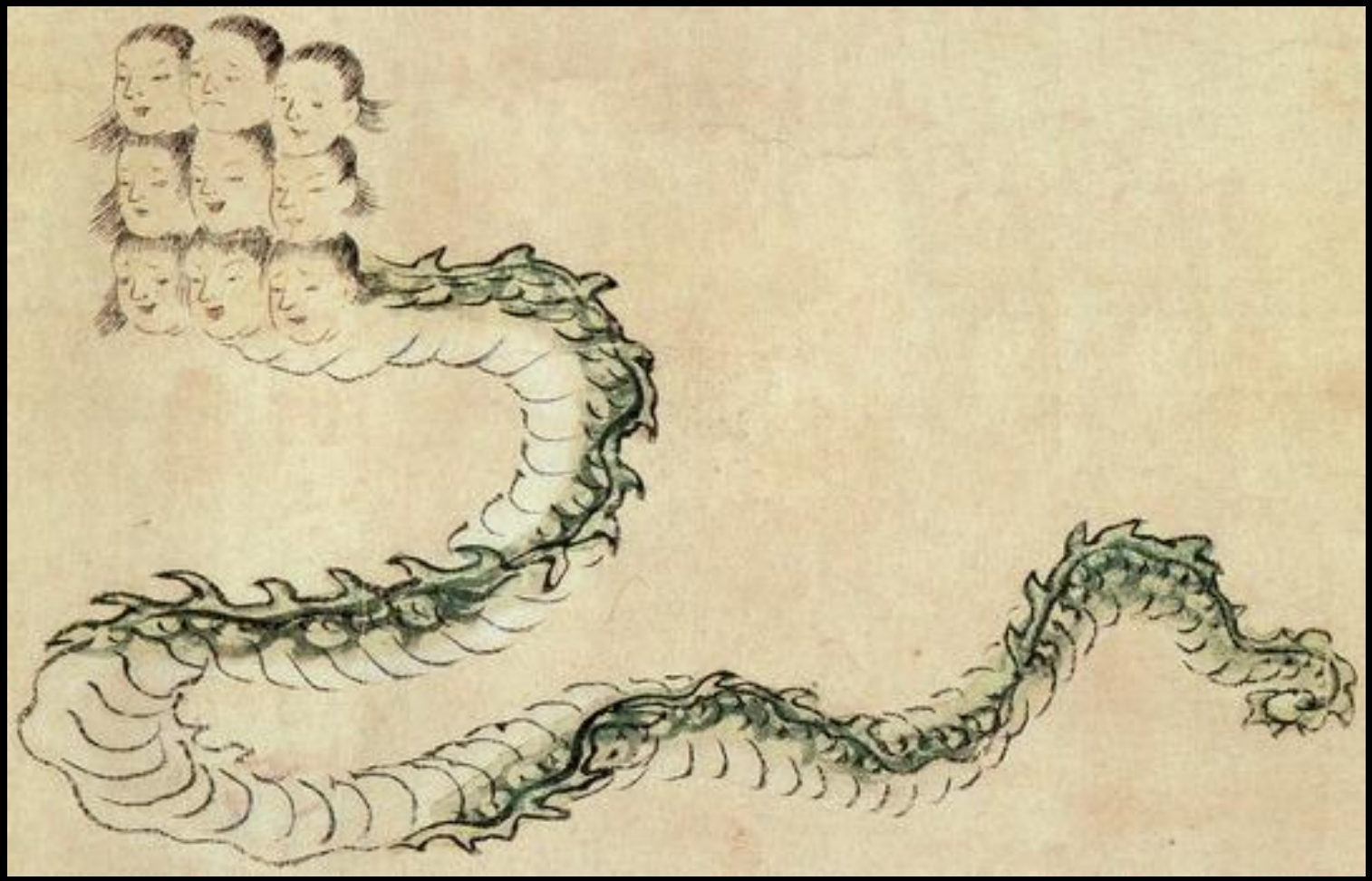
# TRIZ And AntiFragile Systems

Darrell Mann

# Mythology 1…

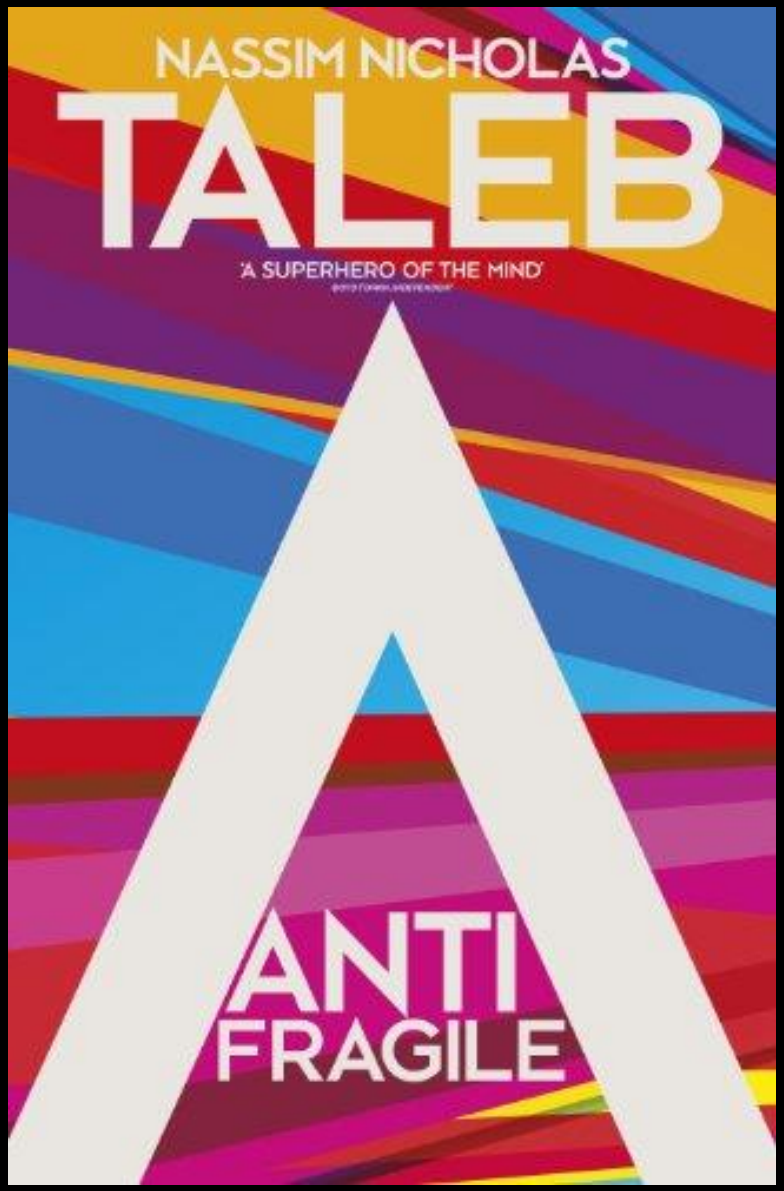


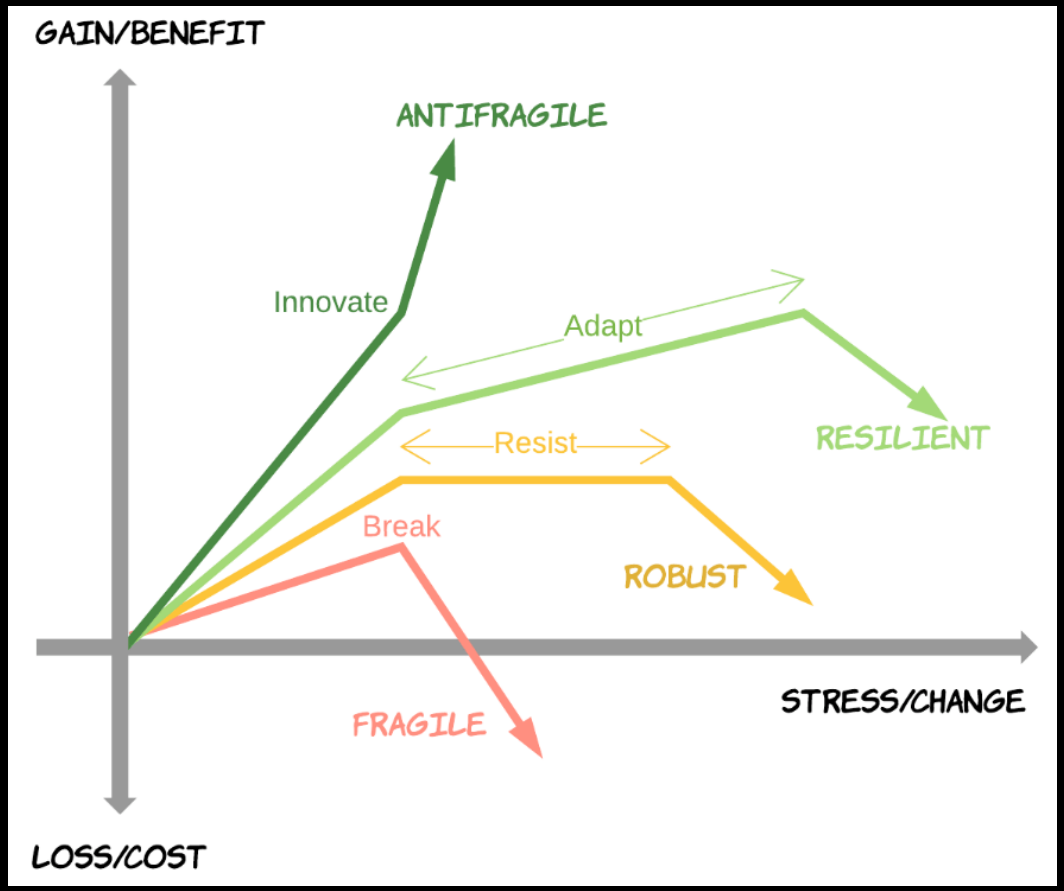
相柳 (Xiang-Liu), in *The Classic of Mountains and seas*

# Mythology 2…

Hydra

# 2012… The World Gets A New Word…



# A Tragedy


Natasha Ednan-Laperouse
17 July 2016

artichoke, olive & tapenade baguette

# A Tragedy

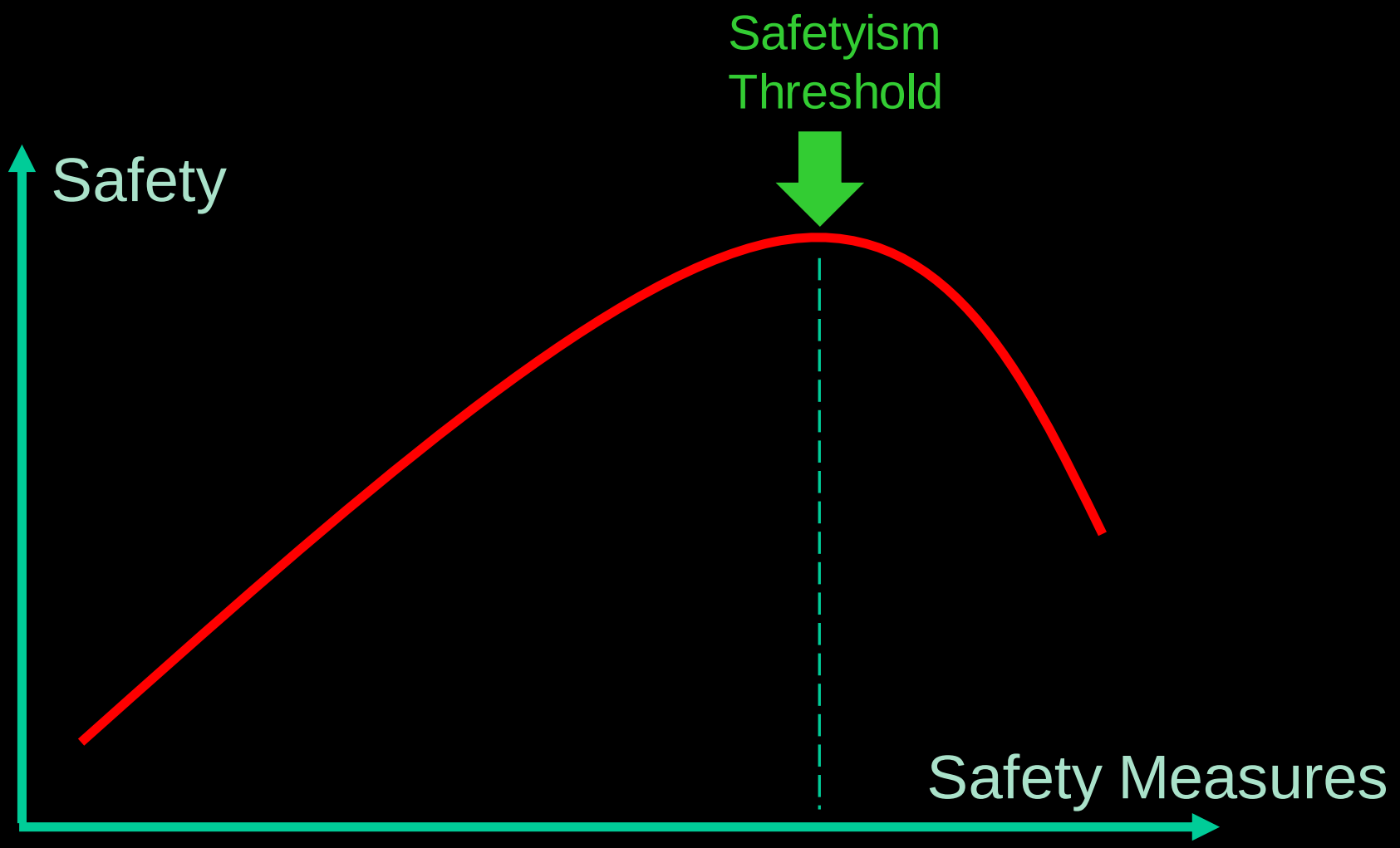

Natasha Ednan-Laperouse
17 July 2016


200+ failures/year
35+ hospitalizations
7+ deaths
'inherently unsafe'

# What Do These Have In Common?



# Safety & Safetyism



# Measuring Resilience

| Level of Availability | Percent of Uptime | Downtime per Year | Downtime per Day |
|---|---|---|---|
| 1 Nine | 90% | 36.5 days | 2.4 hrs. |
| 2 Nines | 99% | 3.65 days | 14 min. |
| 3 Nines | 99.9% | 8.76 hrs. | 86 sec. |
| 4 Nines | 99.99% | 52.6 min. | 8.6 sec. |
| 5 Nines | 99.999% | 5.25 min. | .86 sec. |
| 6 Nines | 99.9999% | 31.5 sec. | 8.6 msec |

