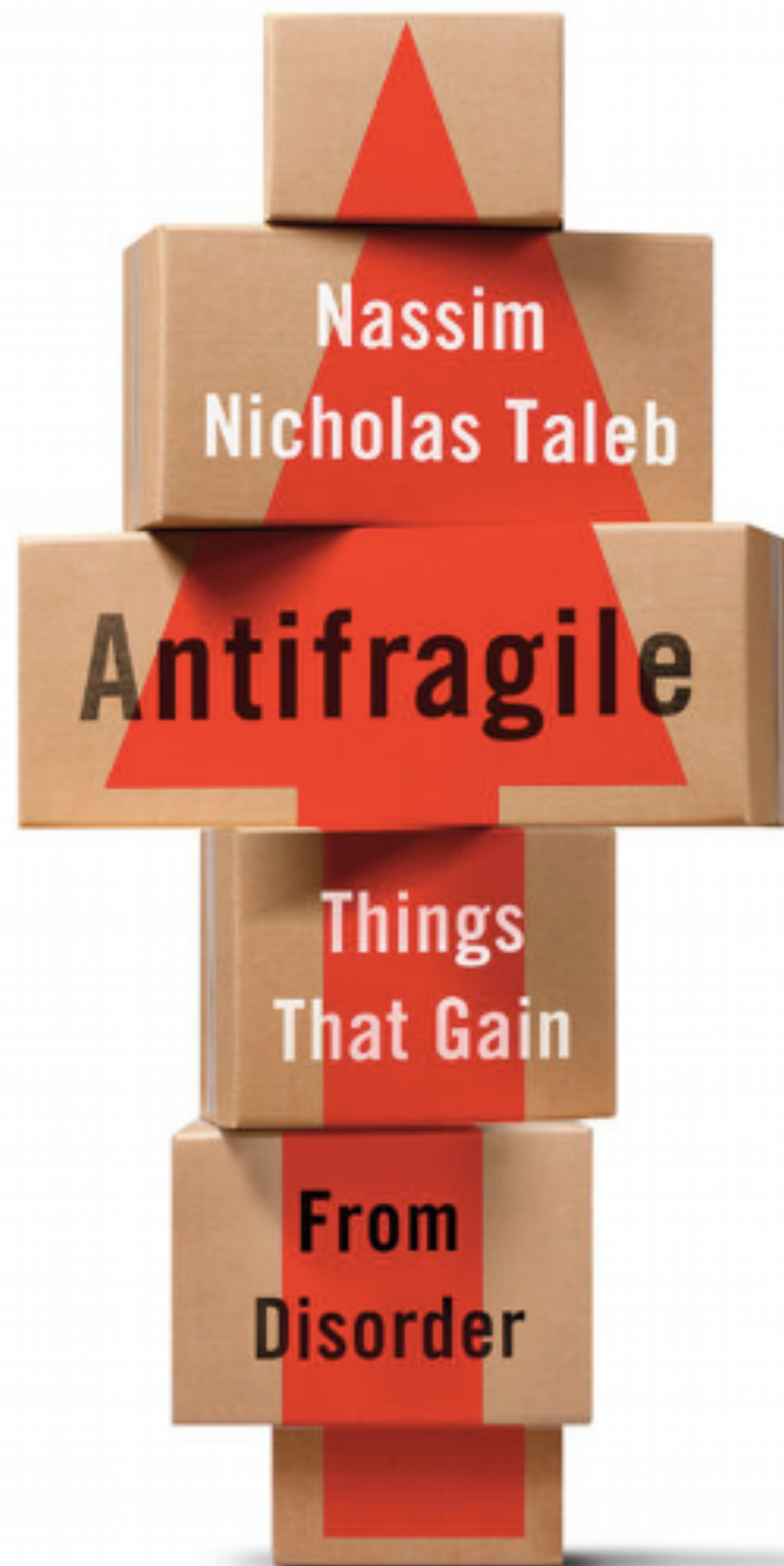
Nassim
Nicholas Taleb

Antifragile

Things
That Gain

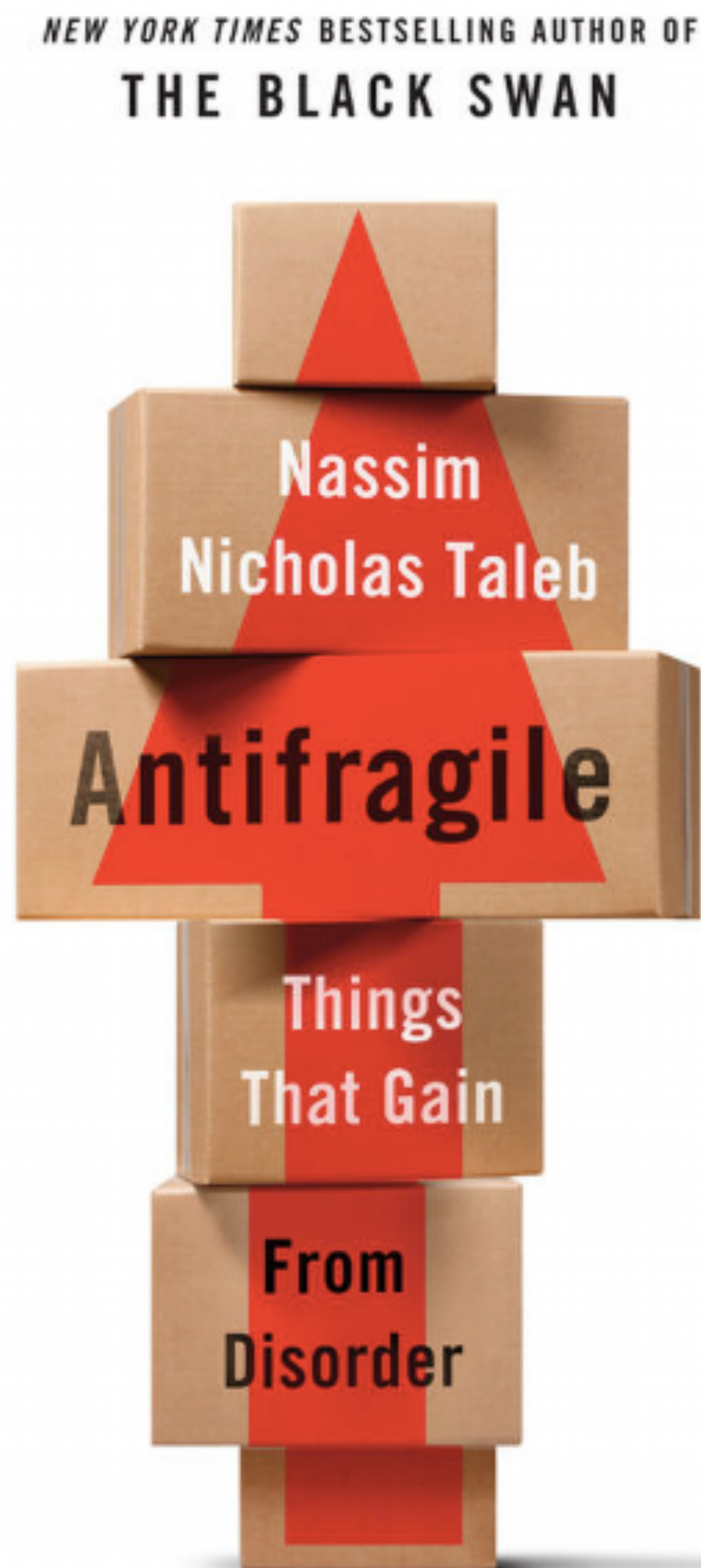
From
Disorder

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Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better.

Taleb, Nassim Nicholas. Antifragile: Things That Gain from Disorder



Fragile



- Suffers or breaks from volatility
- More downside than upside from volatility
- Seeks tranquility
- Mistakes rare and large
- Myth: Sword of Damocles

Resilient



- Stays the same in volatility
- Indifferent to tranquility and volatility
- Myth: The Phoenix

Antifragile



- Grows and gets stronger from volatility
- More upside than downside from volatility
- Seeks disorder
- Mistakes small and benign
- Myth: The Hydra

The Art of
MANLINESS
EST. 2009

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THE BLACK SWAN

Nassim
Nicholas Taleb



Antifragile

Things
That Gain

From
Disorder

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.

