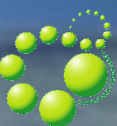
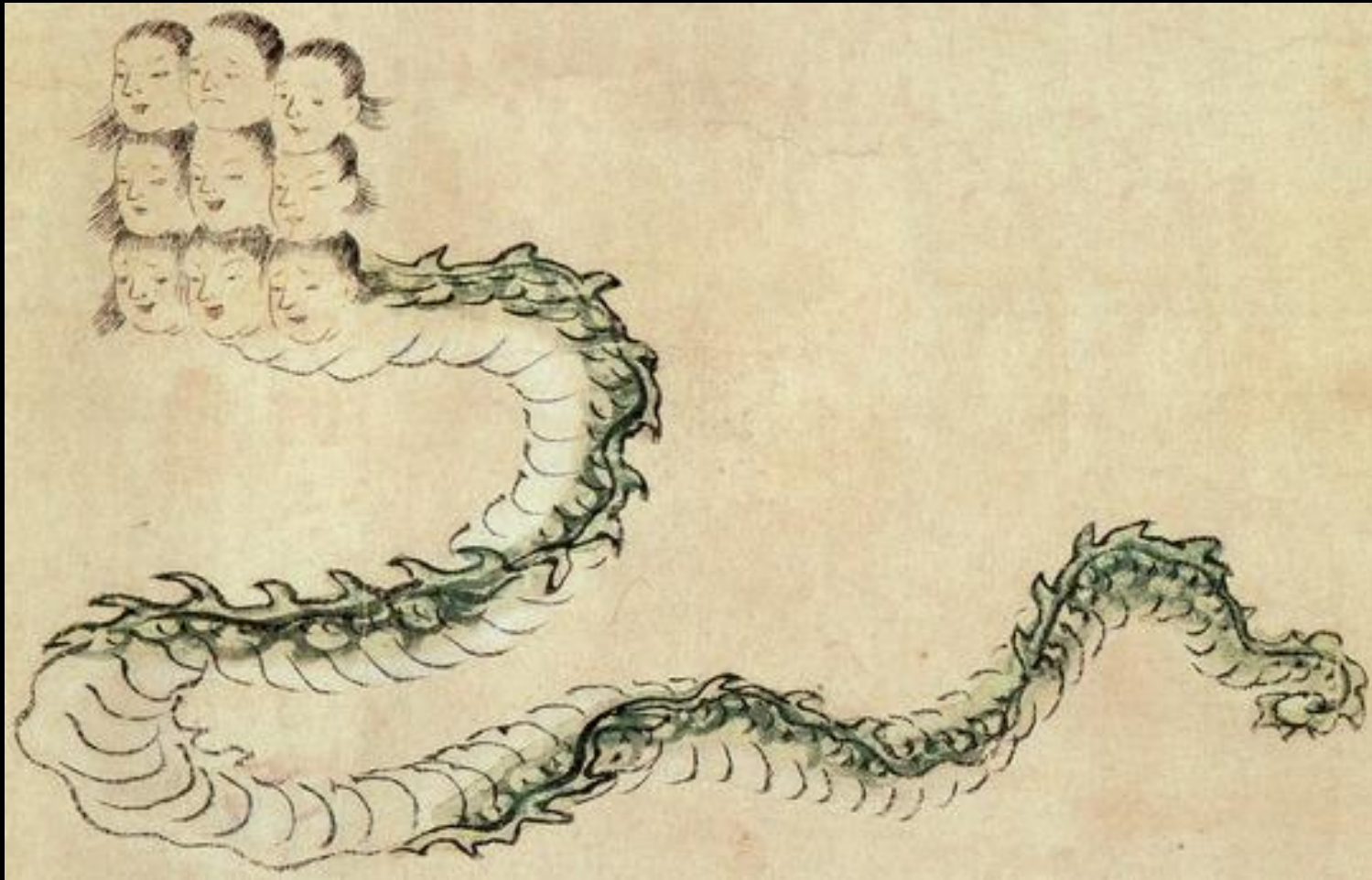