# One Nine


About 90% of UK trains run to schedule

# Two Nines

# Two Nines

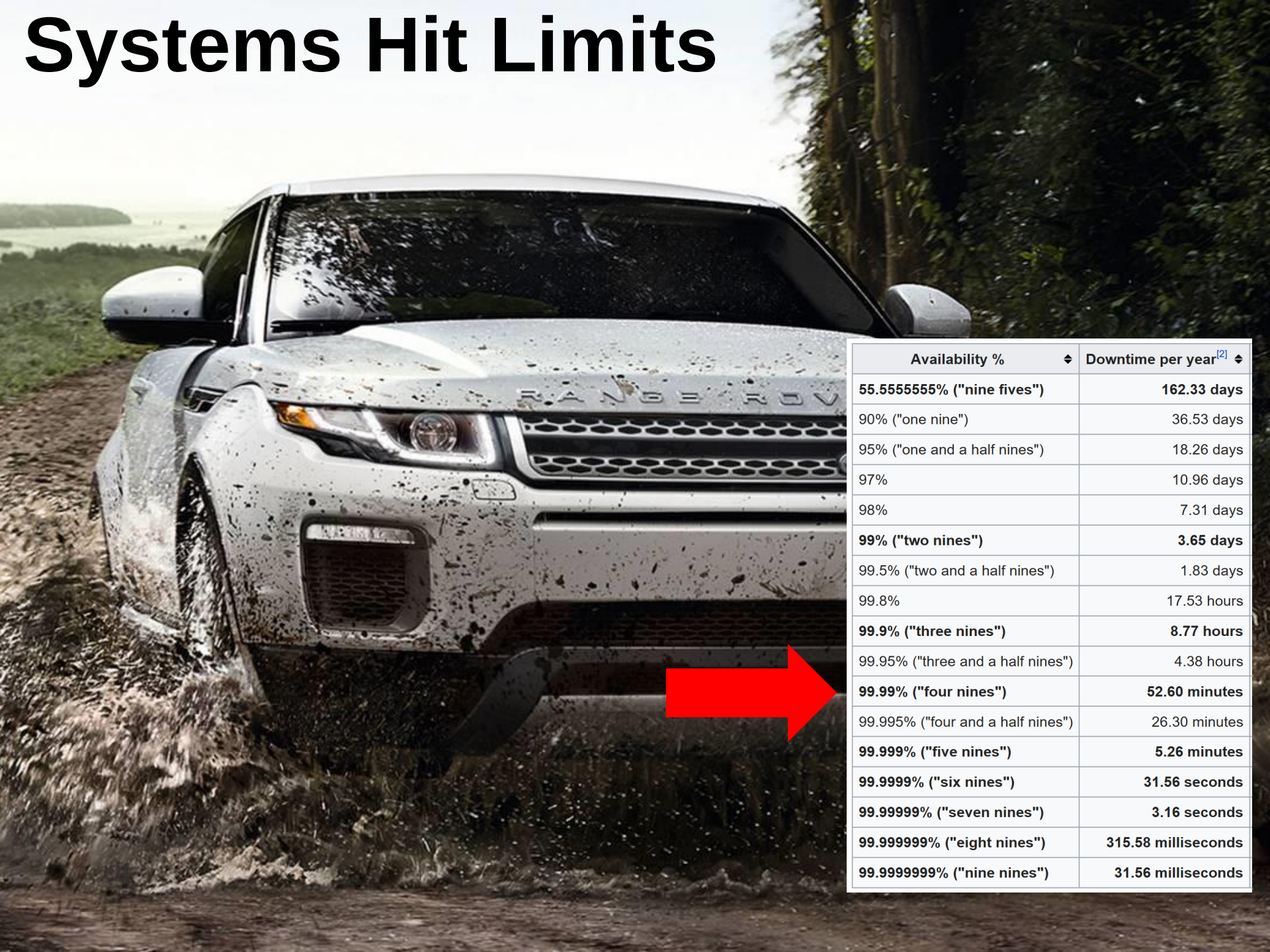
# Three Nines

# Ten Nines?


# Ten Nines? Tacoma Narrows Bridge

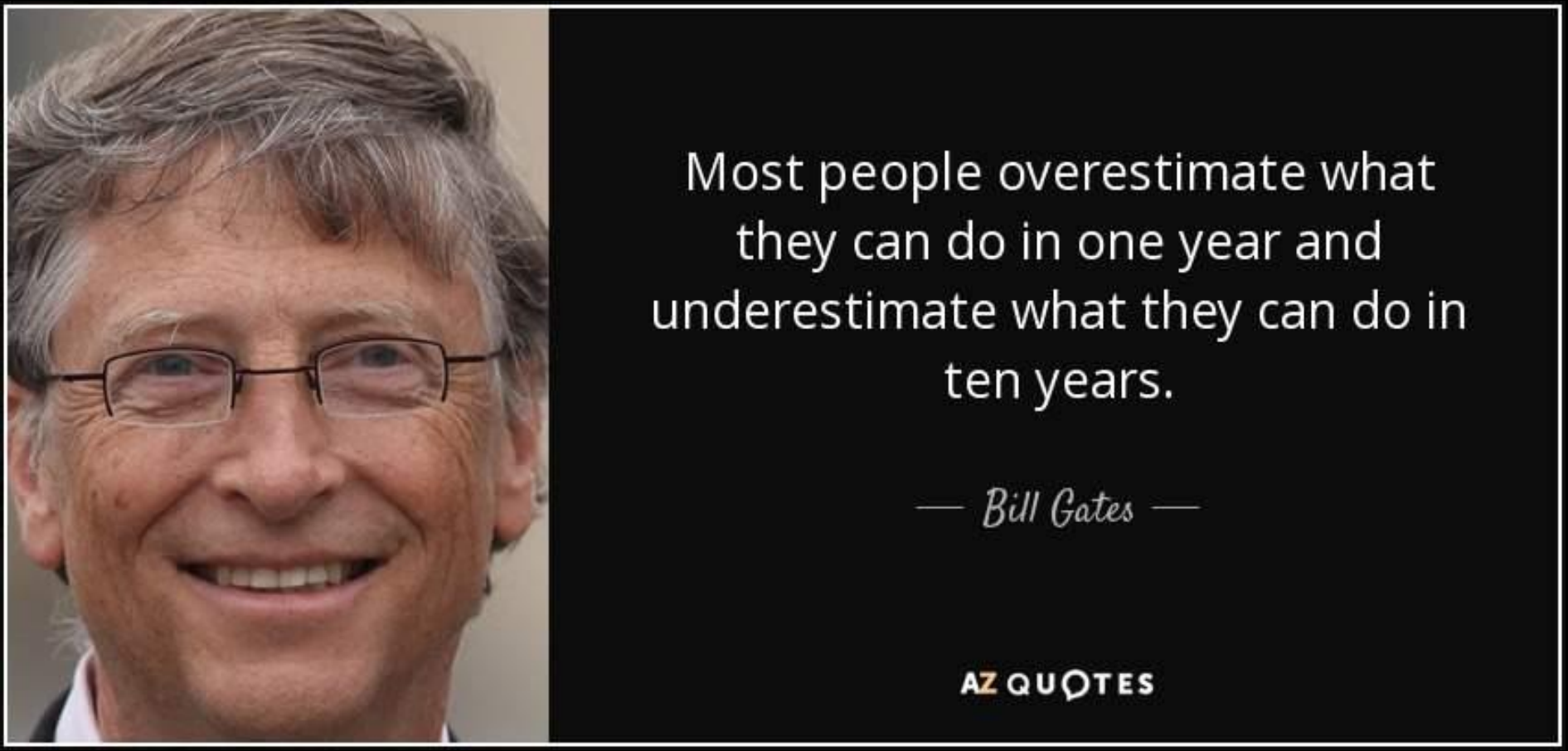
‘Continuous Improvement’ eventually causes engineers to push too far

# Systems Hit Limits

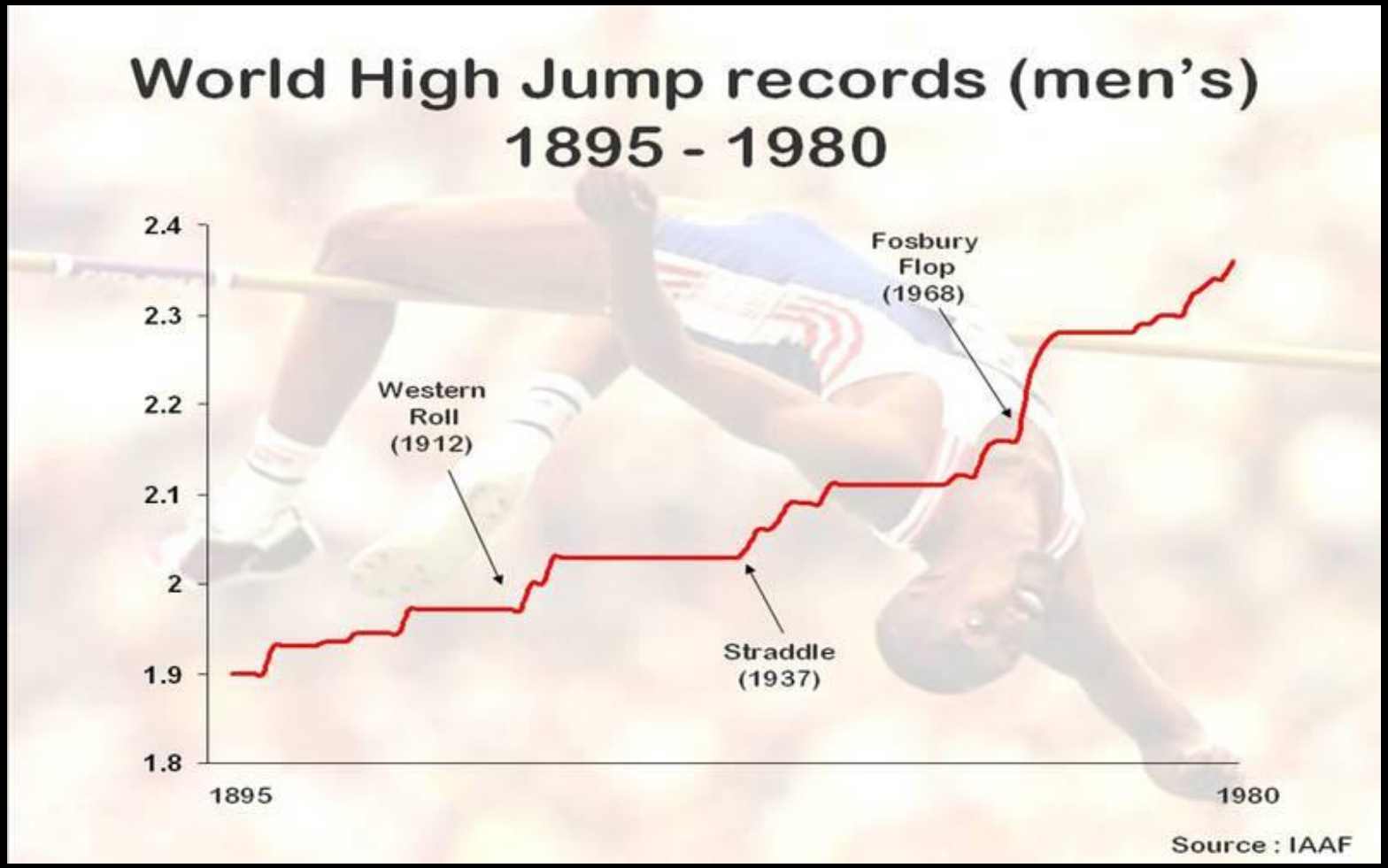


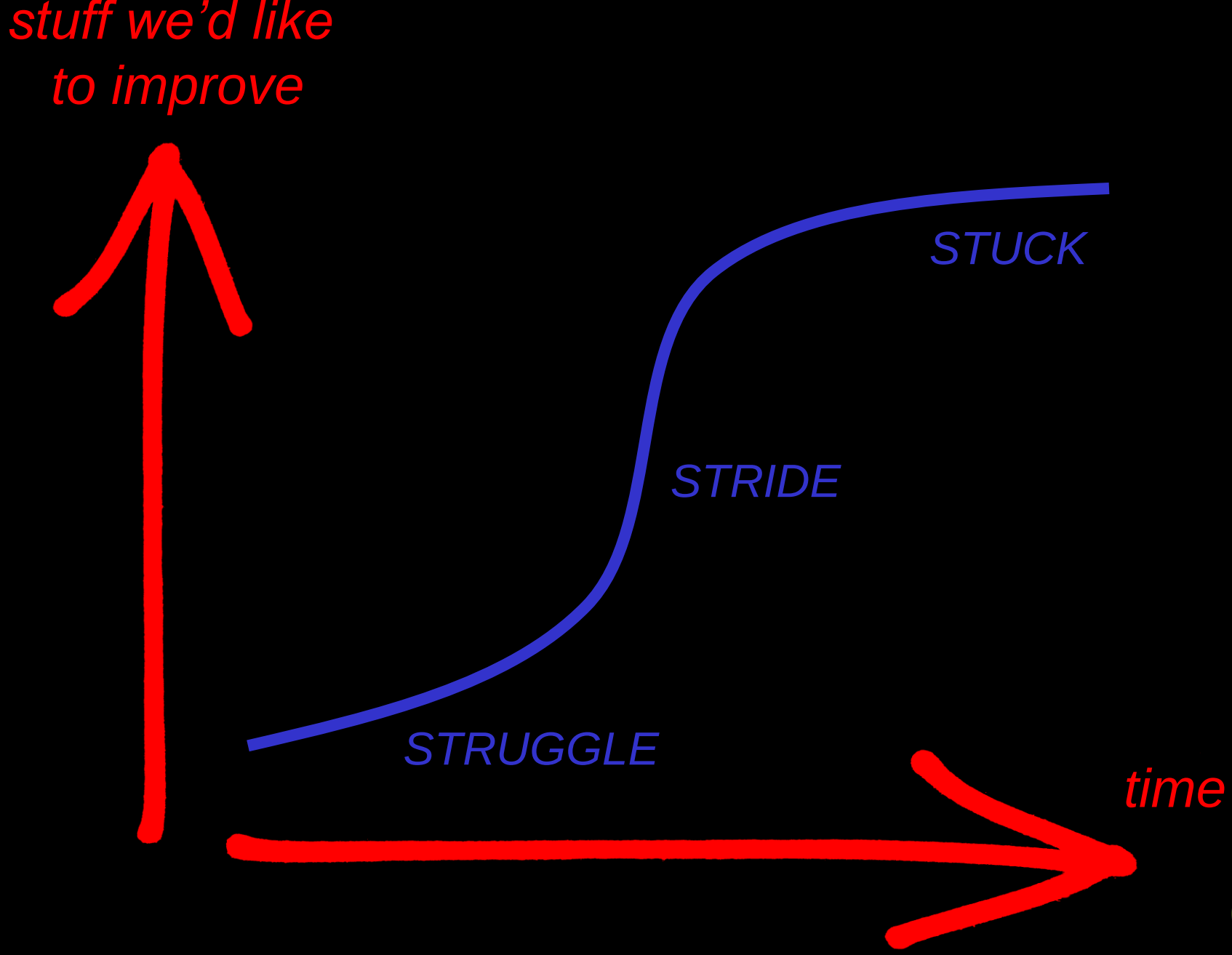
| Availability % | Downtime per year[2] |
|---|---|
| **55.5555555% ("nine fives")** | **162.33 days** |
| 90% ("one nine") | 36.53 days |
| 95% ("one and a half nines") | 18.26 days |
| 97% | 10.96 days |
| 98% | 7.31 days |
| **99% ("two nines")** | **3.65 days** |
| 99.5% ("two and a half nines") | 1.83 days |
| 99.8% | 17.53 hours |
| **99.9% ("three nines")** | **8.77 hours** |
| 99.95% ("three and a half nines") | 4.38 hours |
| **99.99% ("four nines")** | **52.60 minutes** |
| 99.995% ("four and a half nines") | 26.30 minutes |
| **99.999% ("five nines")** | **5.26 minutes** |
| **99.9999% ("six nines")** | **31.56 seconds** |
| **99.99999% ("seven nines")** | **3.16 seconds** |
| **99.999999% ("eight nines")** | **315.58 milliseconds** |
| **99.9999999% ("nine nines")** | **31.56 milliseconds** |

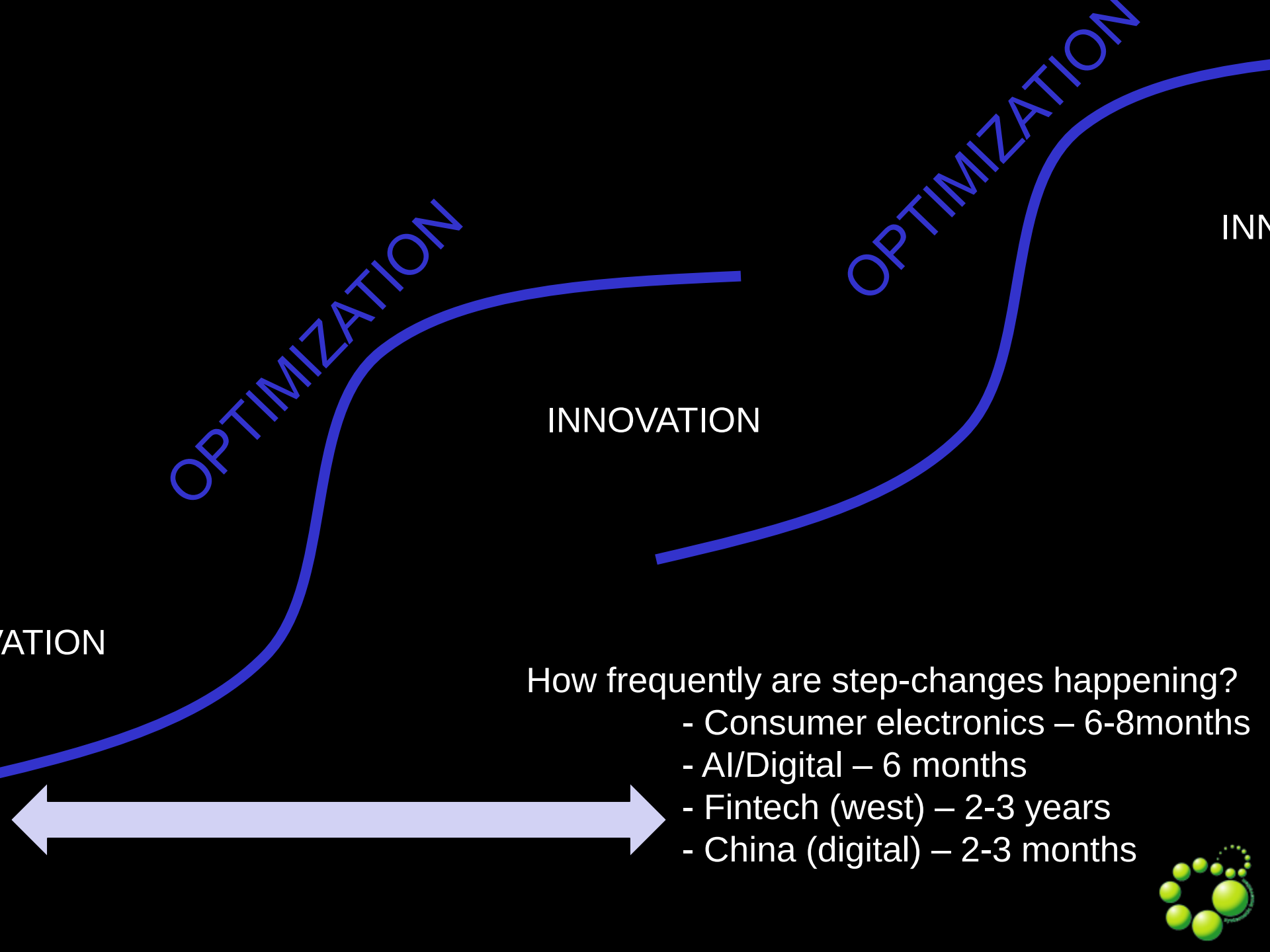
# …provided we understand how the world works…