Taleb, Nassim Nicholas. Antifragile: Things That Gain from Disorder



<ul style="list-style-type: none">• Suffers or breaks from volatility• More downside than upside from volatility• Seeks tranquility• Mistakes rare and large• Myth: Sword of Damocles	<ul style="list-style-type: none">• Stays the same in volatility• Indifferent to tranquility and volatility• Myth: The Phoenix	<ul style="list-style-type: none">• Grows and gets stronger from volatility• More upside than downside from volatility• Seeks disorder• Mistakes small and benign• Myth: The Hydra
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The Art of
MANLINESS
BY.  2009

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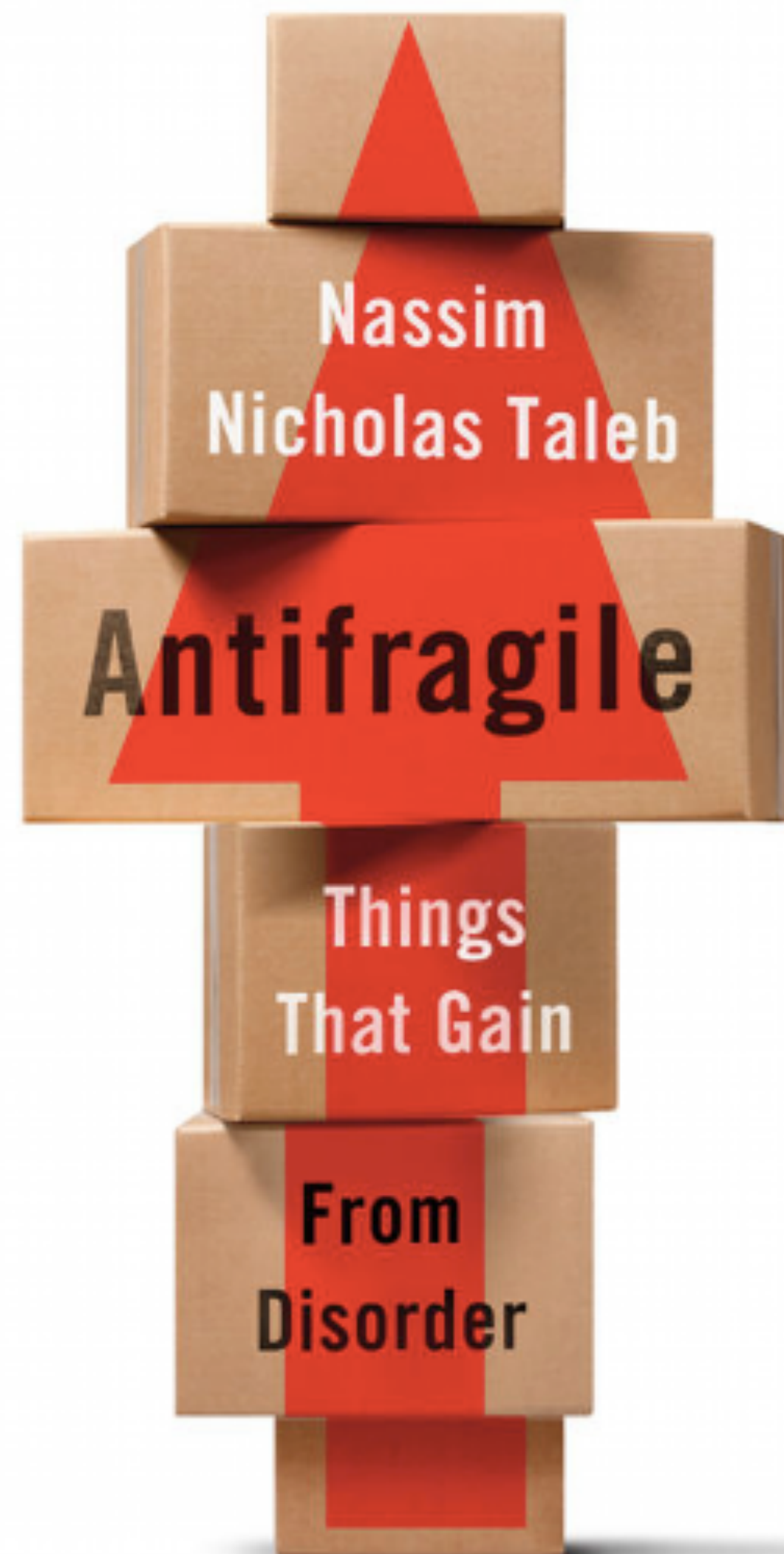
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Antifragile

Things
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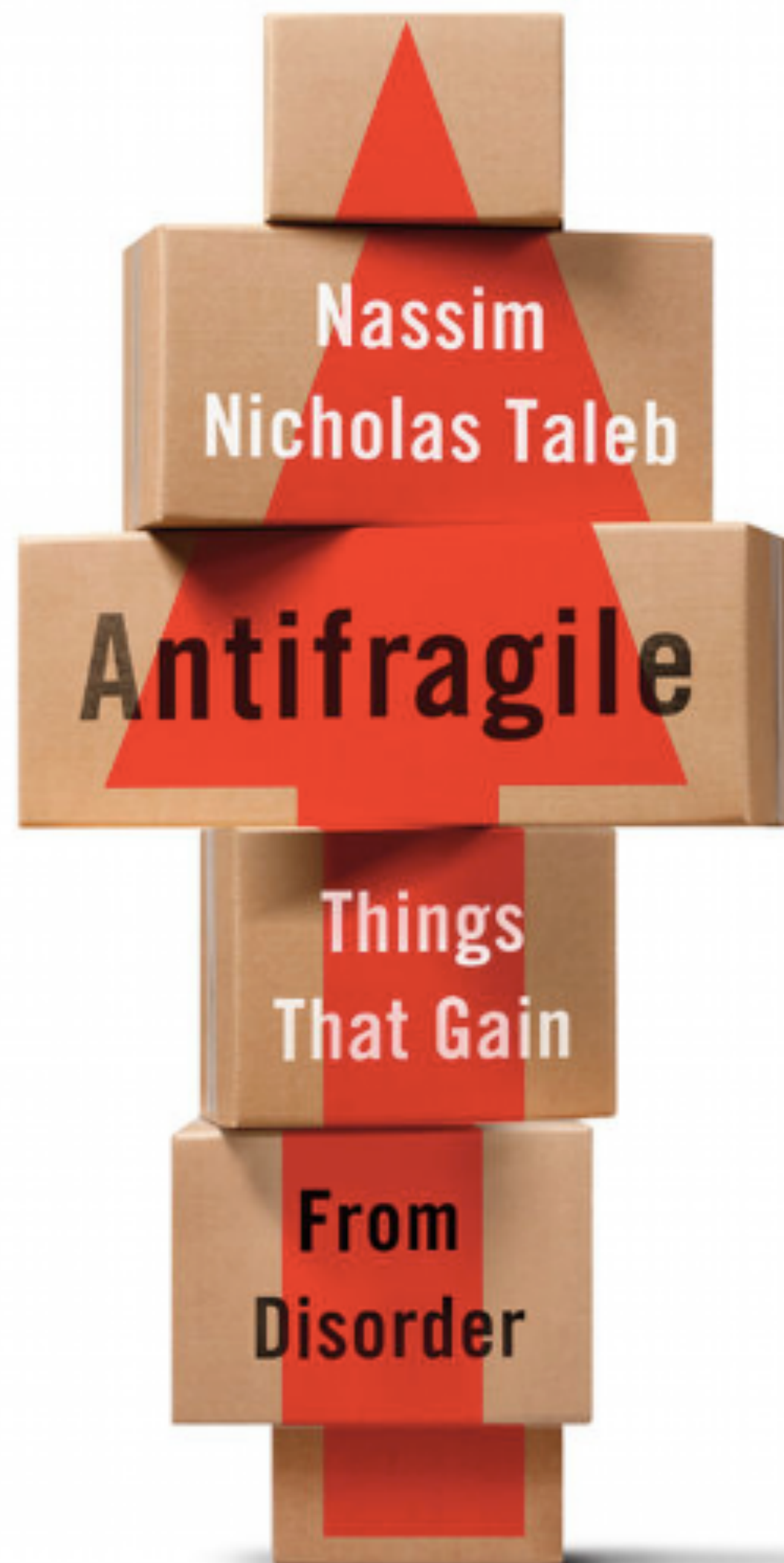
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Which brings us to the largest fragilizer of society, and greatest generator of crises, absence of “skin in the game.” Some become antifragile at the expense of others by getting the upside (or gains) from volatility, variations, and disorder and exposing others to the downside risks of losses or harm. And such antifragility-at-the-cost-of-fragility-of-others is hidden ...

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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 ...