# TRIZ And AntiFragile Systems

Darrell Mann



# Mythology 1...



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



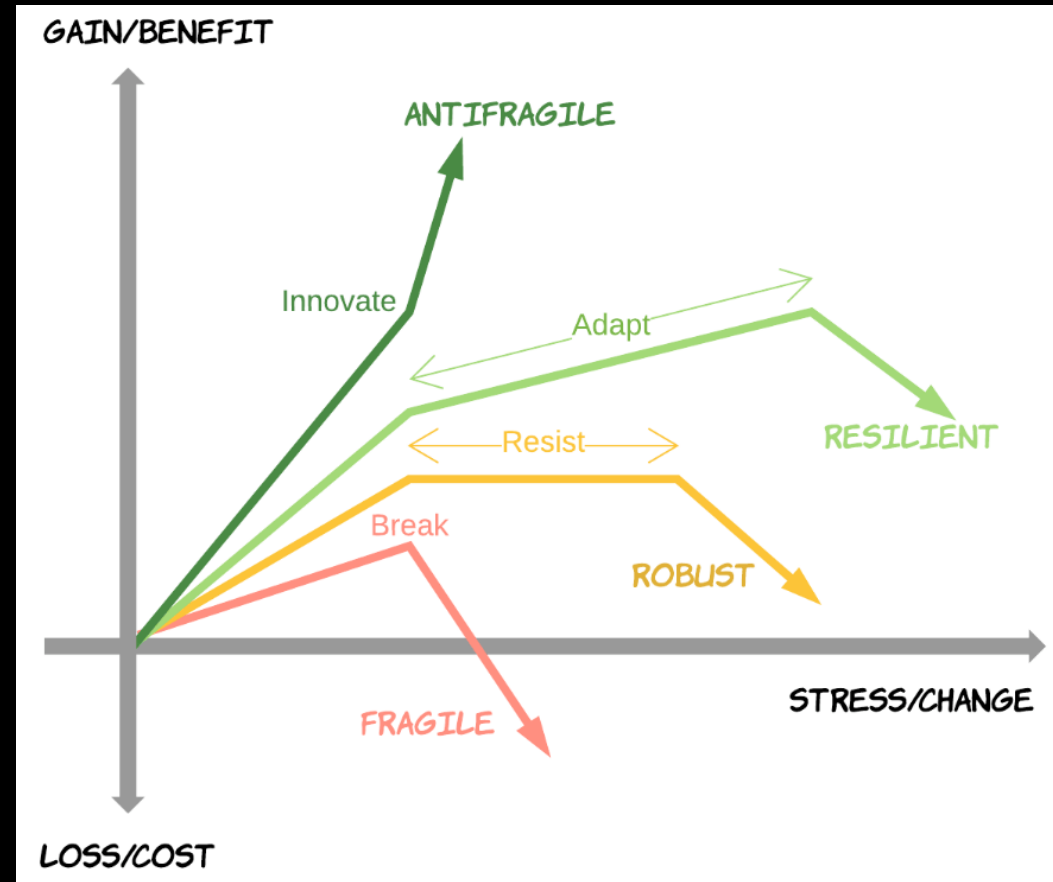
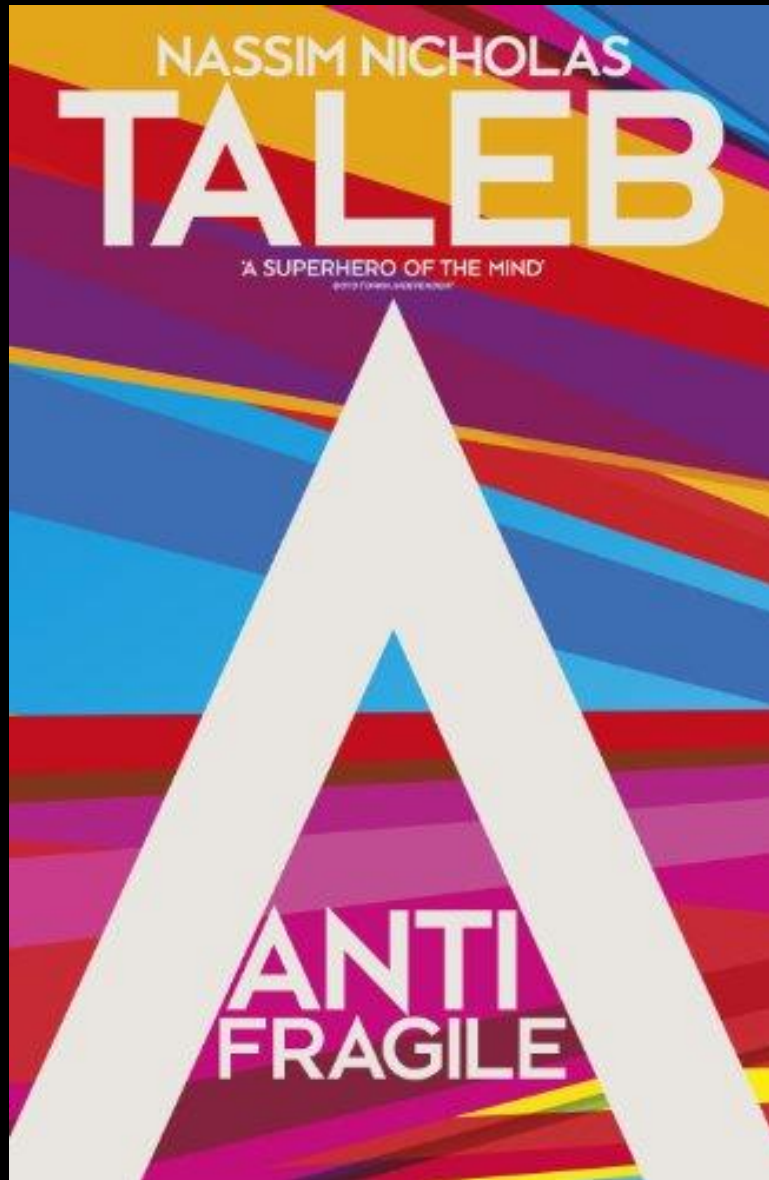
# Mythology 2...