# World High Jump records (men's) 1895 - 1980



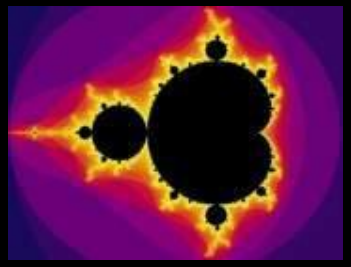

stuff we'd like to improve
STUCK
STRIDE
STRUGGLE
time

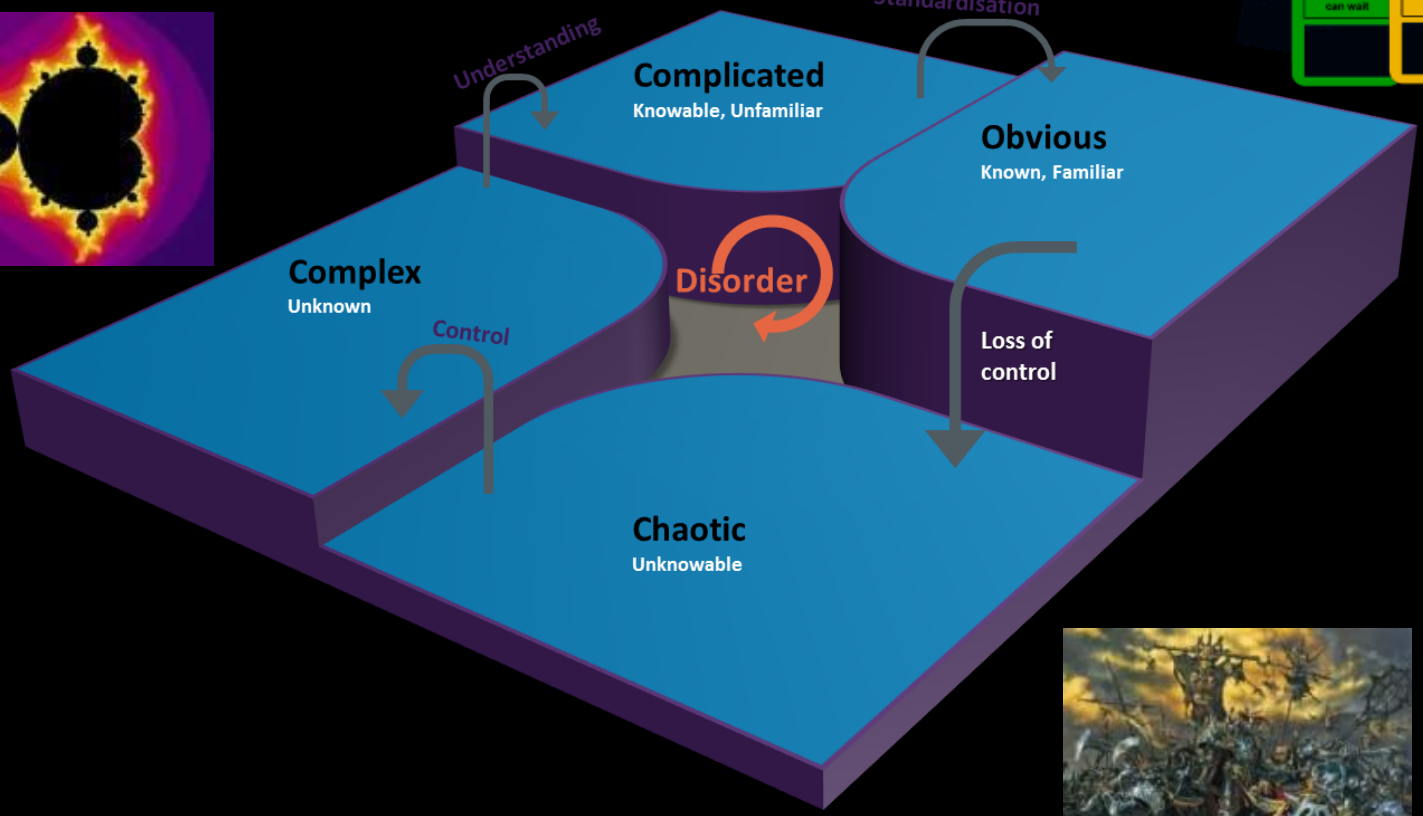



How frequently are step-changes happening?

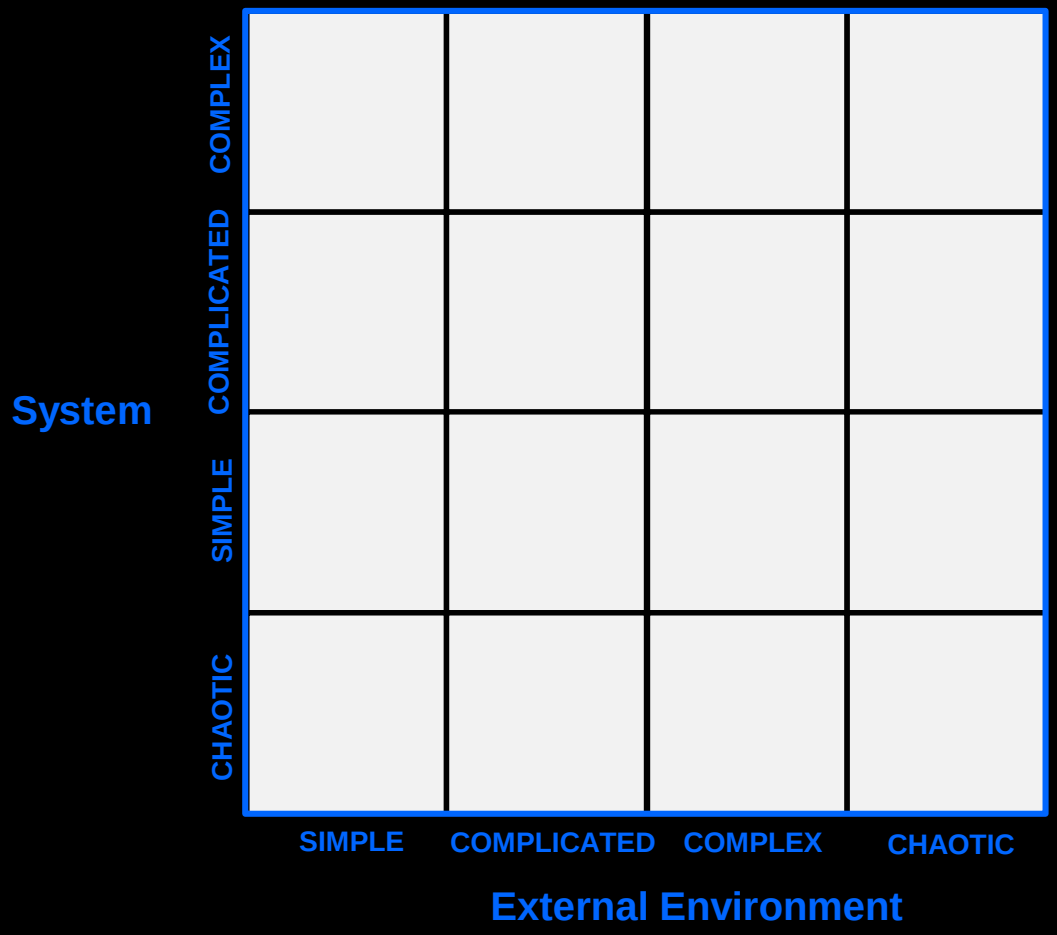
- Consumer electronics – 6-8months
- AI/Digital – 6 months
- Fintech (west) – 2-3 years
- China (digital) – 2-3 months

# Cynefin




# Complexity Landscape Model



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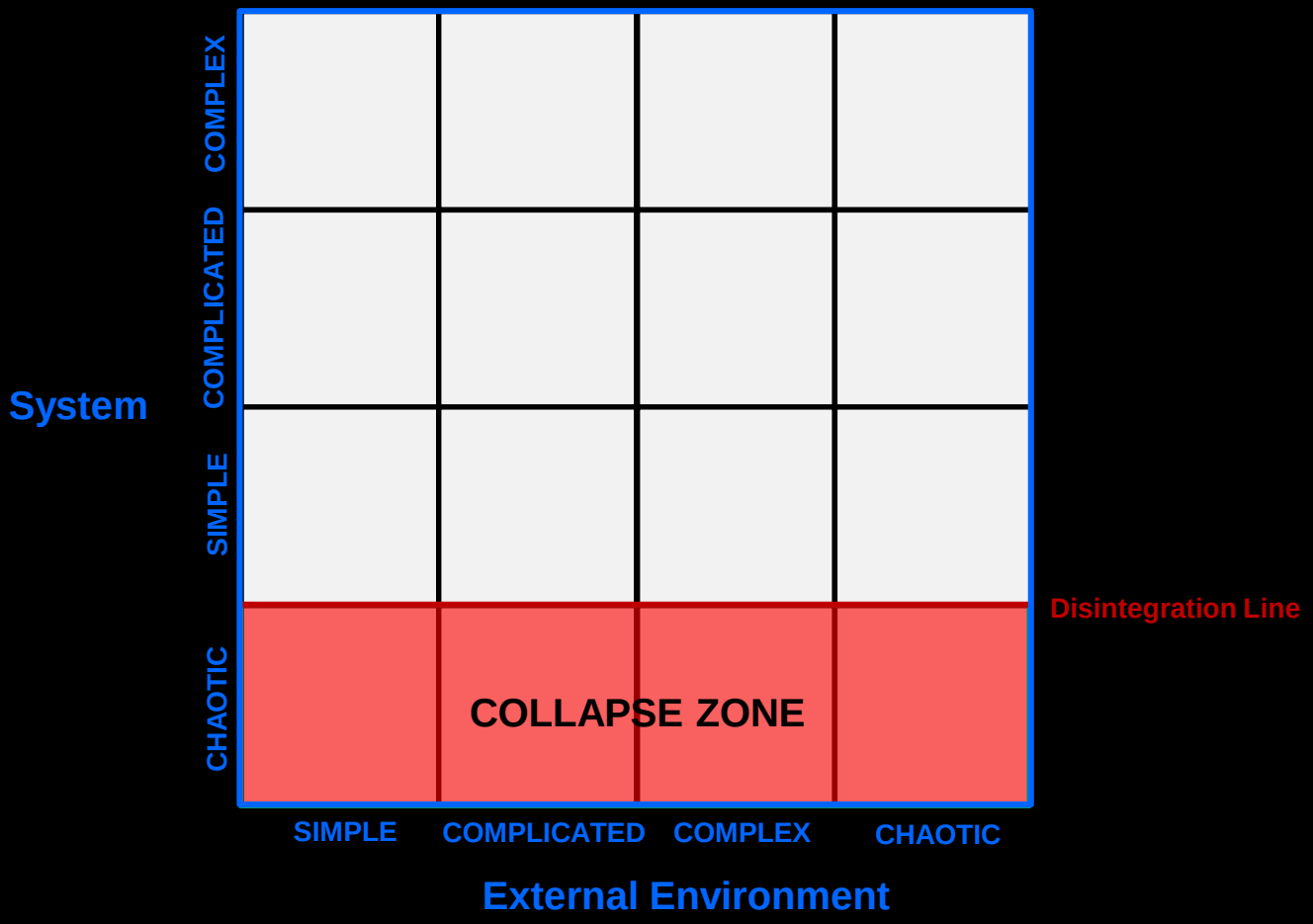
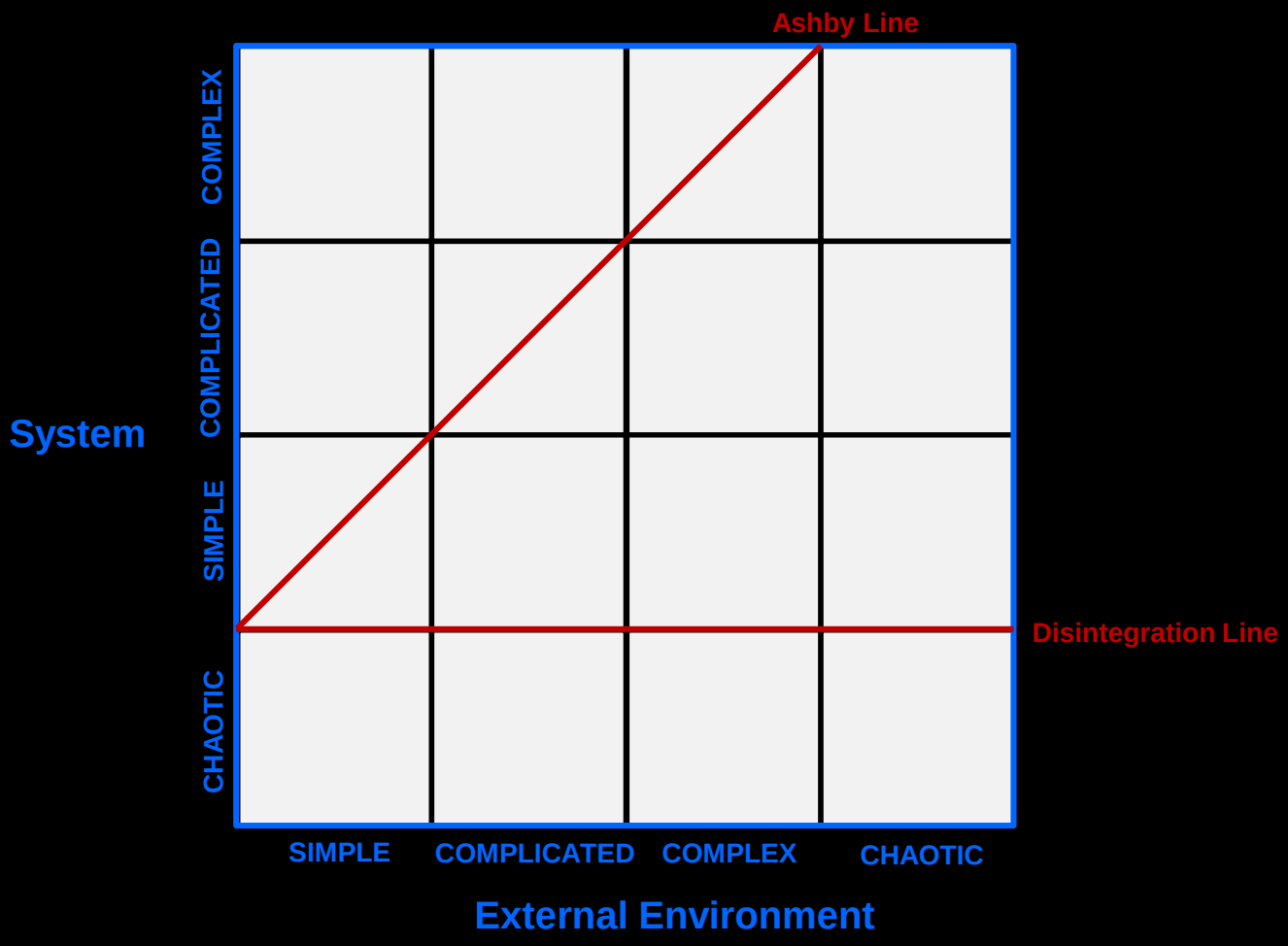
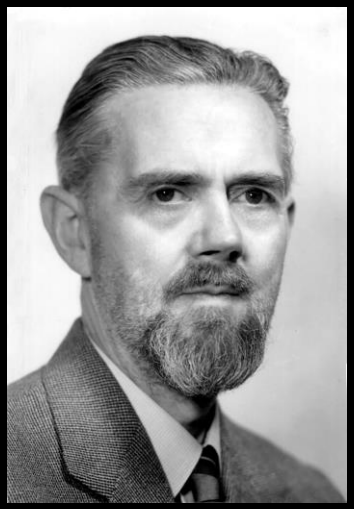
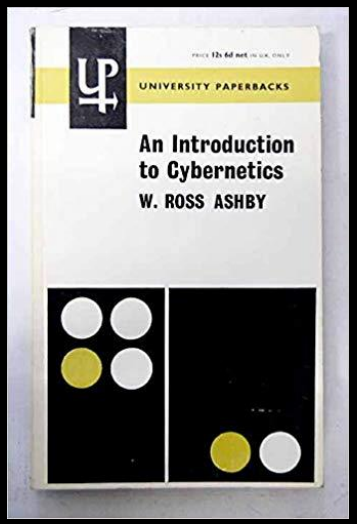