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

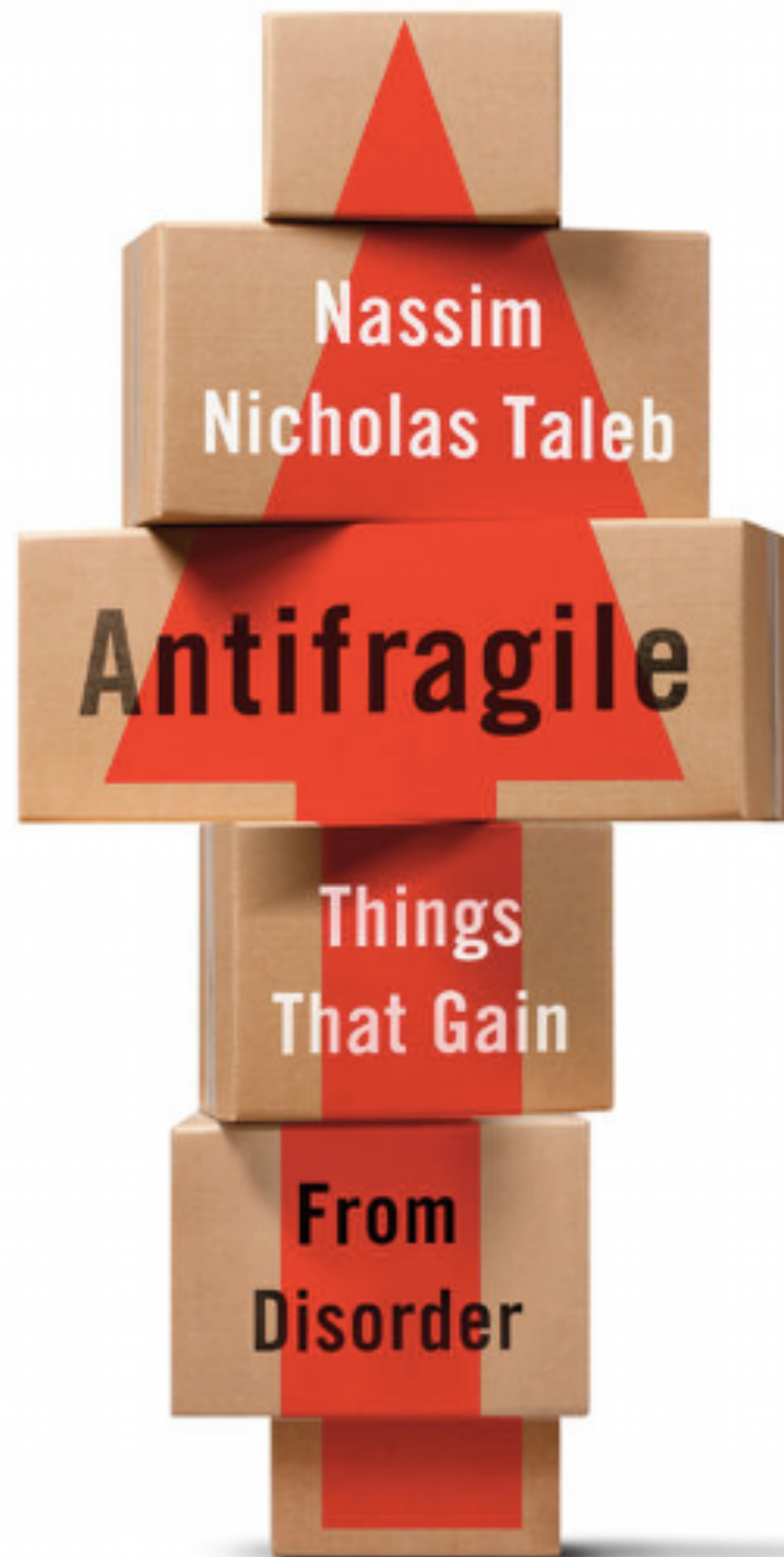
NEW YORK TIMES BESTSELLING AUTHOR OF
THE BLACK SWAN

Nassim
Nicholas Taleb

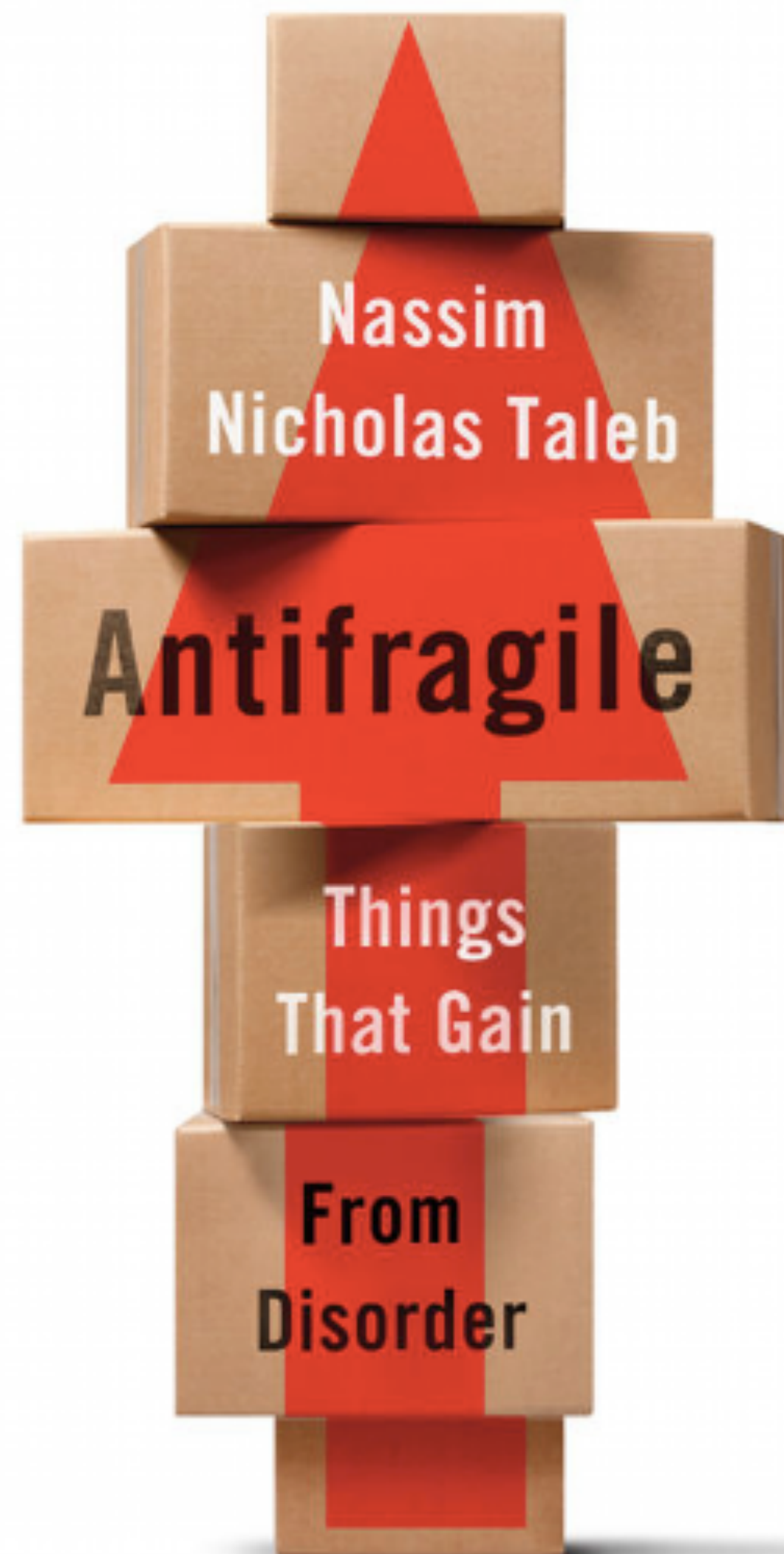
Antifragile

Things
That Gain

From
Disorder

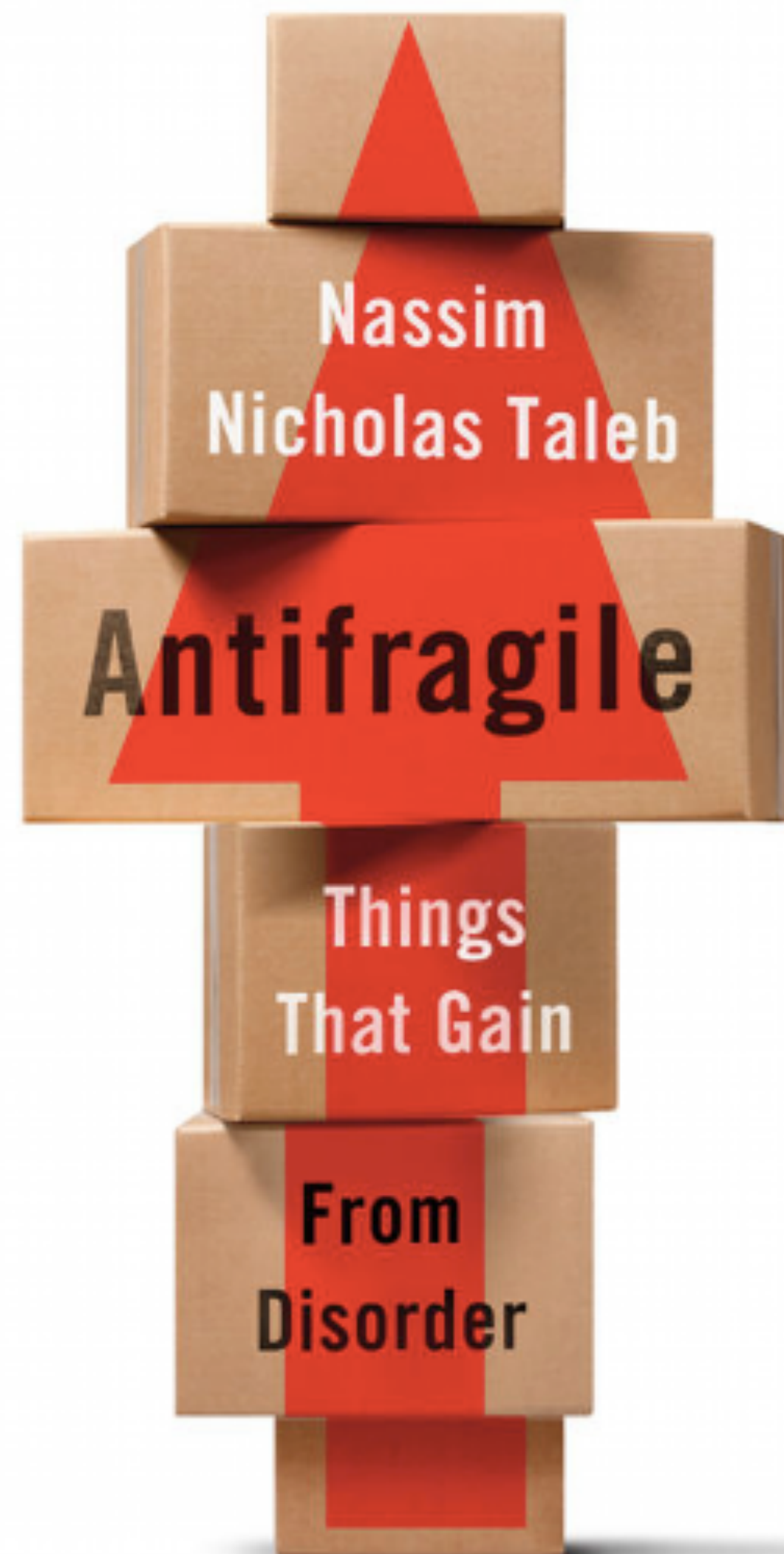


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Black Swans (capitalized) are large-scale unpredictable and irregular events of massive consequence— unpredicted by a certain observer, and such unpredictor is generally called the “turkey” when he is both surprised and harmed by these events.

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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.