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?

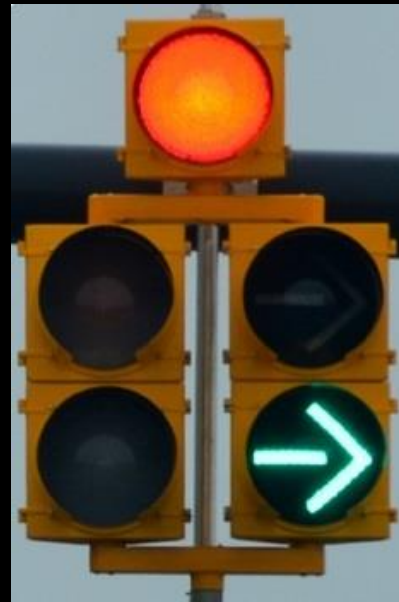


Show you care

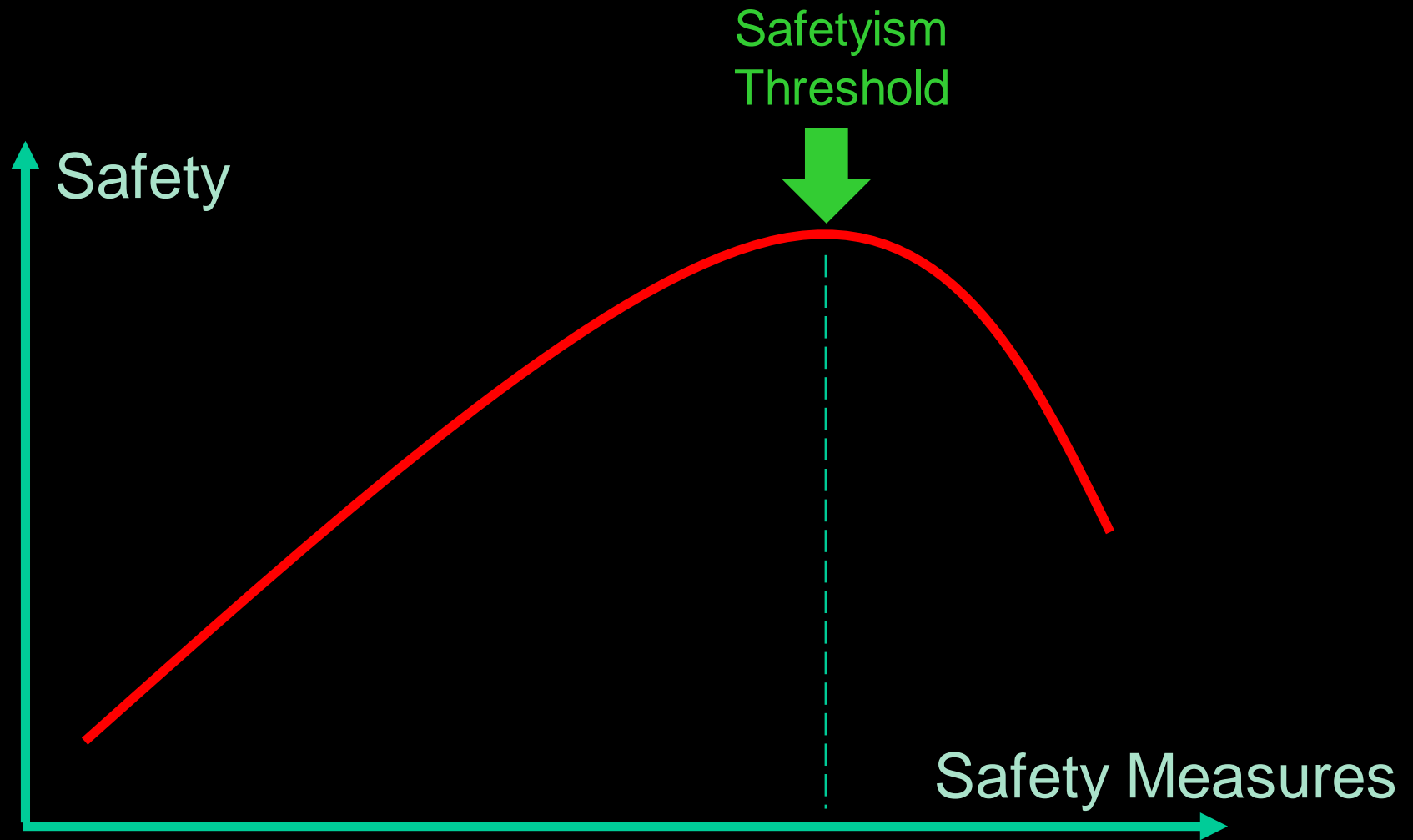
**Speak up**

Remind a co-worker

Safety is everyone's responsibility



# Safety & Safetyism



**CAUTION**

**THIS SIGN HAS  
SHARP EDGES**