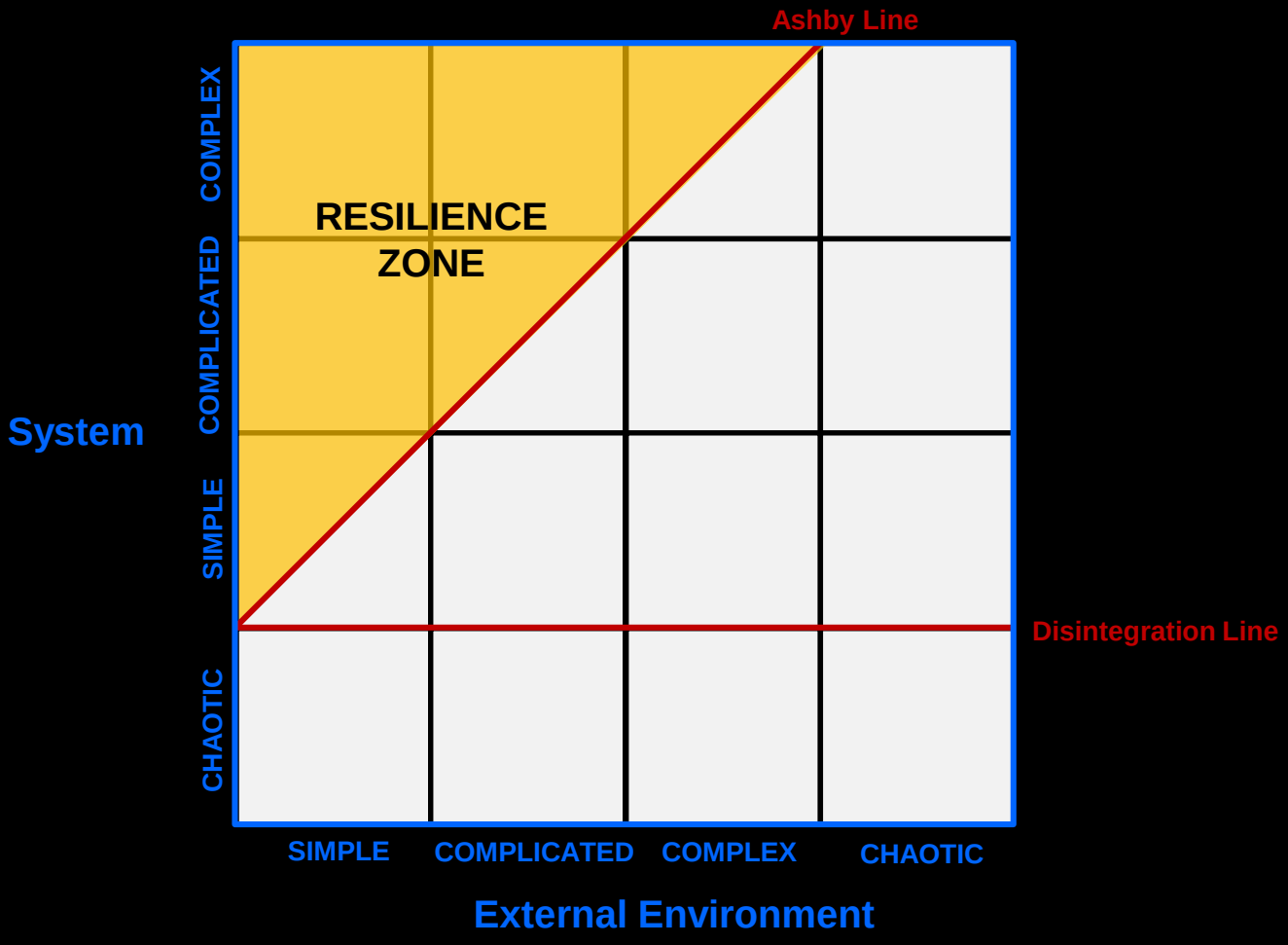
# Complexity Landscape & W. Ross Ashby



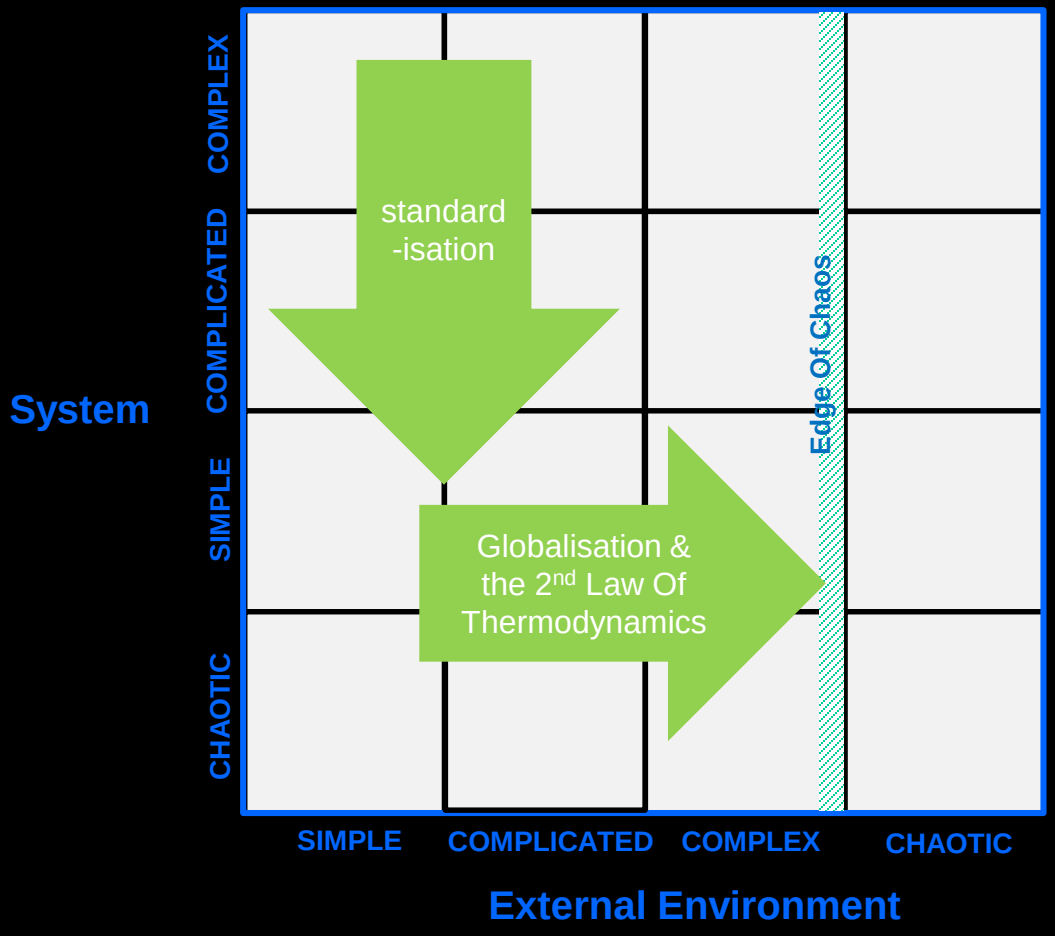



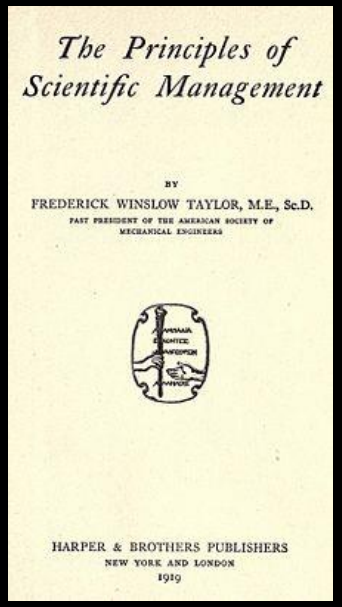


# Complexity Landscape - Resilience Zone

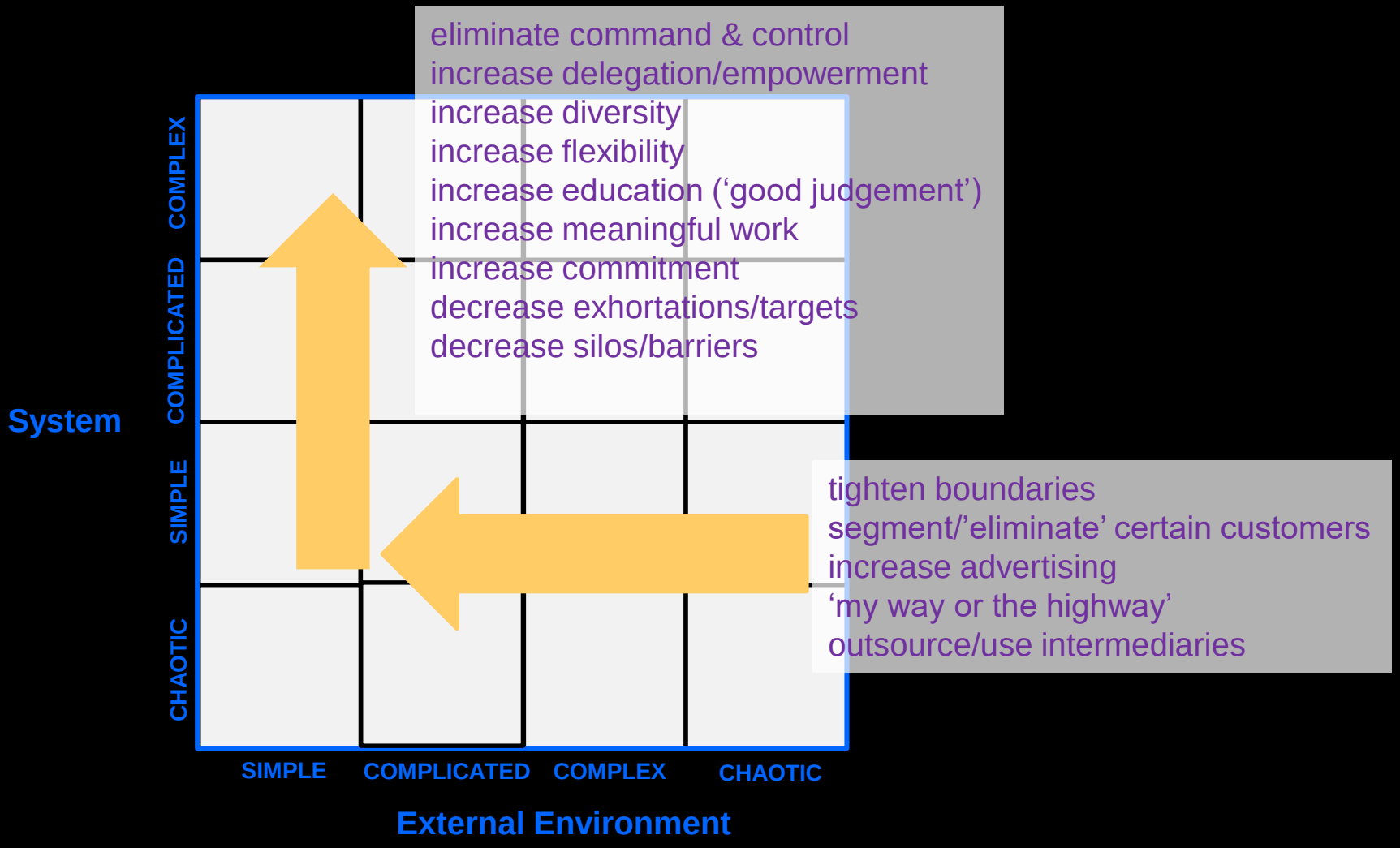


# Complexity Landscape - ‘Natural’ Forces

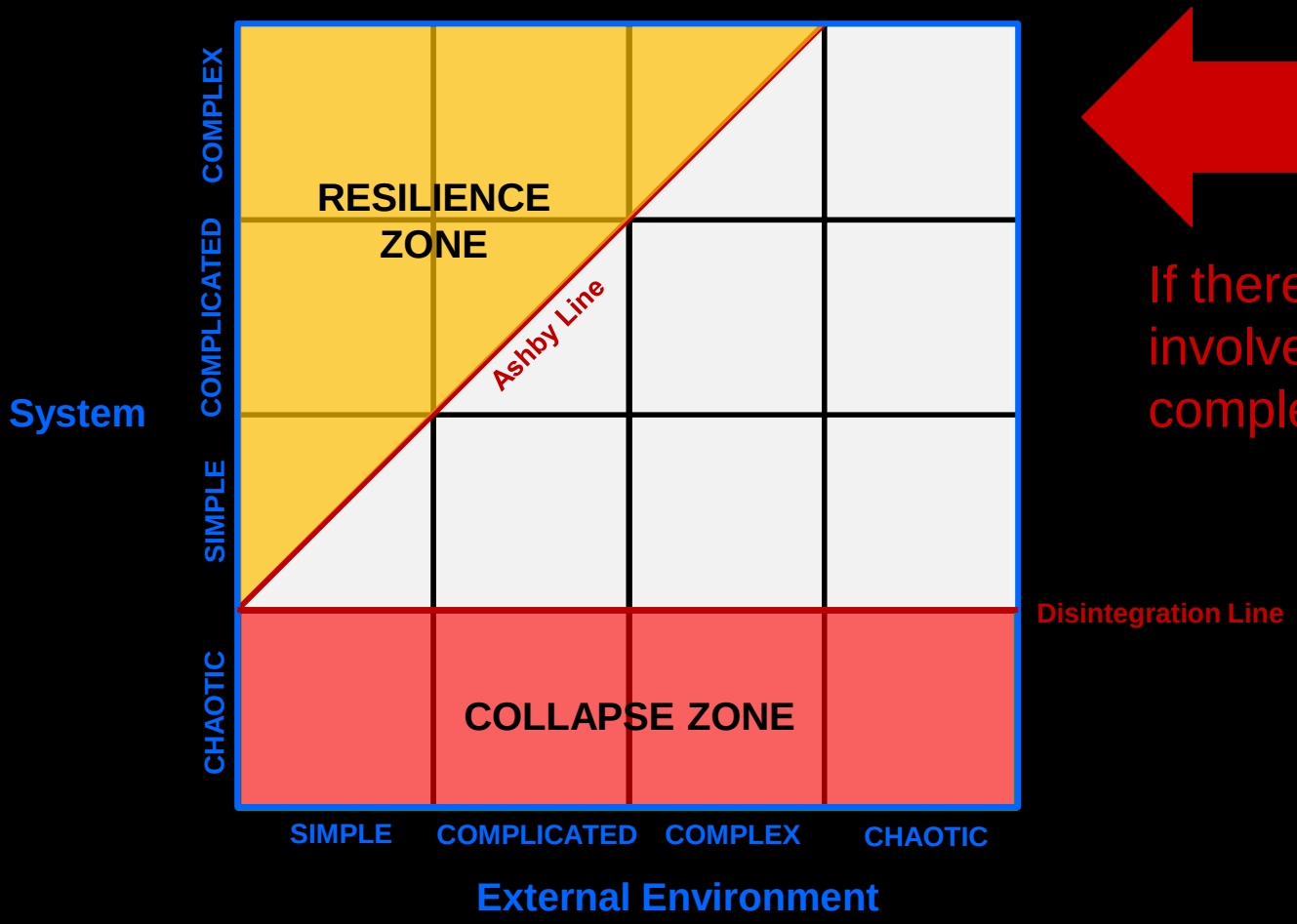


# Complexity Landscape - Management

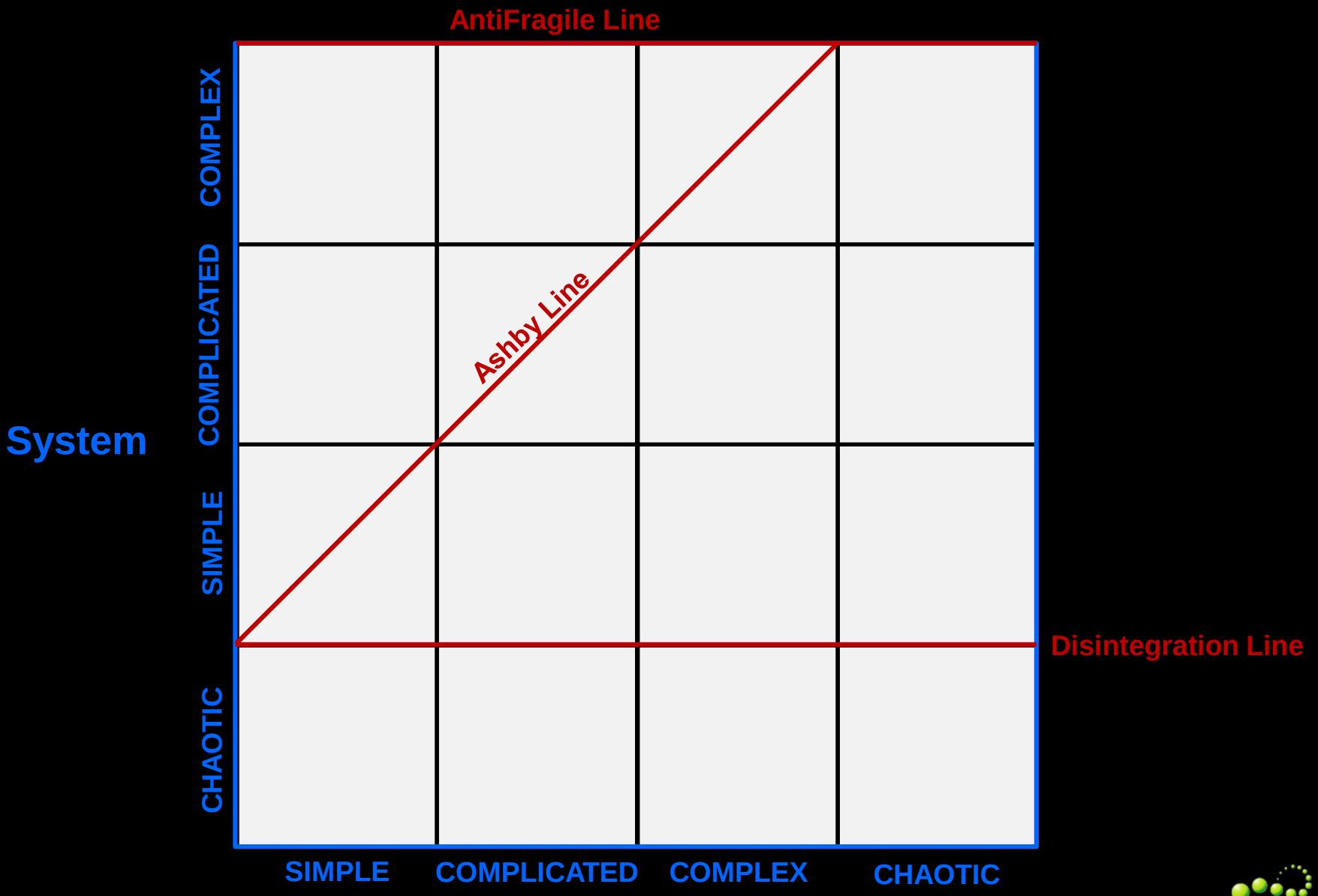