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.

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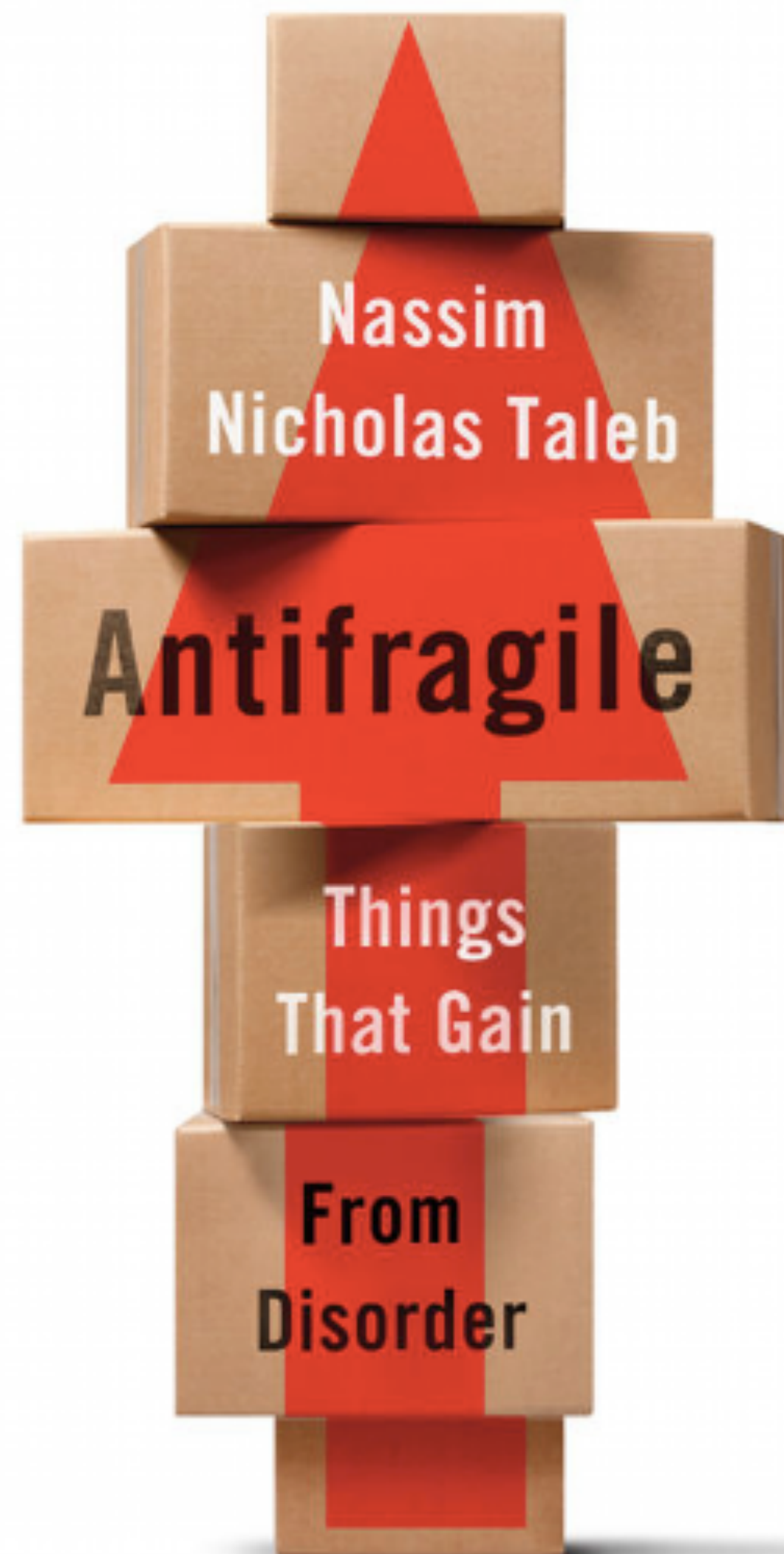
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Complex systems are full of interdependencies— hard to detect— and nonlinear responses. “Nonlinear” means that when you double the dose of, say, a medication, or when you double the number of employees in a factory, you don’t get twice the initial effect, but rather a lot more or a lot less.

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Man-made complex systems tend to develop cascades and runaway chains of reactions that decrease, even eliminate, predictability and cause outsized events.