**DO NOT TOUCH THE EDGES OF THIS SIGN**



**ALSO, THE BRIDGE IS OUT AHEAD**



# 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



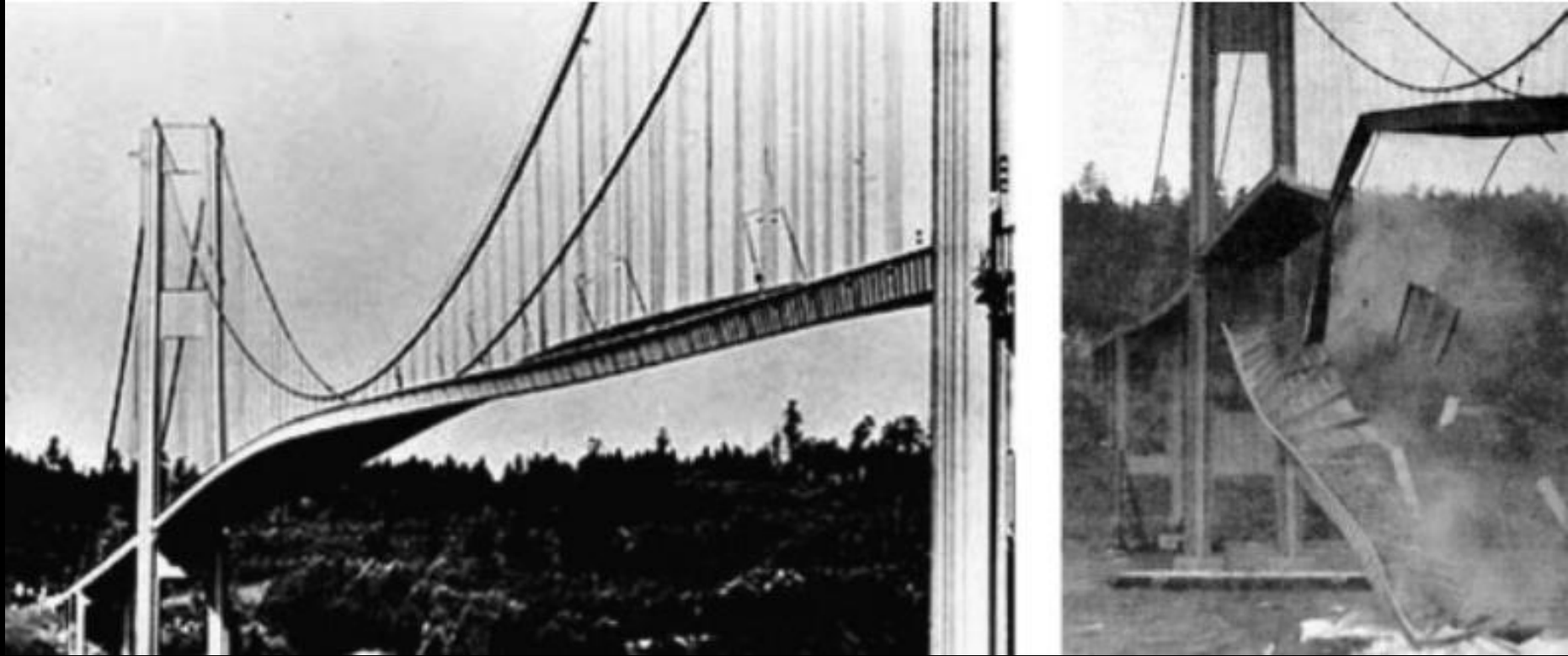
# Three Nines



# Ten Nines?



# Ten Nines? Tacoma Narrows Bridge



'Continuous Improvement' eventually causes engineers to push too far