# Complexity Landscape - Heuristic #1




If there are 2+ humans involved, the system is complex

# AntiFragility

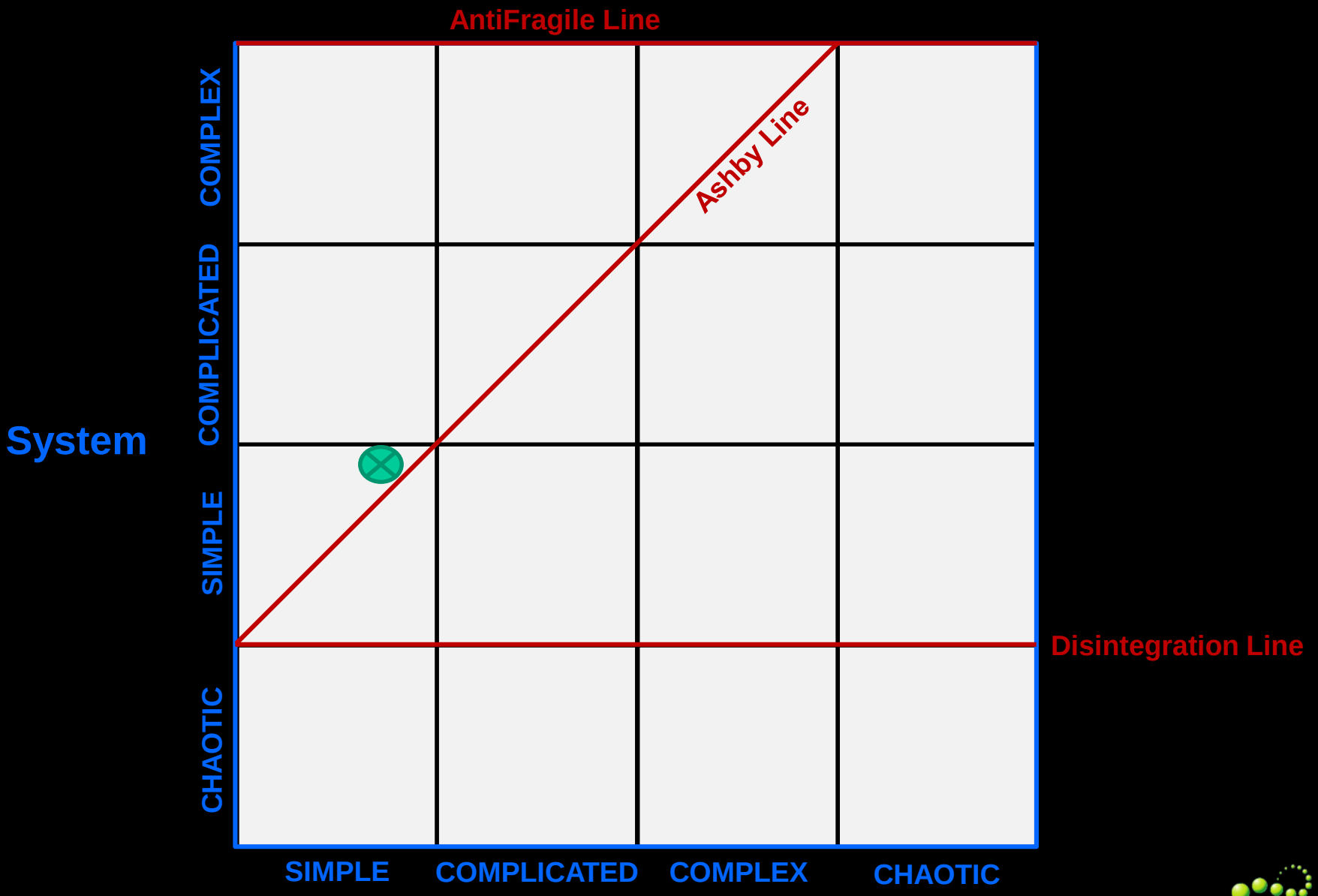


# Boeing 737

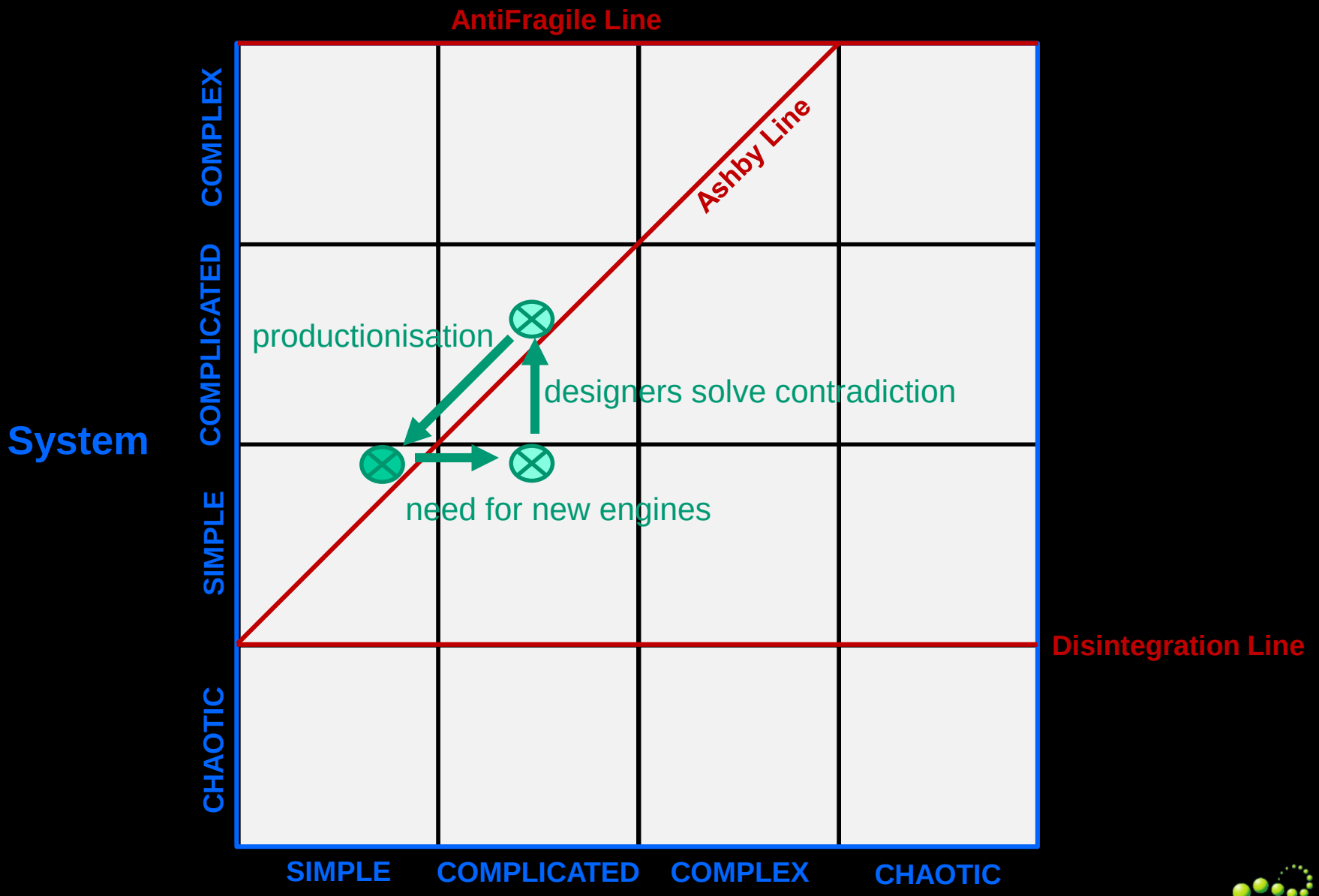

100/200 Series

300 Series

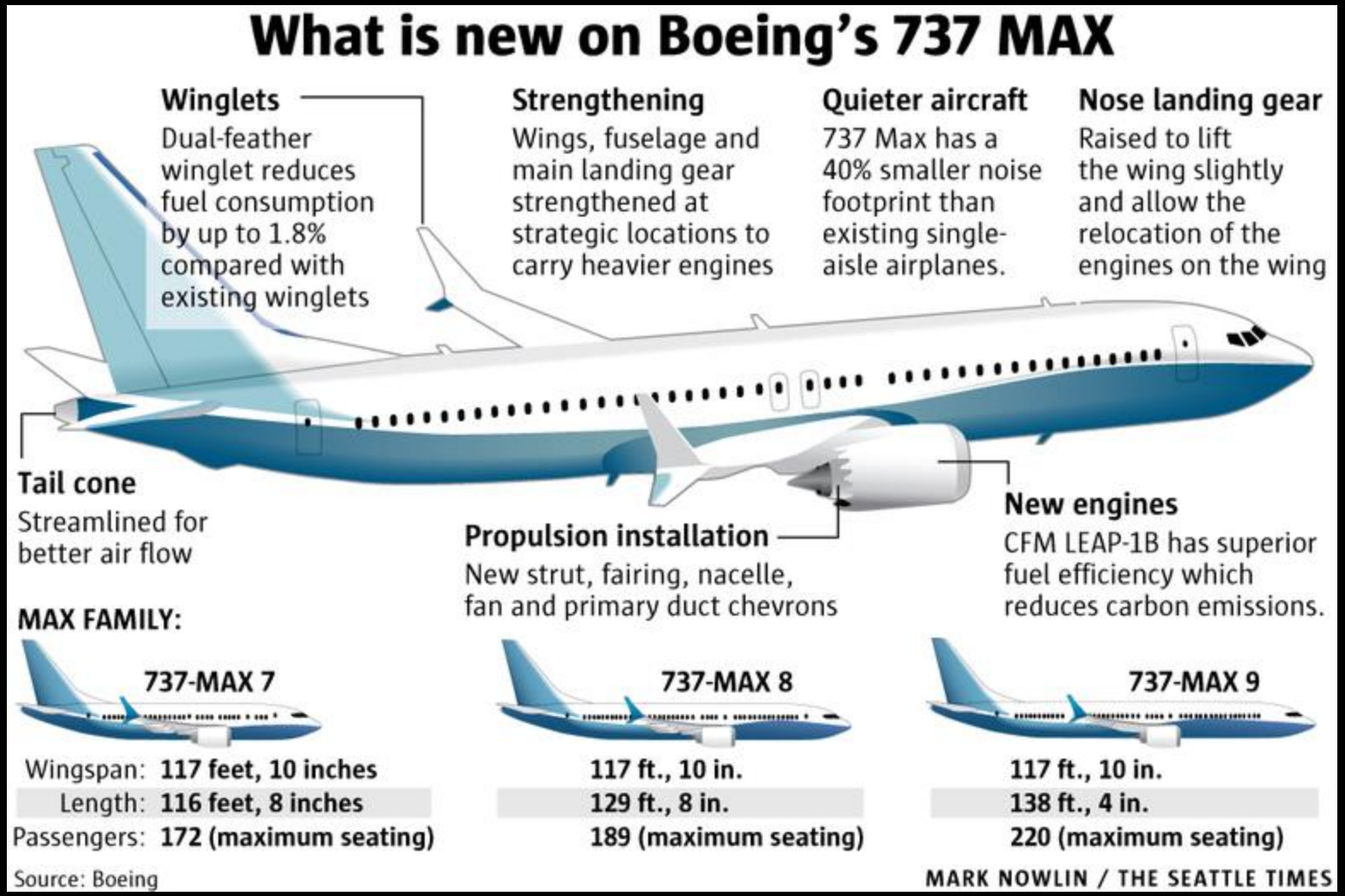
# Boeing 737



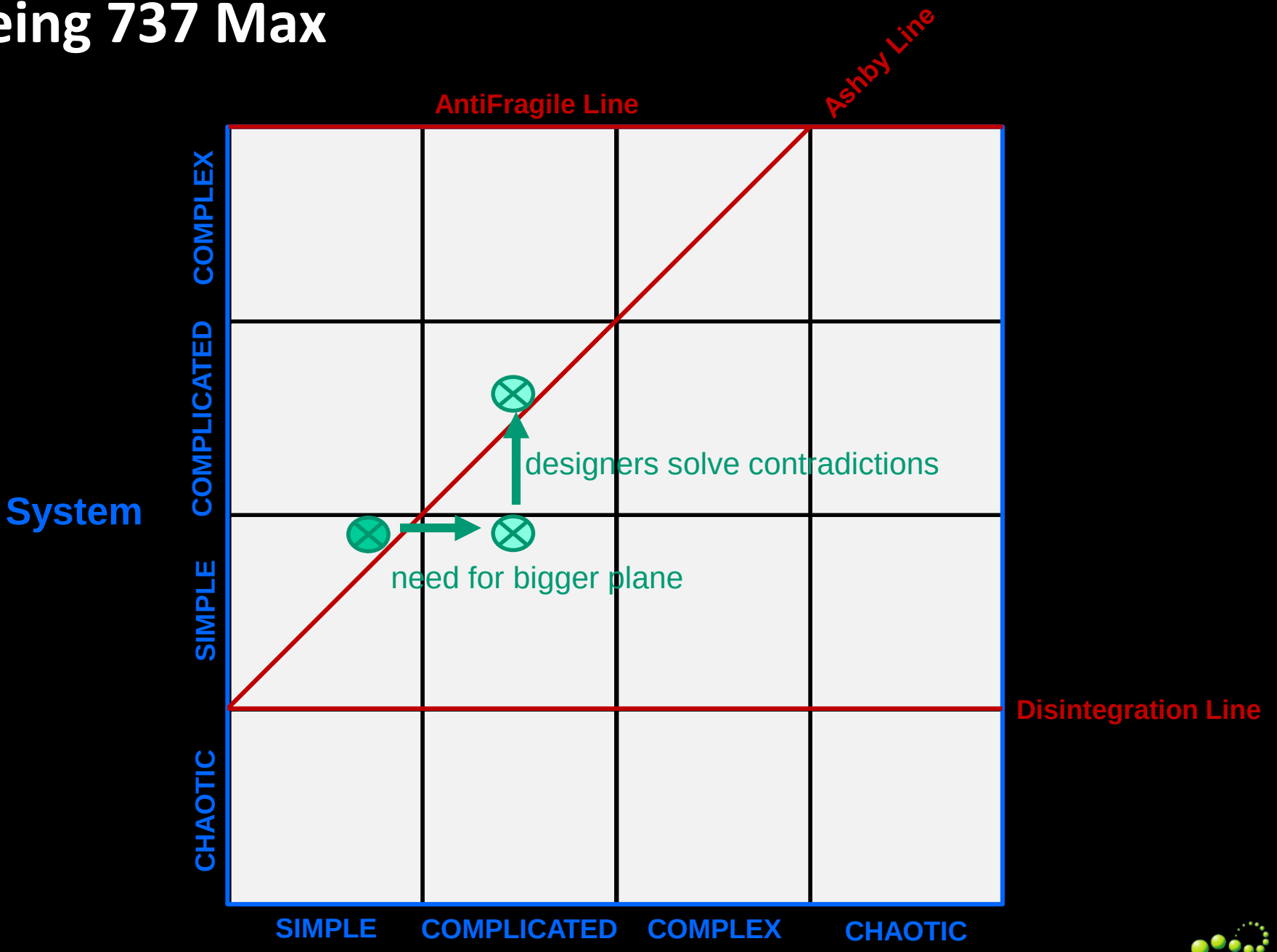
# Boeing 737



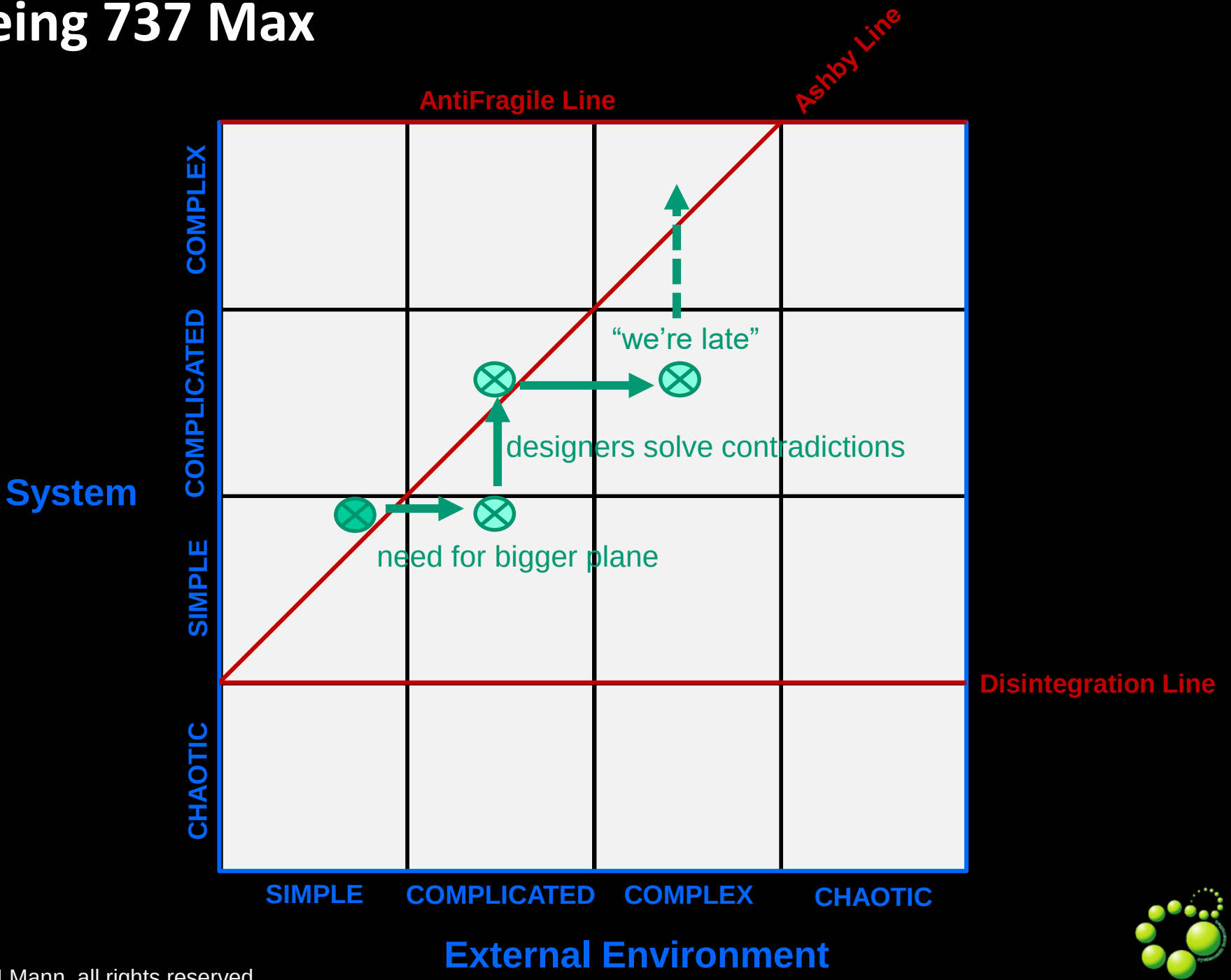
# Boeing 737 Max



# Boeing 737 Max



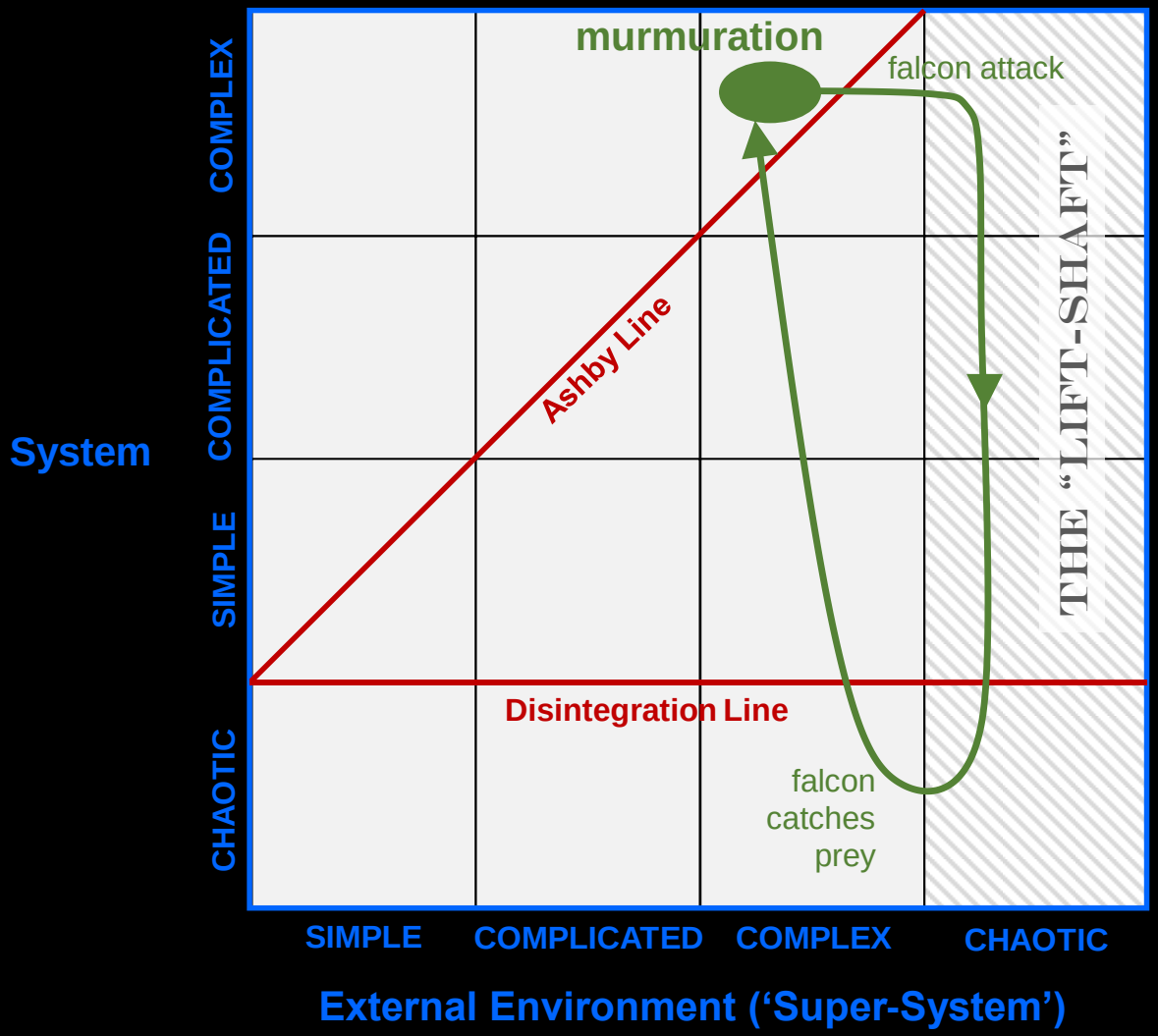