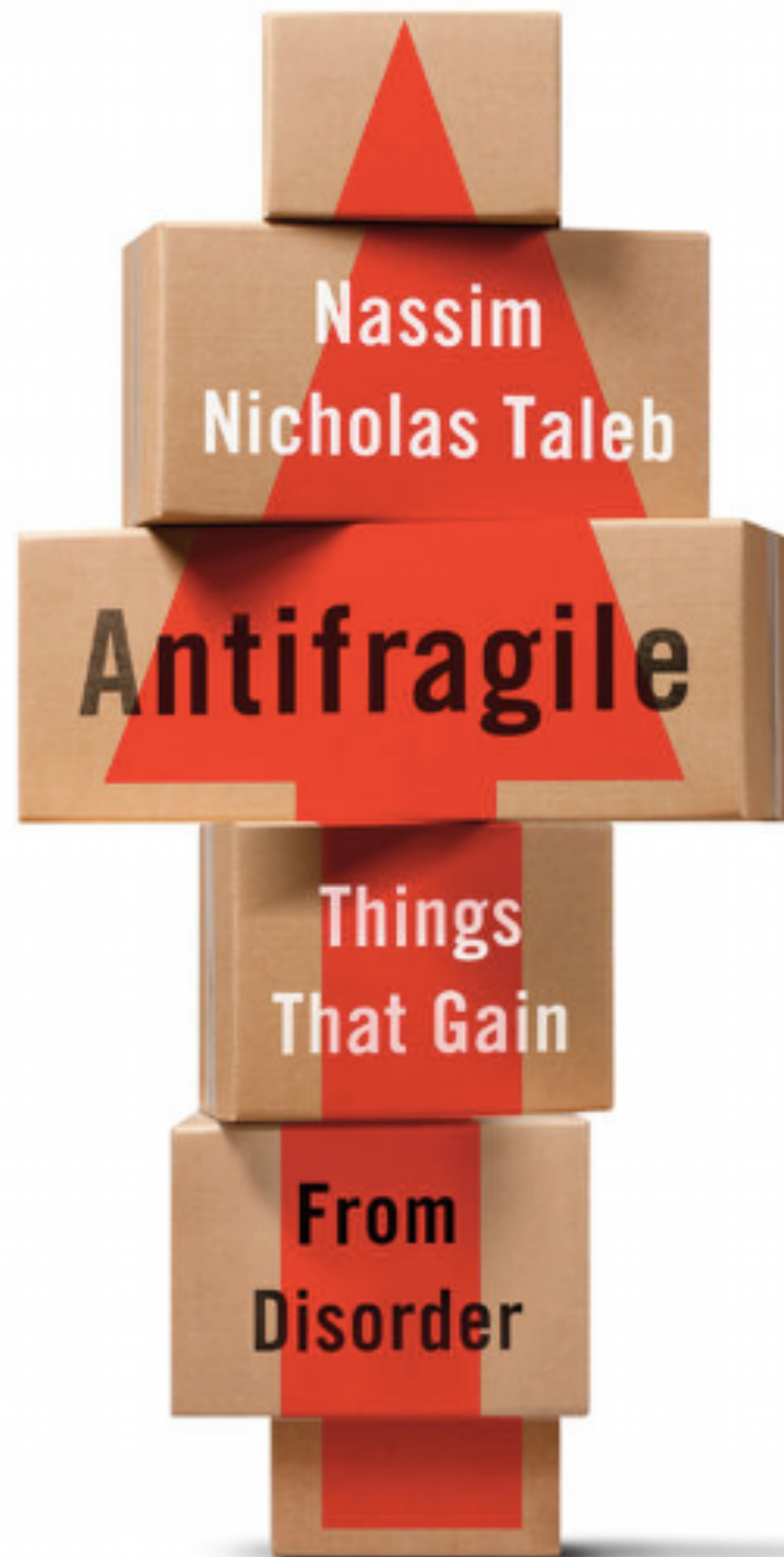
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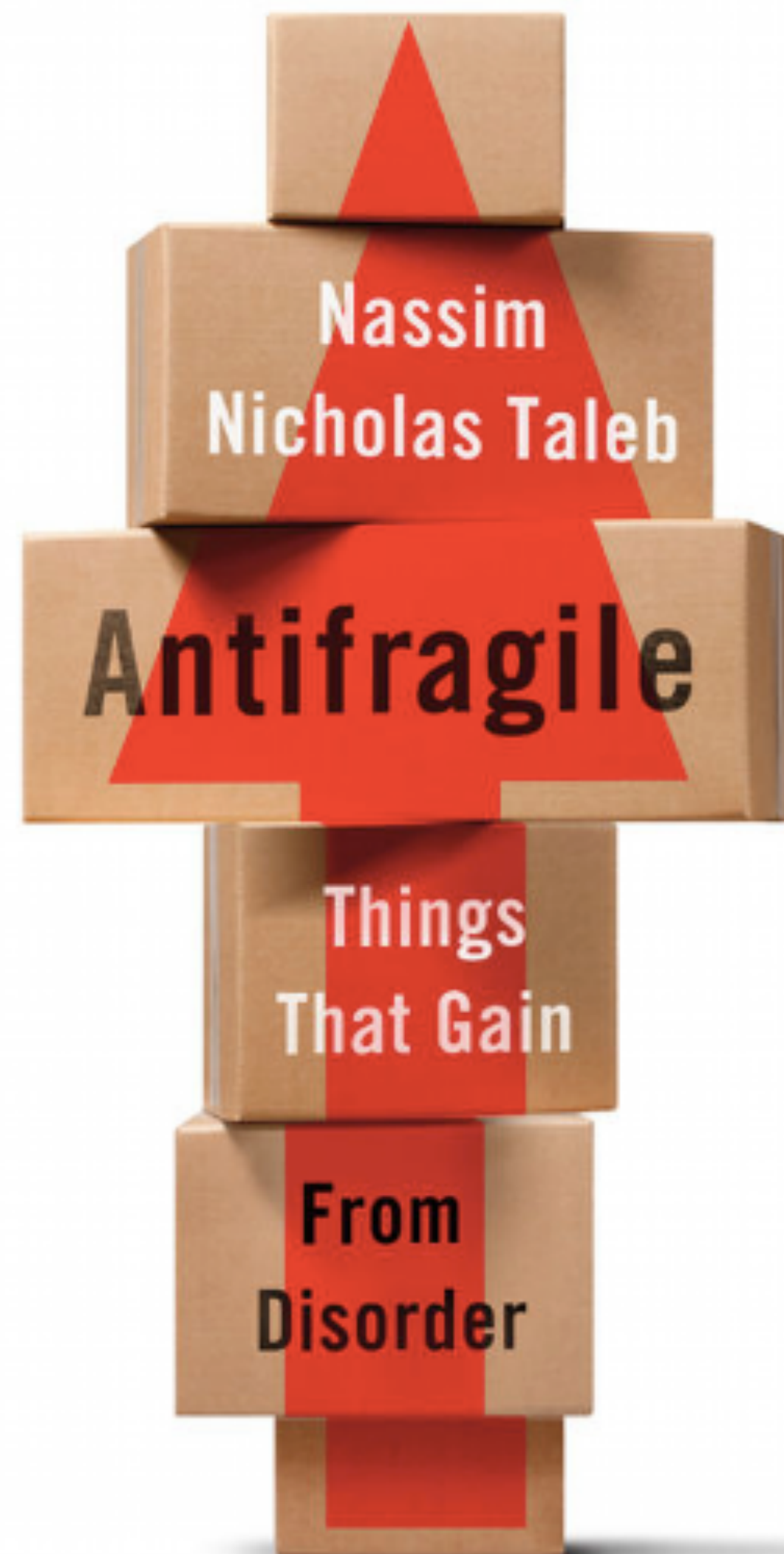
Antifragile

Things
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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.

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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.

Mitigation and Adaptation Studies

Class 23: Developing Options: Mitigating the Degradation of Earth's Life-Support System