# Boeing 737 Max



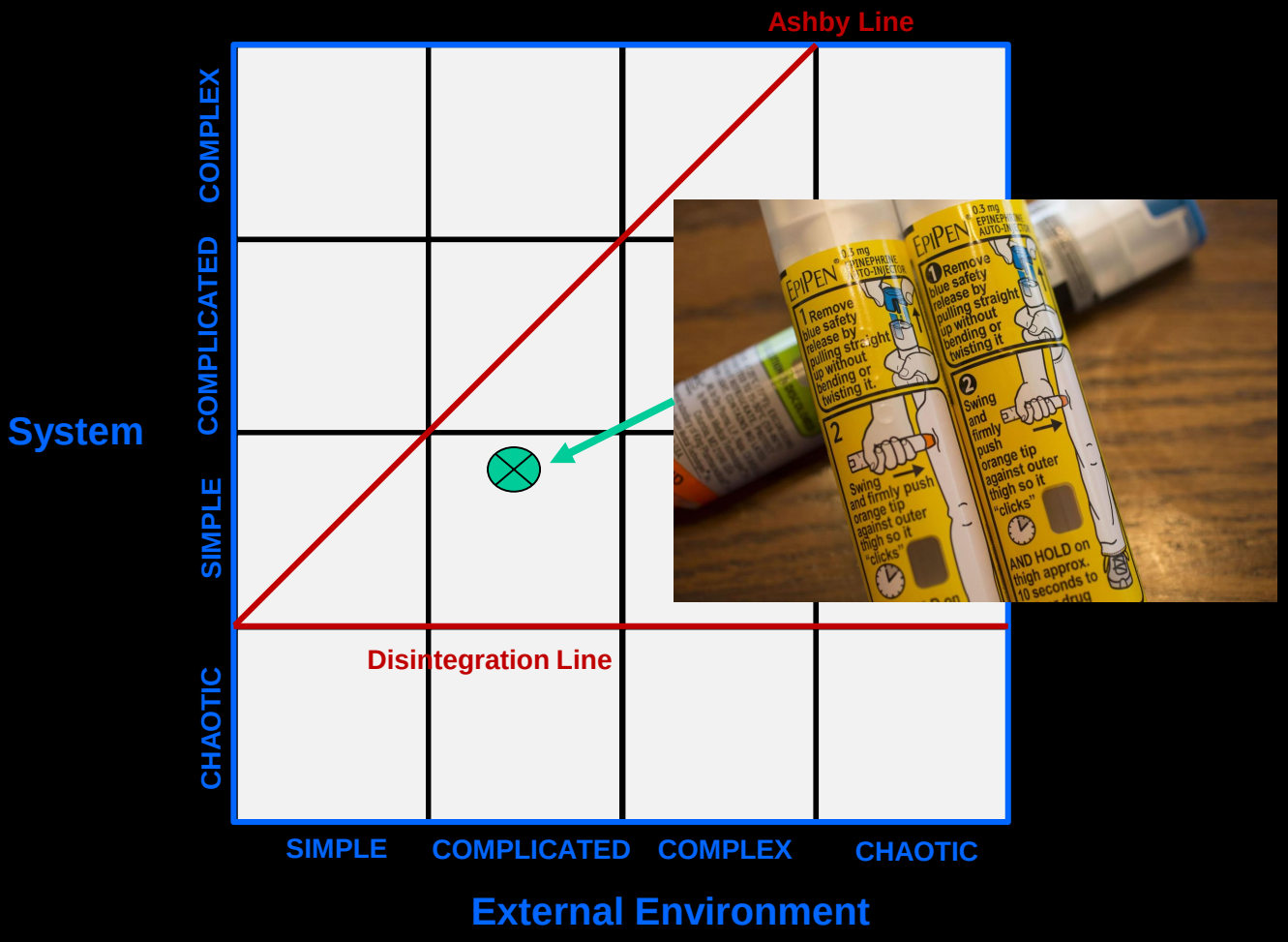

“fly as close to your neighbours as possible”


“get away from the falcon”

# Complexity Landscape - Starlings I




# Complexity Landscape - EpiPen

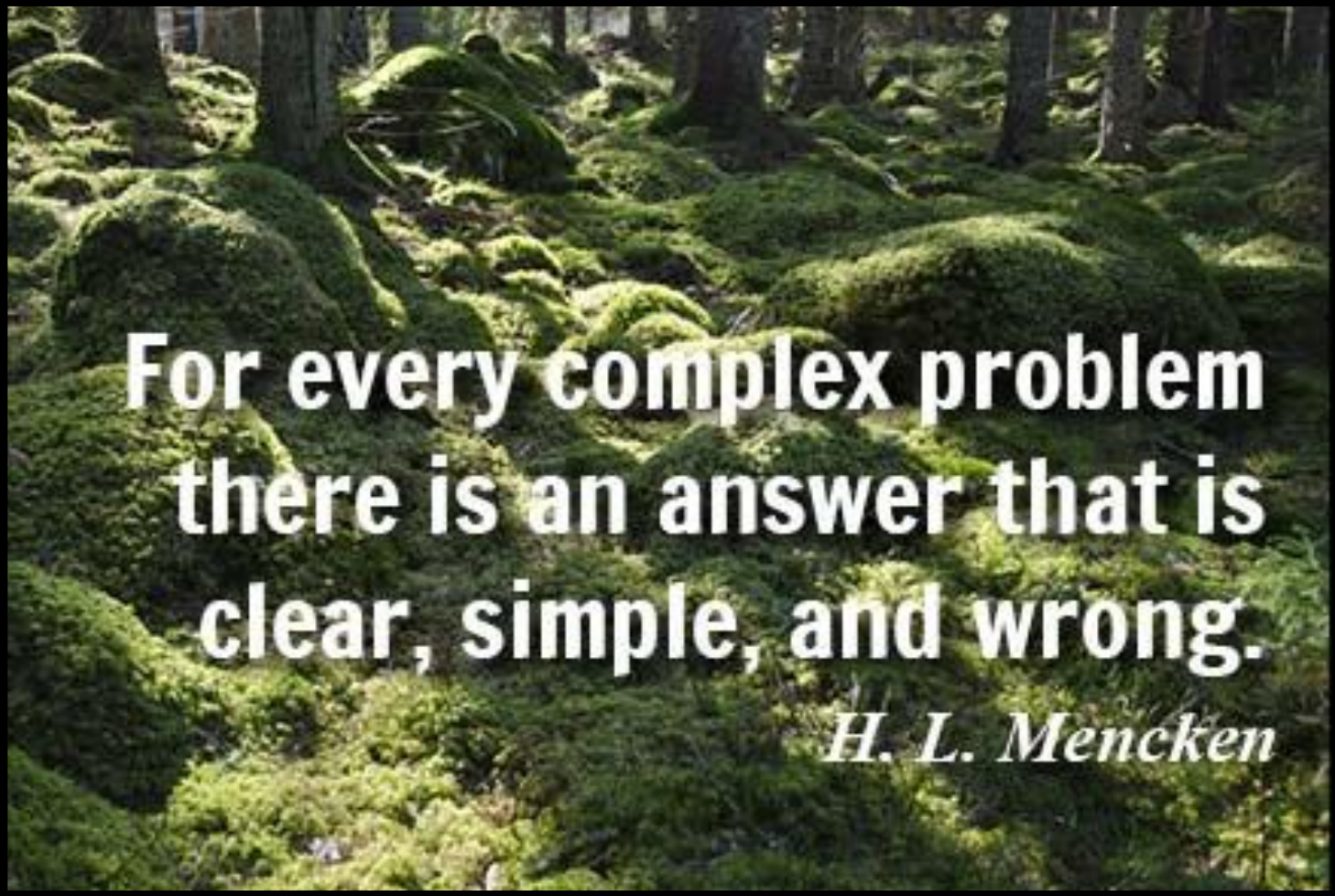


# Safety, Safetyism & EpiPen


Safetyism Threshold

Safety

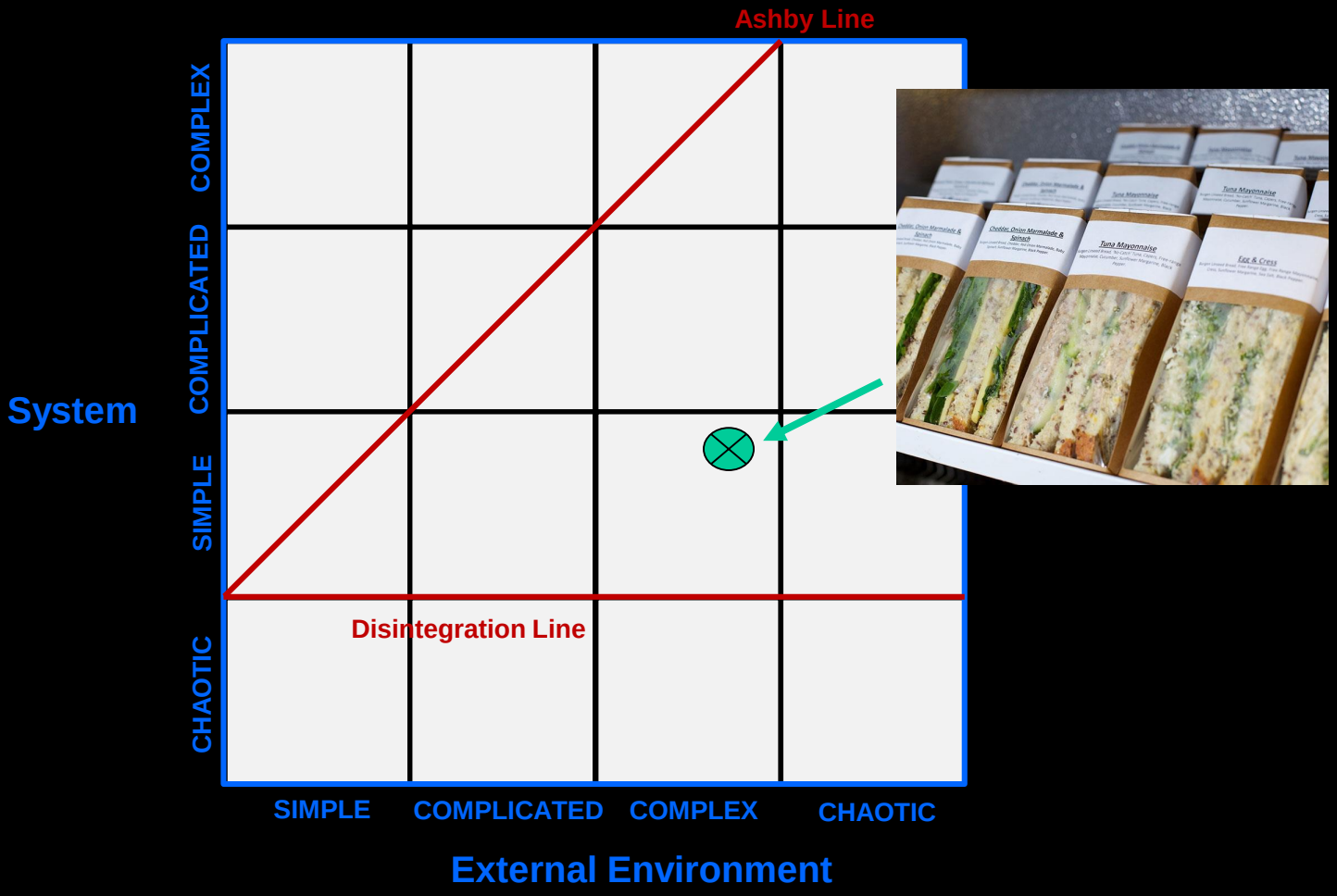
Safety Measures


For every complex problem
there is an answer that is
clear, simple, and wrong.
H. L. Mencken

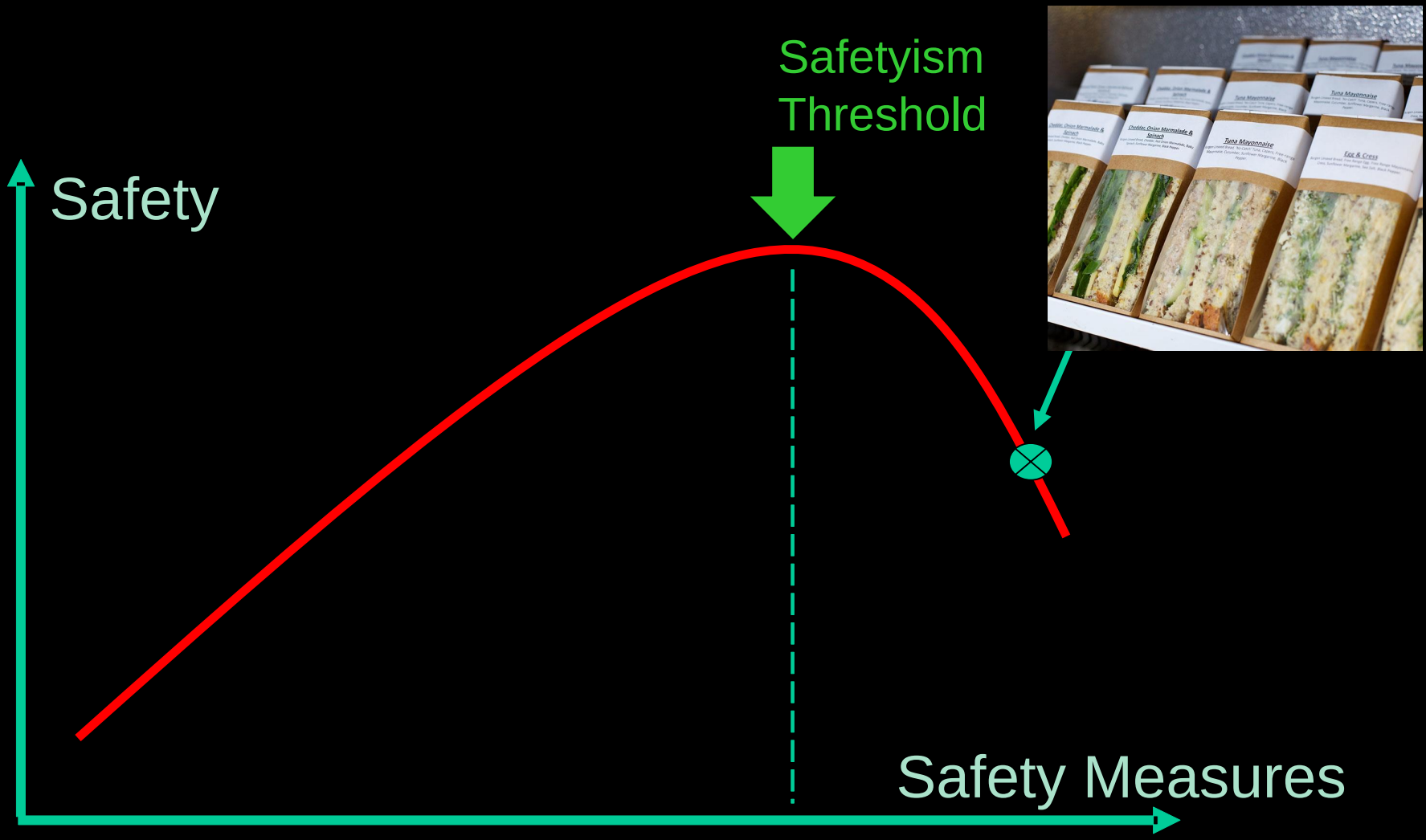
# Natasha’s Law

All food from all outlets will require ingredient labelling’

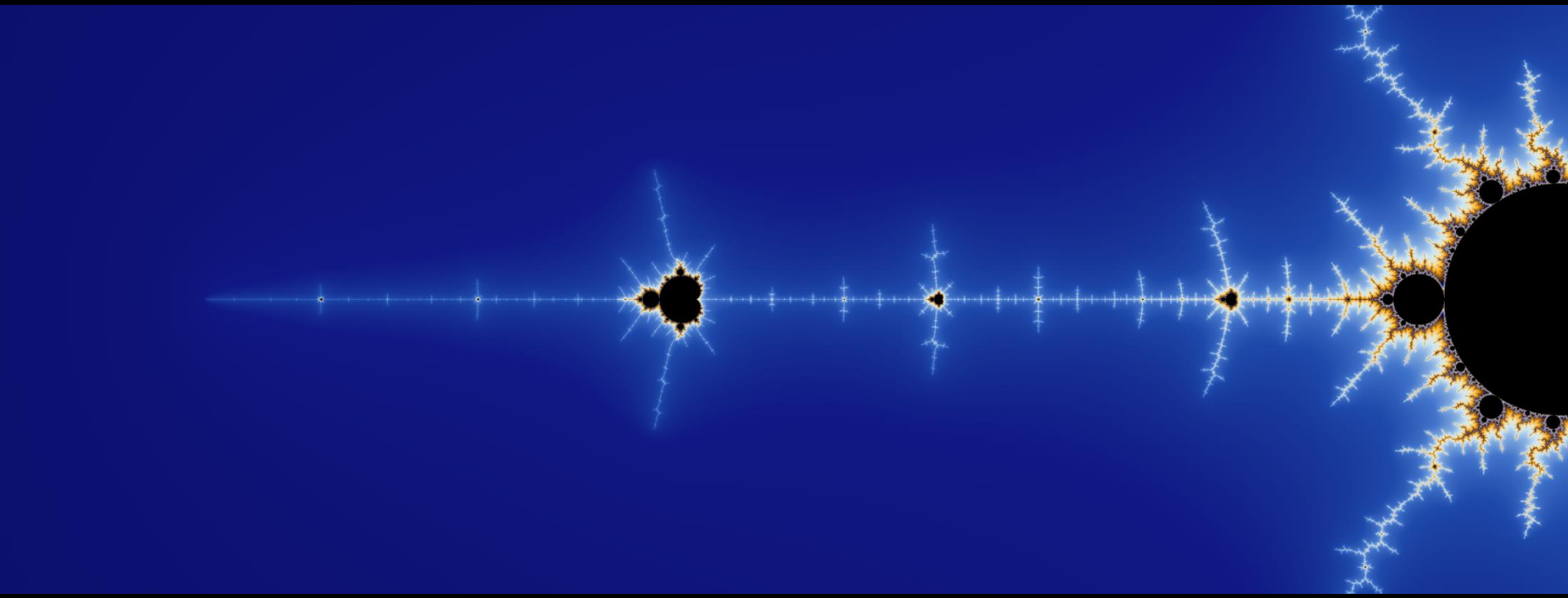
# Complexity Landscape - Natasha's Law



# Safety, Safetyism & Natasha's Law



For every complex problem there are thousands of clear, simple, wrong answers.



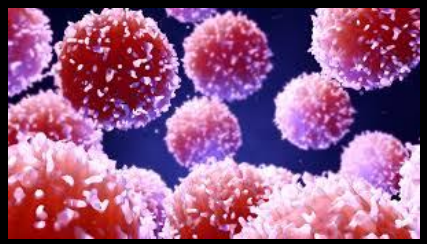
For every complex problem there is a clear, simple, right one.

If we understand and affect the first principles.

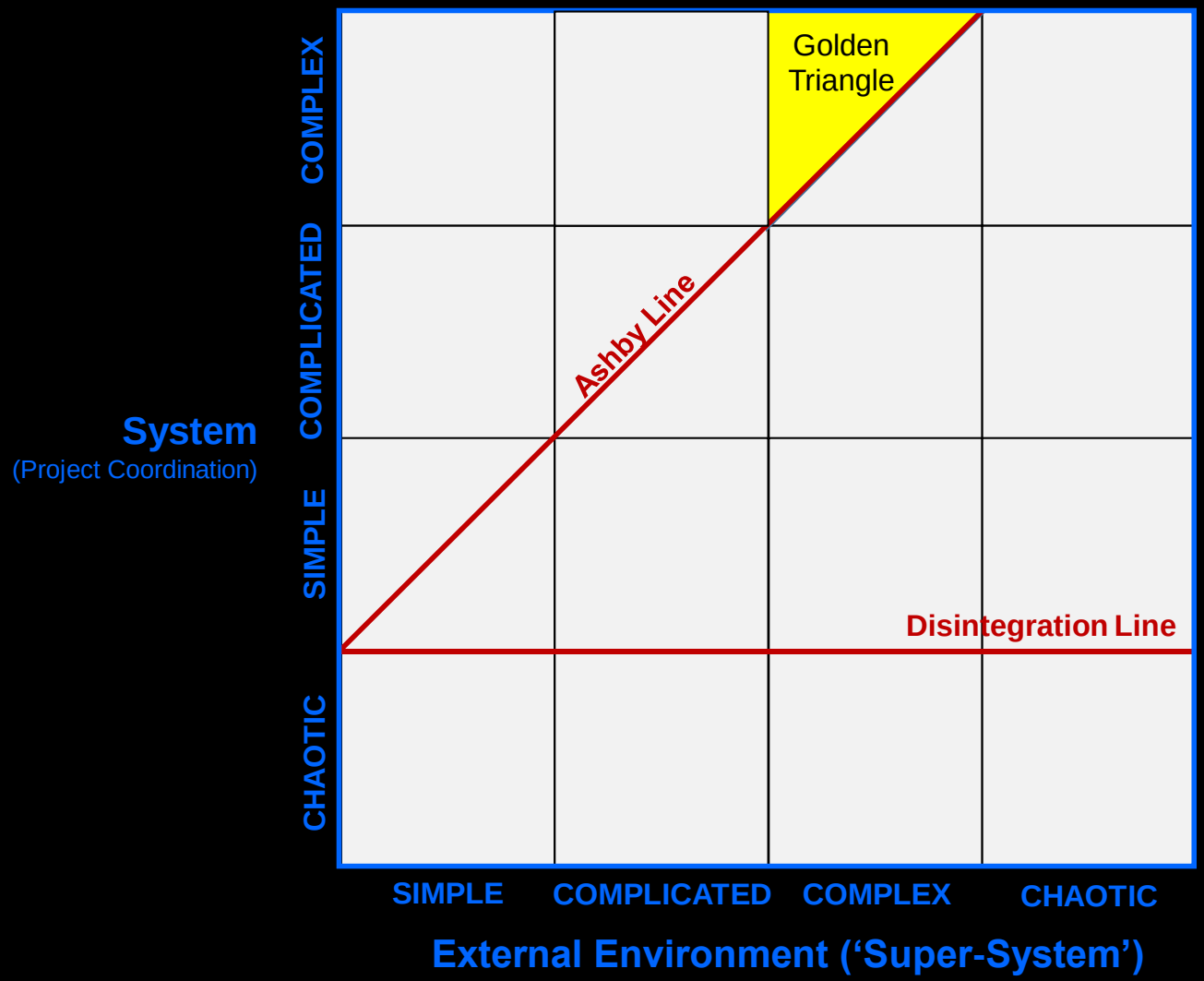
# First Principles

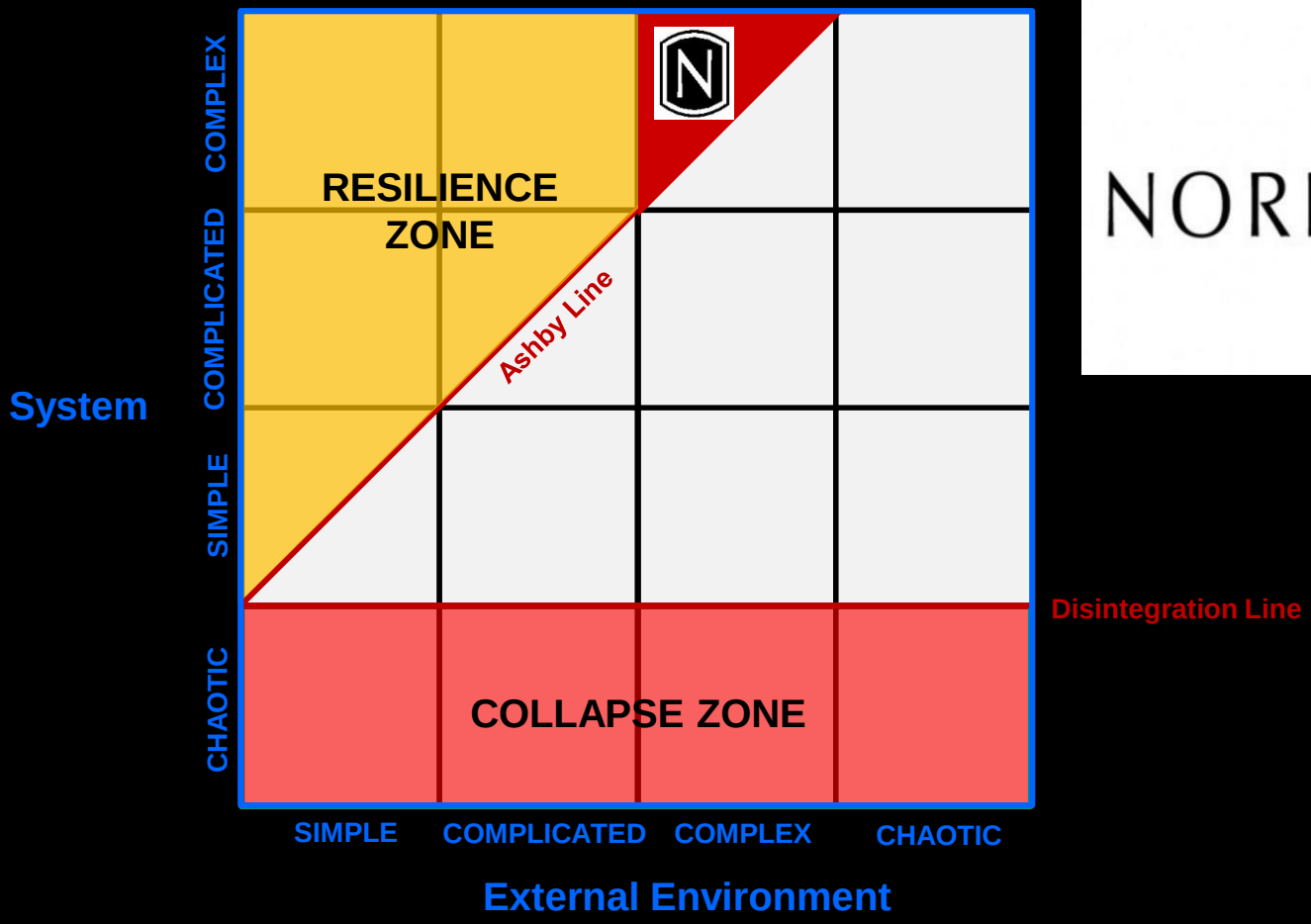
Kids need to eat dirt to develop immune system

The human body is antifragile…
if correctly primed
(“use it or lose it”)