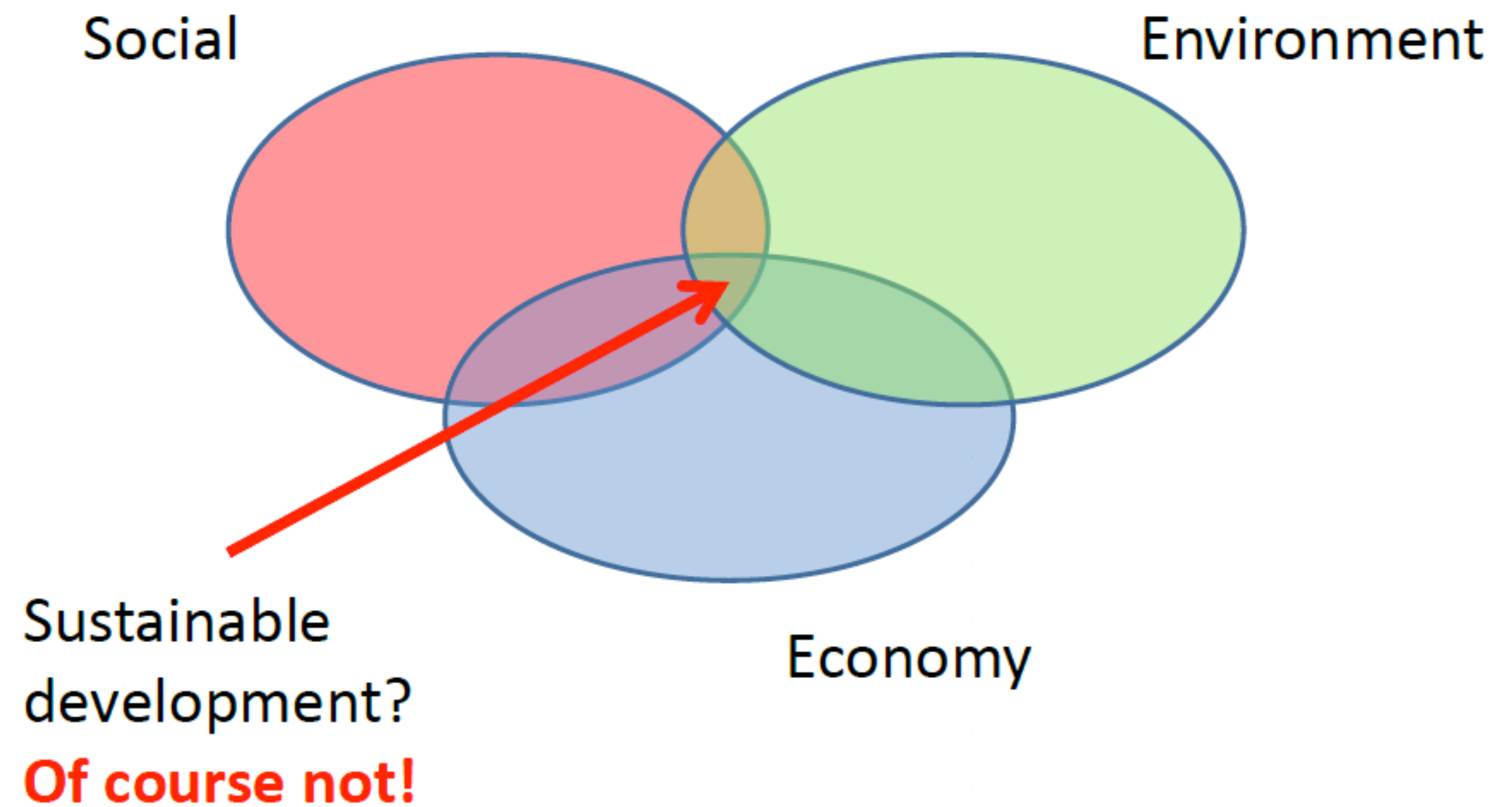
Contents

- Sustainability and Policy Making
- Making Choices between Options
- Adaptation to Sea Level Rise
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- Accounting for Slow Changes
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Sustainable Development:
Brundtland et al., 1987: “Development that meets the needs of the present without compromising the ability of future generations to meet their needs”



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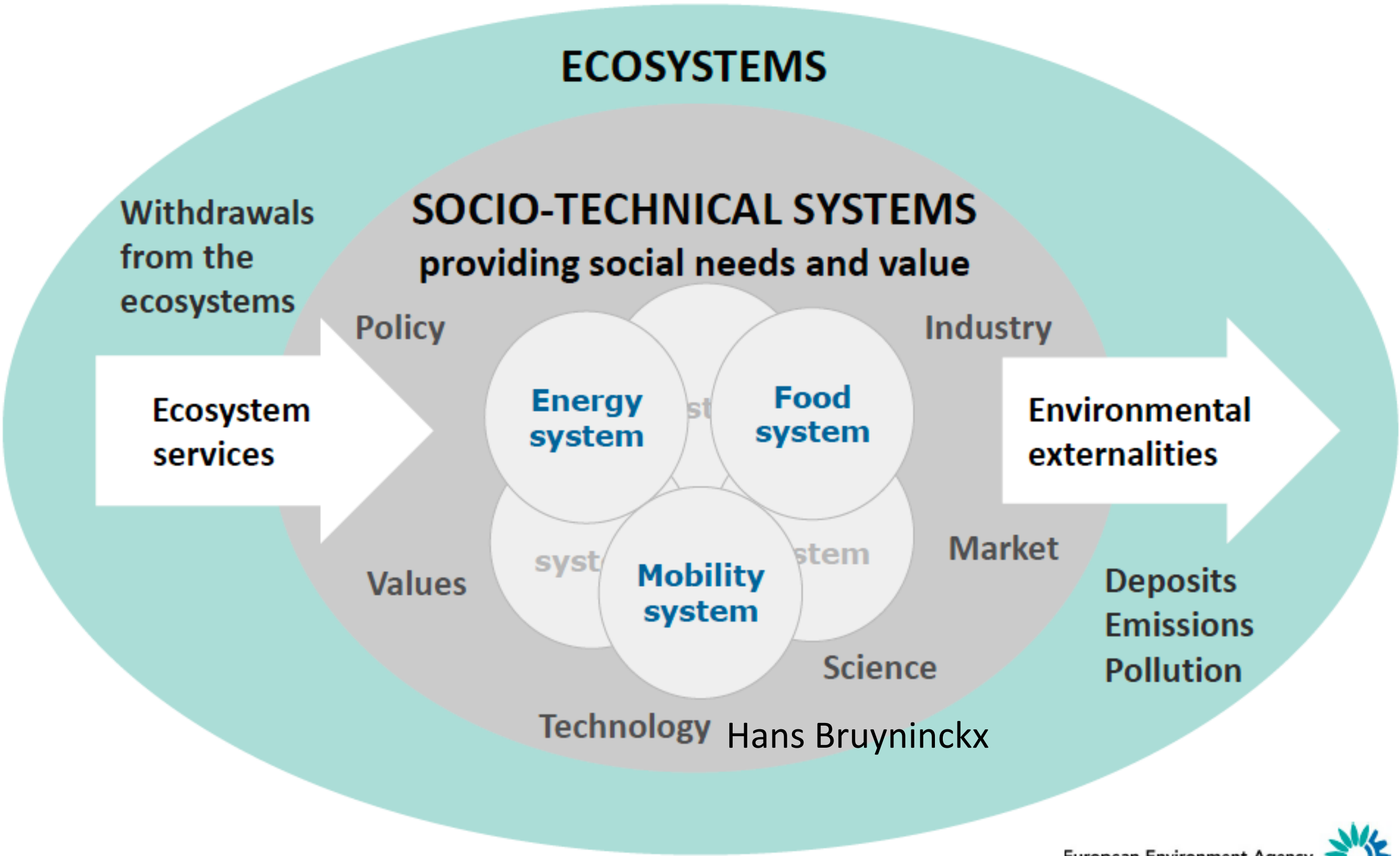


Systemic Changes

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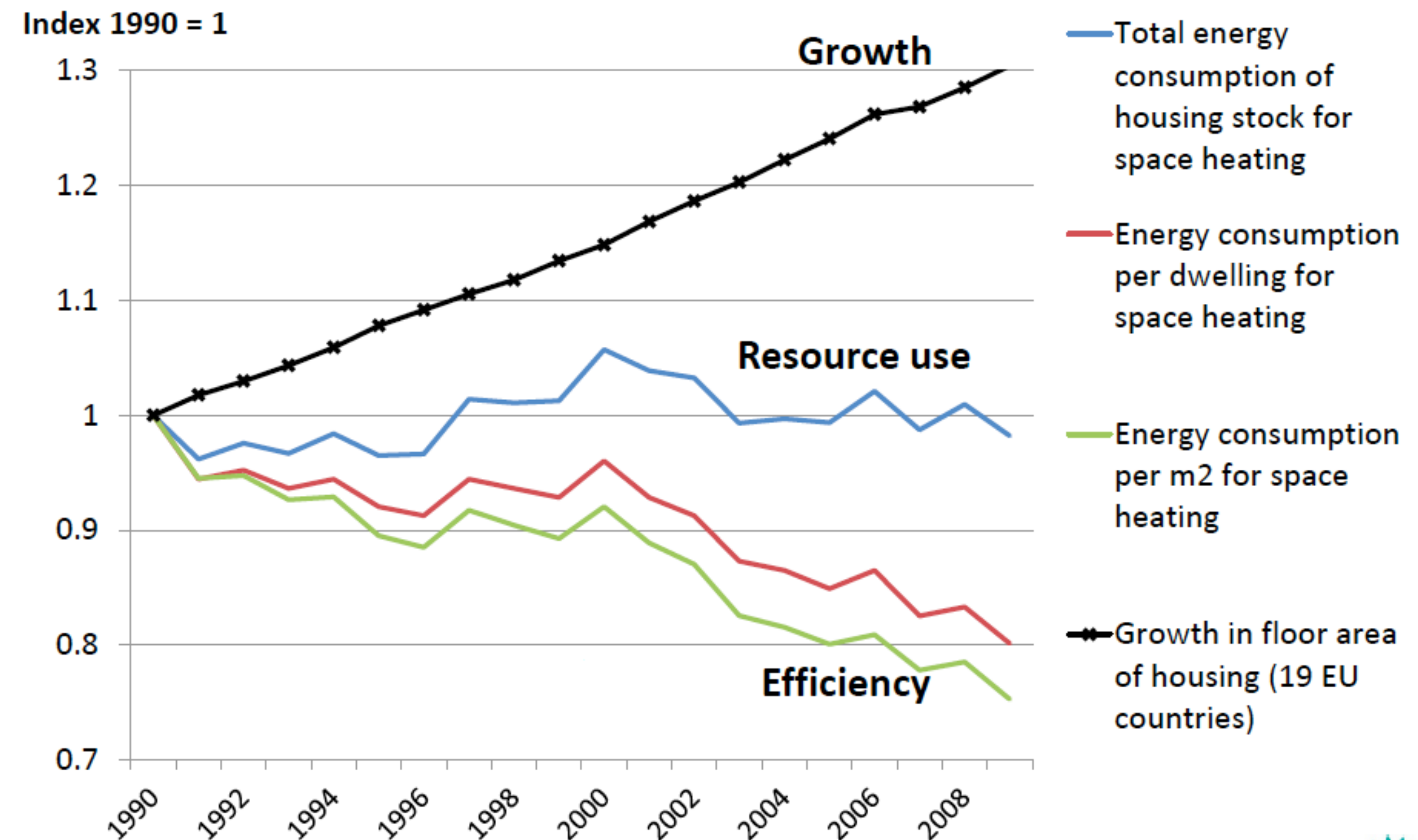
Systems Thinking



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Homes (EU) are now more energy efficient, but also much larger, increasing pressures on land, water and materials



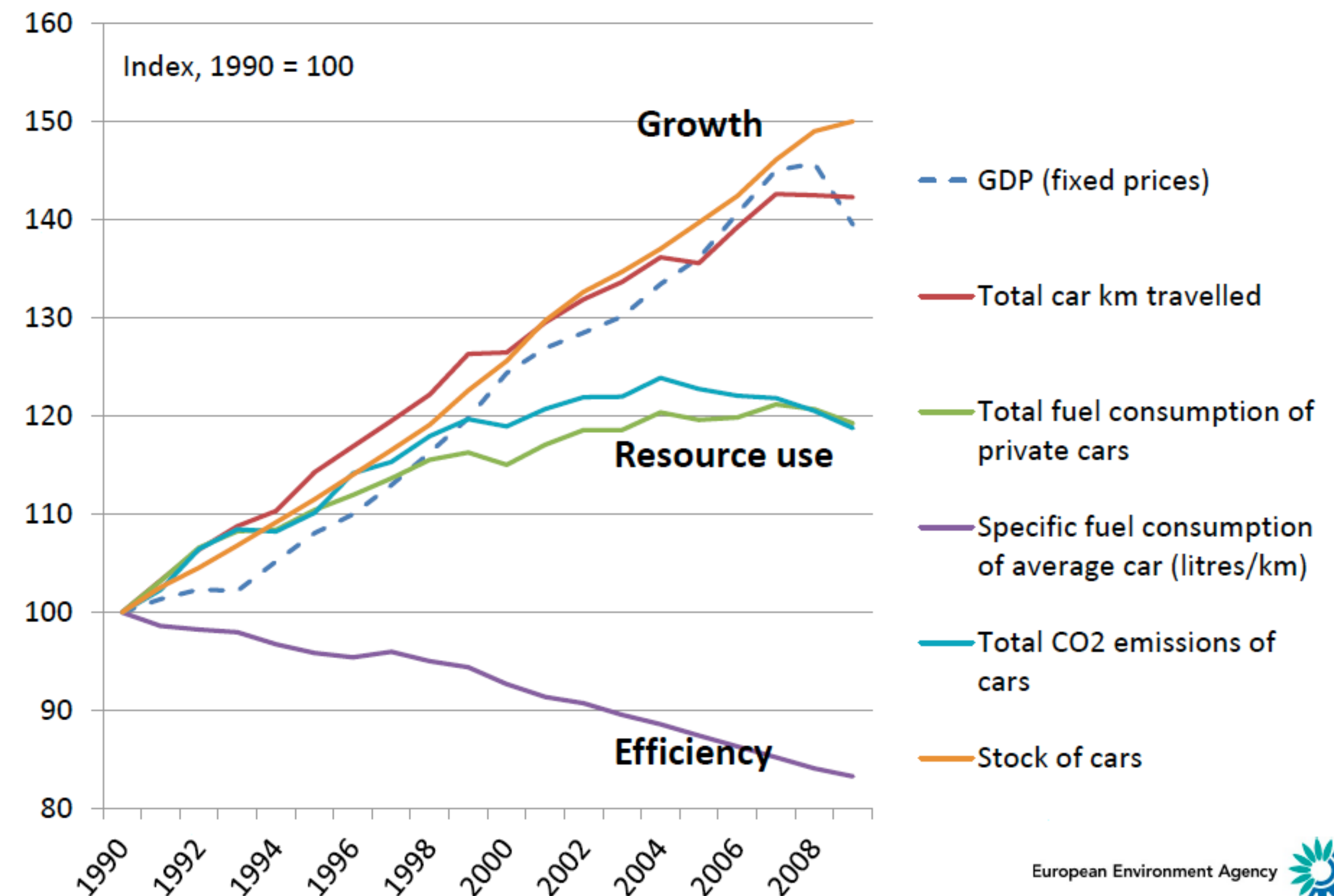
Source: SCP023 indicator (draft)

Systemic Changes

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Cars (EU) are more efficient but contribute to a range of negative impacts on people's quality of life in cities