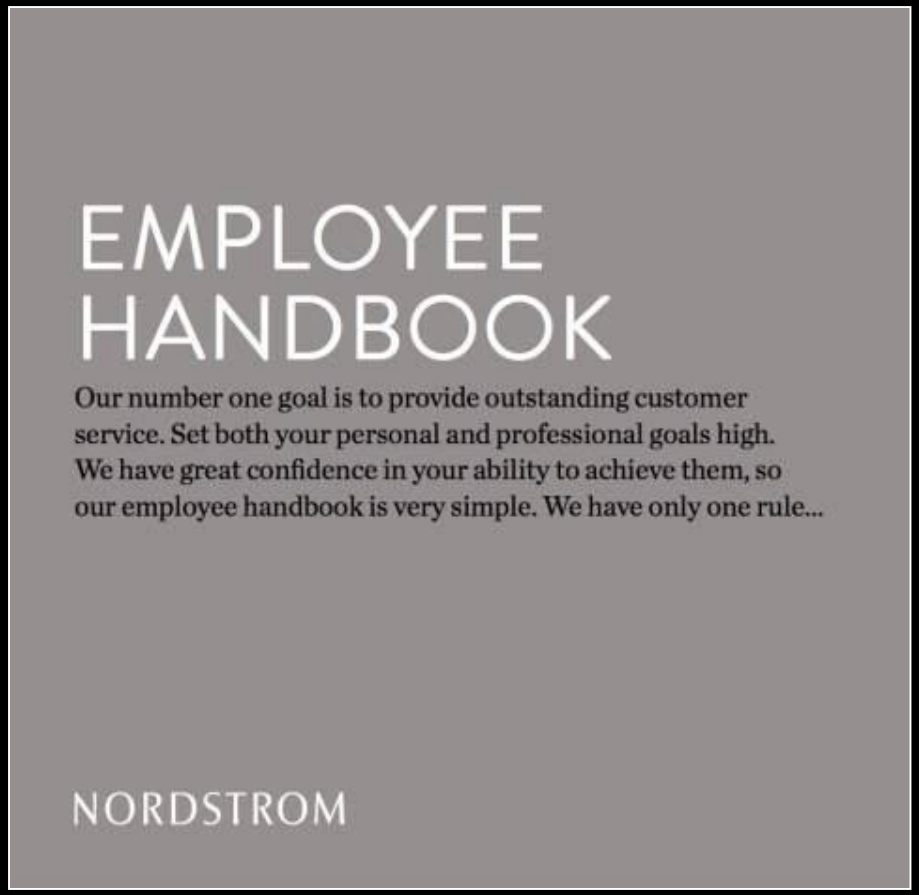


# Complex Change - The Golden Triangle



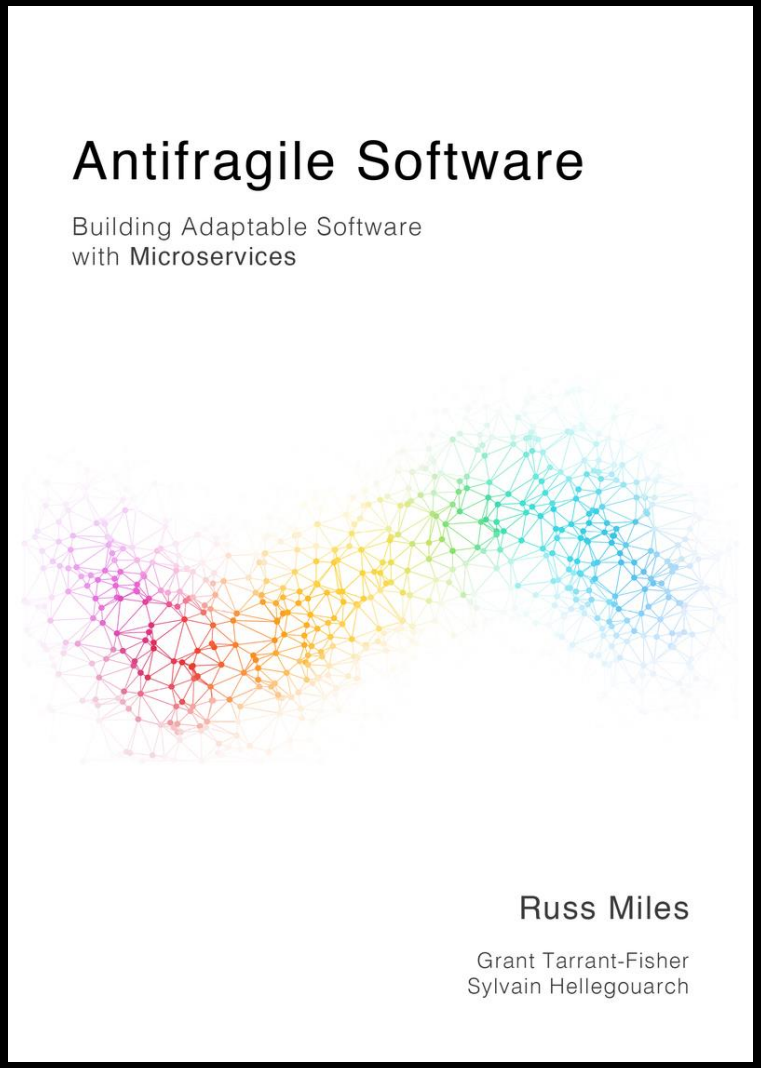


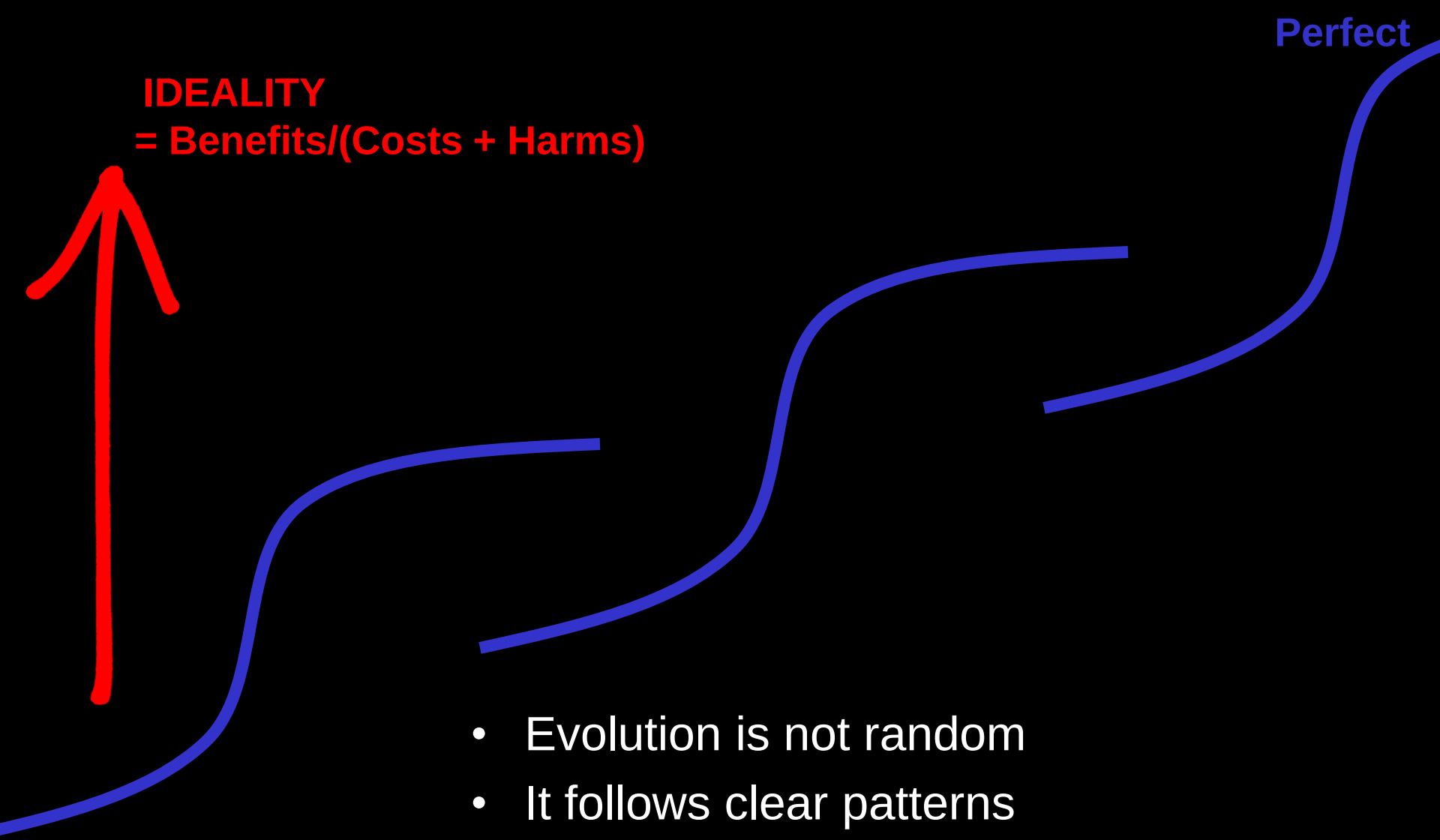
# Nordstrom: Managing Complexity




# AntiFragile



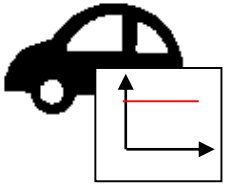




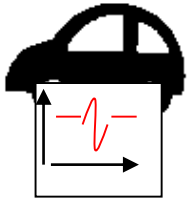

- Evolution is not random
- It follows clear patterns
- Different Stages can be predicted
- There is a ‘road-map’ to perfect

# RESILIENT DESIGN

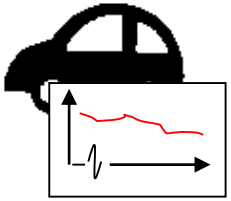
**Trial & Error**



**Steady -State**



**Transient**



**Slow Degradation**

**Cross-Coupling**

**Idiot-Proof Design**

-improved use of design resources
-reduced waste in development time/cost
-reduced waste of materials
-reduced product development time

'one nine' failure rate

-improve product reliability

three nines

five nines

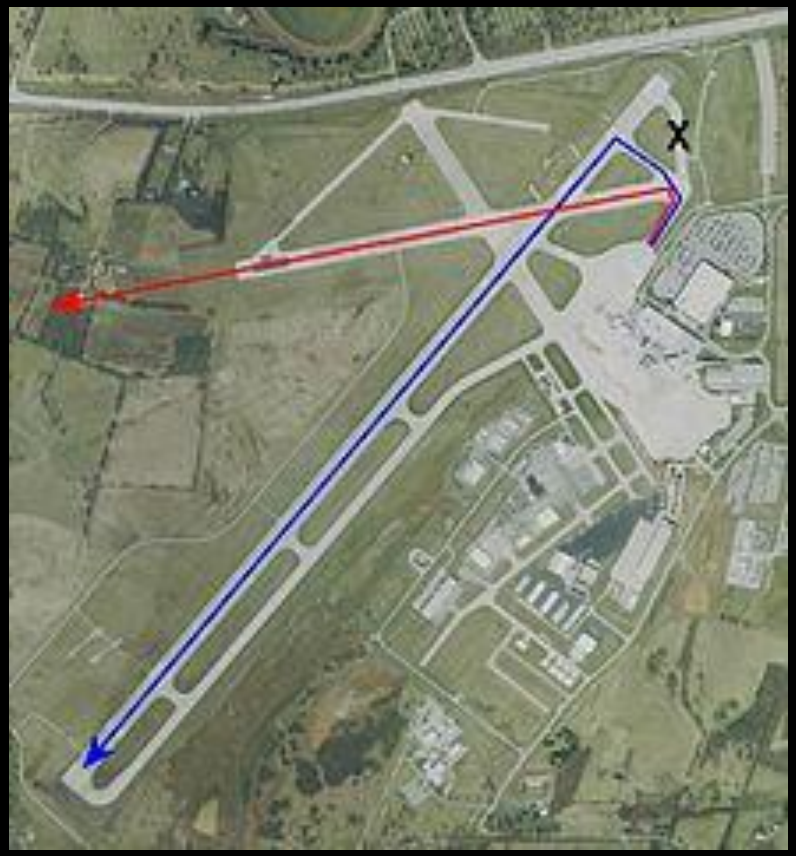
seven nines

-improve reliability
-enable easy shift to 'functional sales model'

nine nines

ten nines

# Idiot-Proofing

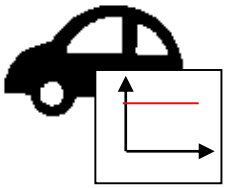




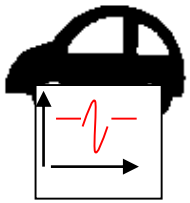
Comair 5191
Lexington, Kentucky
27 August, 2006
0607 EDT.

# RESILIENT DESIGN/ANTIFRAGILE

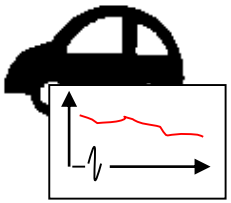
**Trial & Error**



**Steady -State**



**Transient**



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‘one nine’ failure rate

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three nines

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nine nines

ten nines

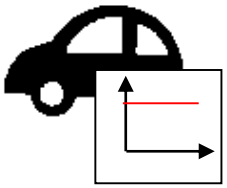
# EpiPen…

five nines

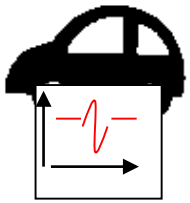
seven nines

nine nines

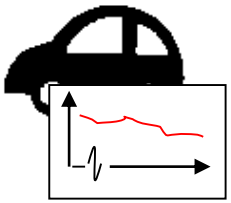
Trial & Error



Steady -State



Transient



Slow Degradation

Cross-Coupling

Idiot-Proof Design

Antifragile Design


The EpiPen design is a complicated problem and achieving the desired reliability demands the right design methodology

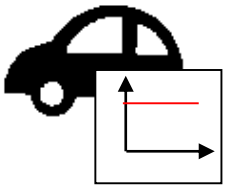
# Natasha's Law…

five nines

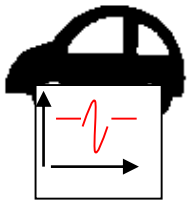
seven nines

nine nines

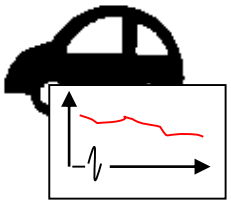
Trial & Error



Steady -State



Transient



Slow Degradation

Cross-Coupling

Idiot-Proof Design

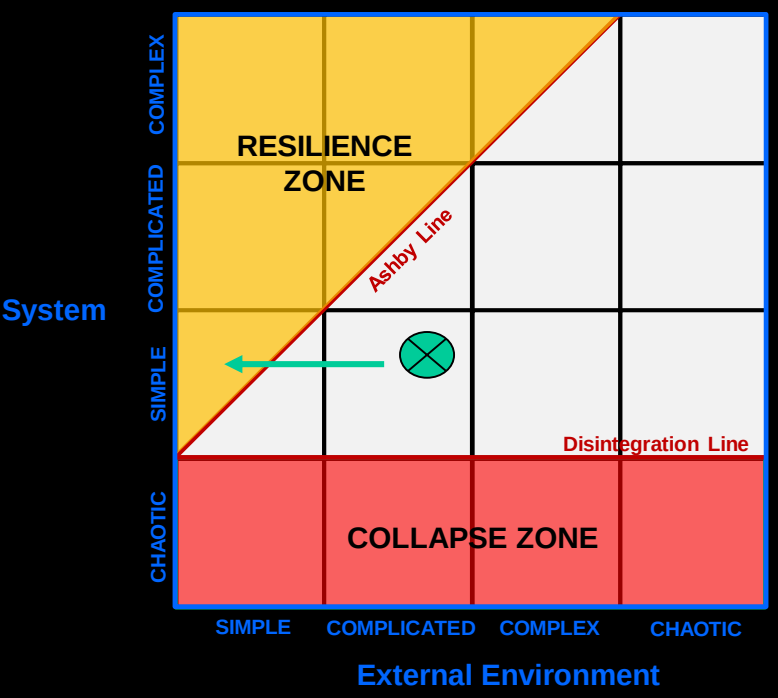
Antifragile Design

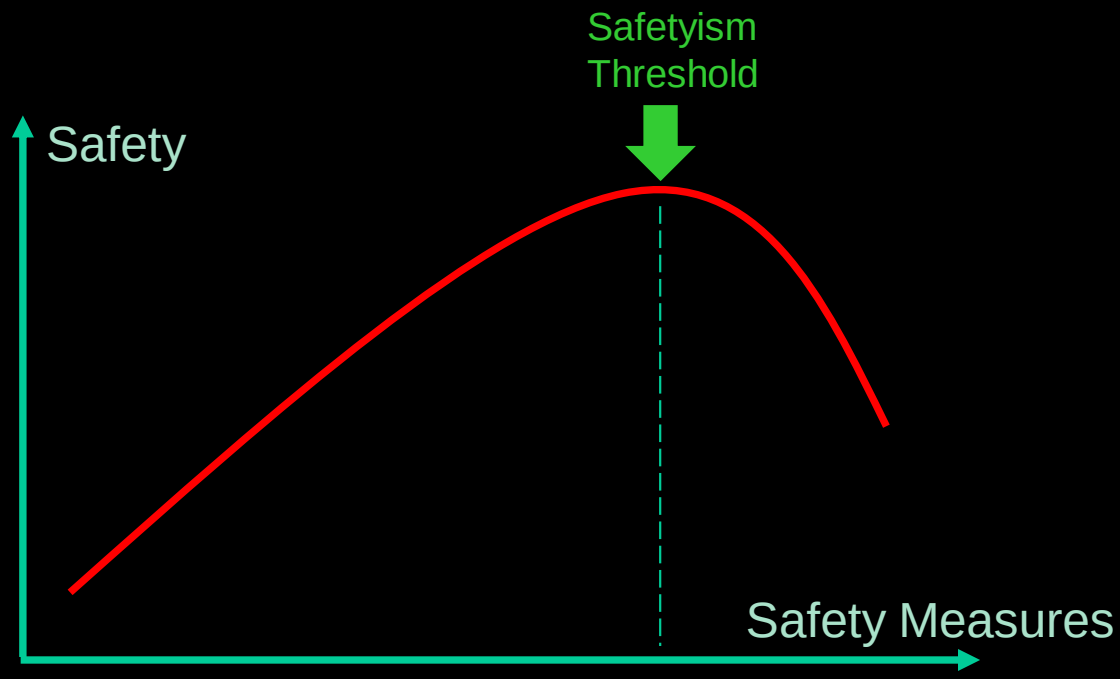
In a complex environment, achieving antifragility is the only way to ensure long-term survival

(the system that learns fastest persists the best).

Natasha's Law is inconsistent with complex systems and will make matters worse.

# Doing The Right Thing…




If its complex, antifragility is the only way.

If its complicated, use the design strategy that will enable the required resilience and don't exceed safetyism threshold

# Complexity & Appropriate Change Methods