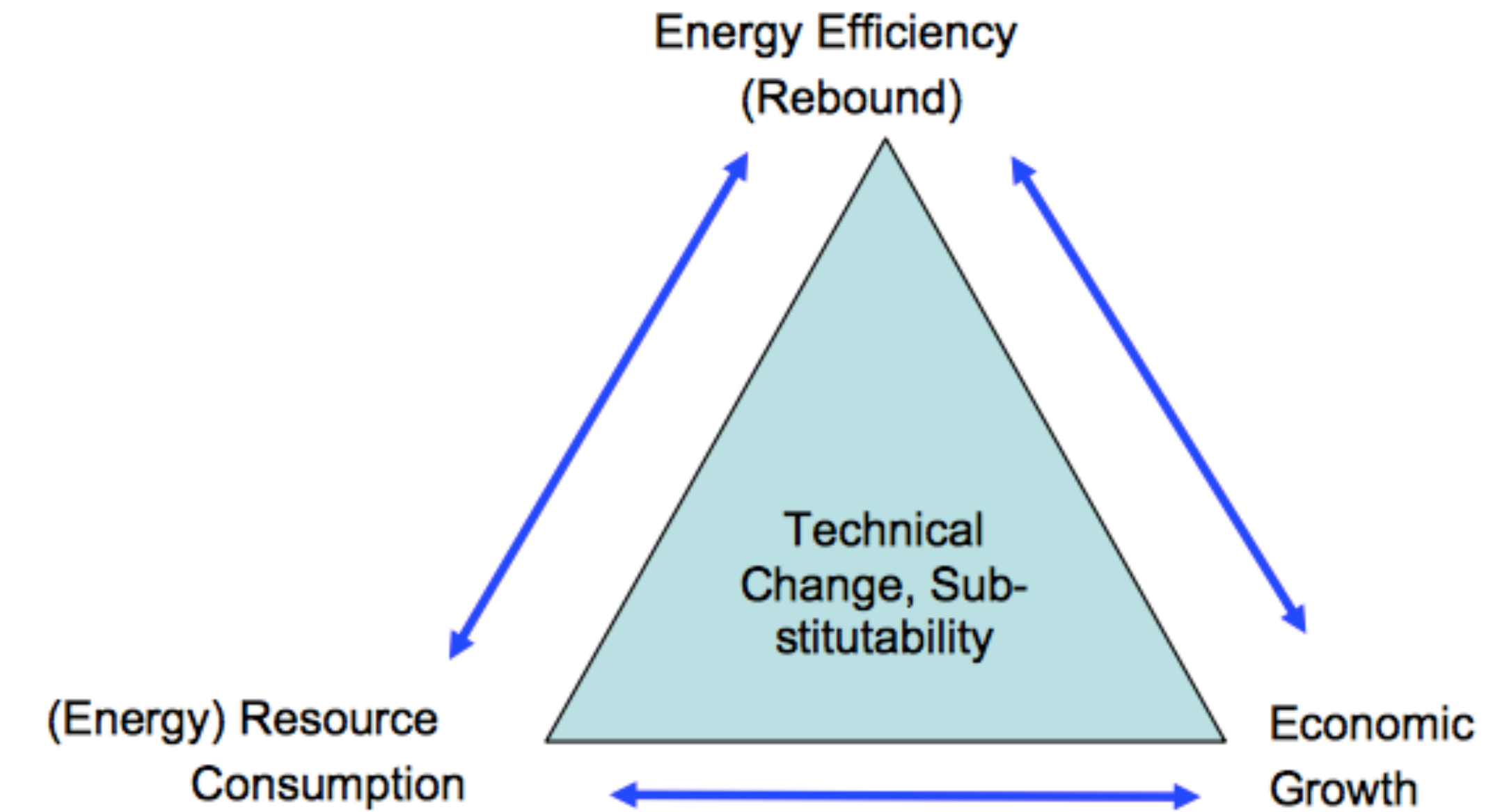
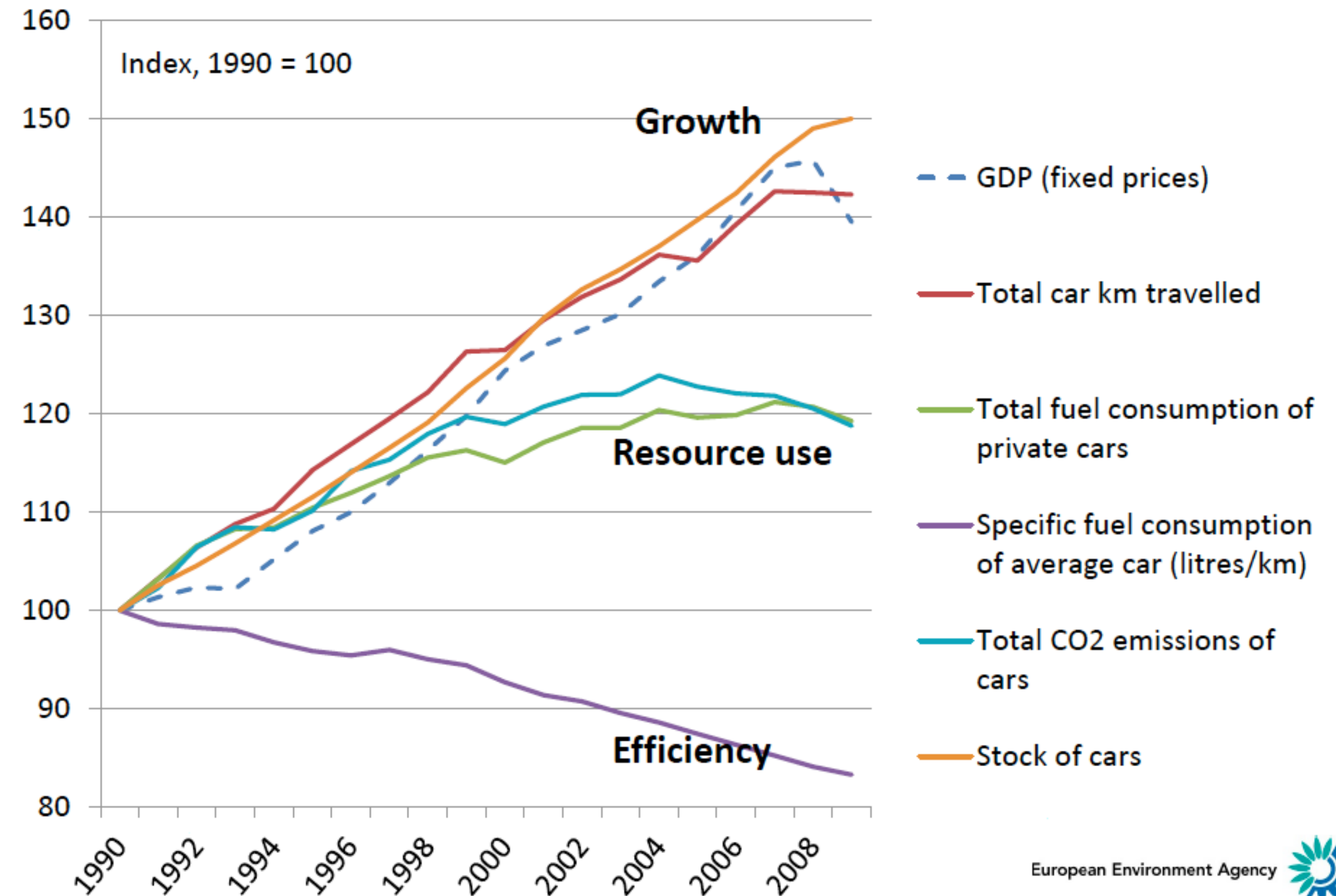


Fig. 1. Dimensions considered for the discussion of energy rebound and economic growth.

Jevons Paradox (1906)

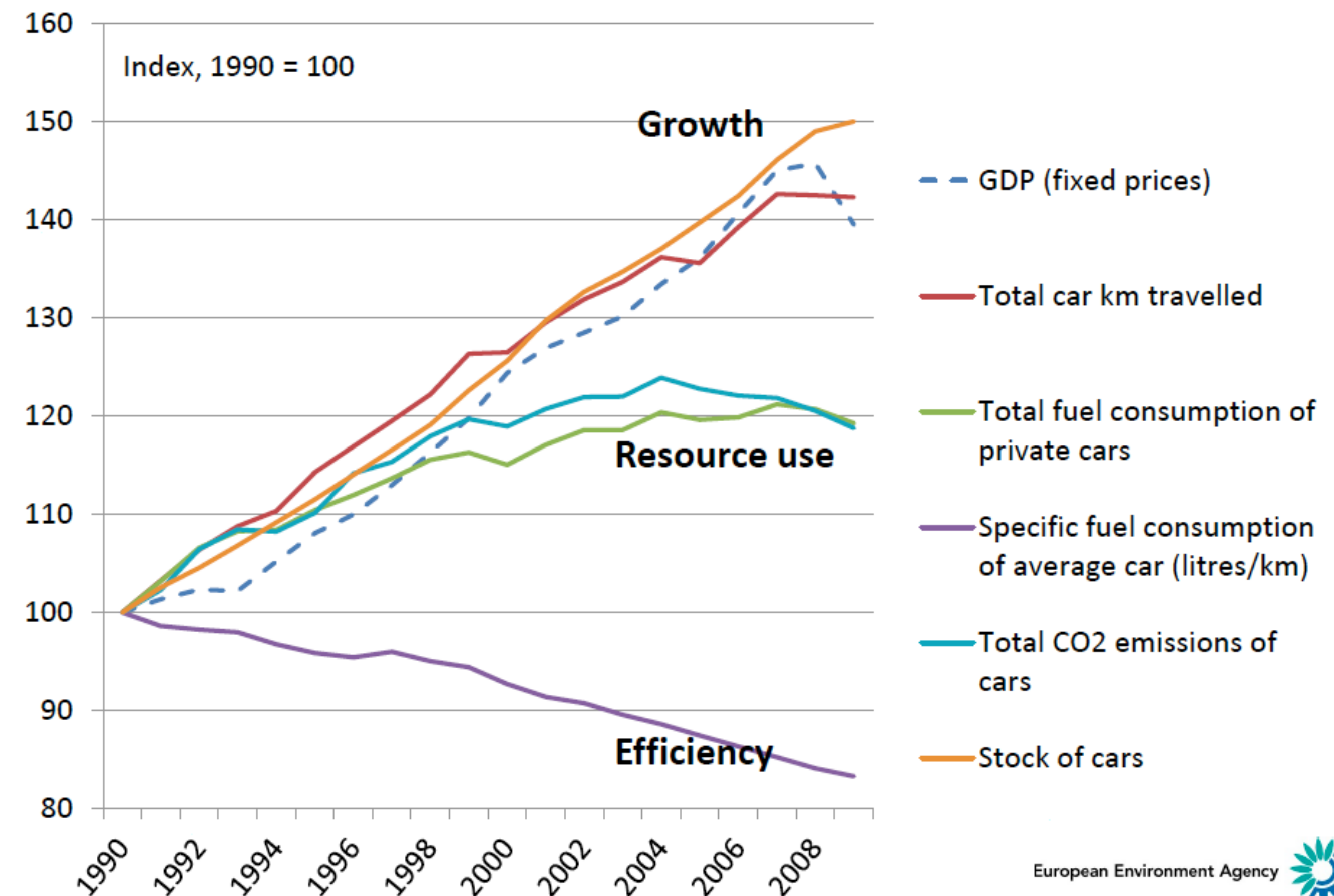
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To reach ambitious environmental visions

Not just incremental efficiency gains ...



nor new technologies only ...



Systemic Changes

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... but also a different systemic (re-) thinking.



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See Class 28