# Systems Hit Limits



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

...provided we understand how the world works...



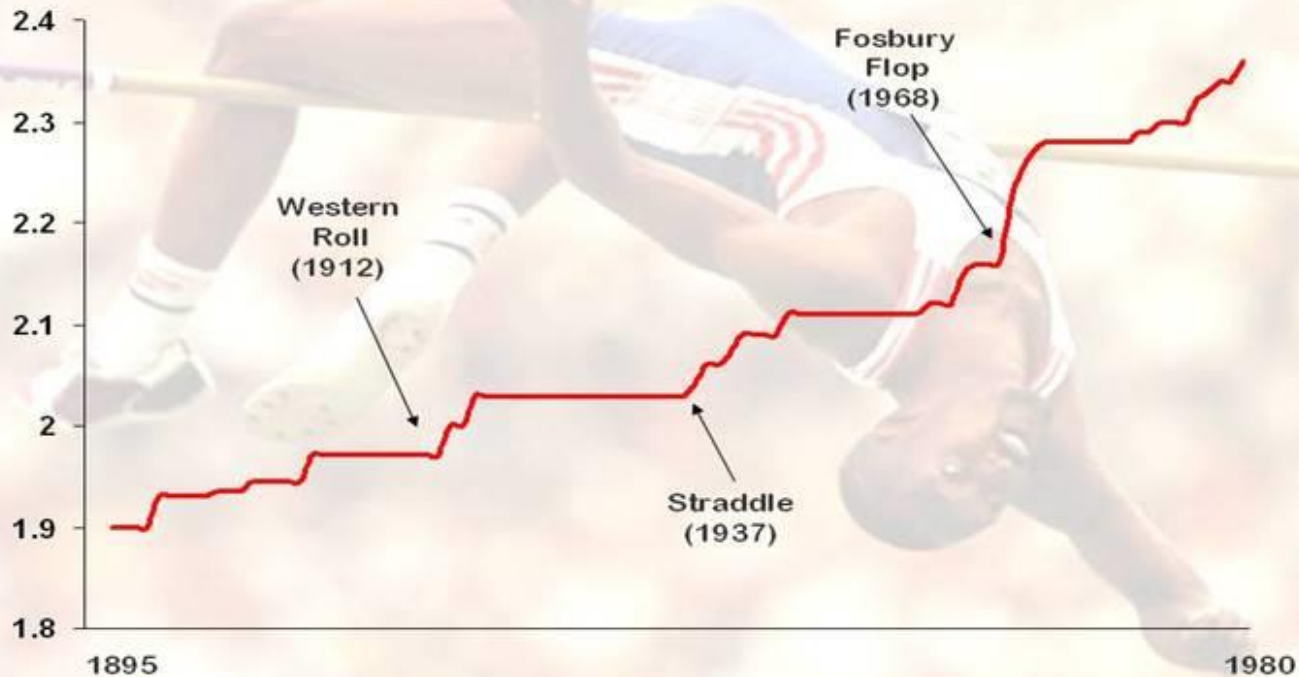
Most people overestimate what they can do in one year and underestimate what they can do in ten years.

— *Bill Gates* —

AZ QUOTES



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

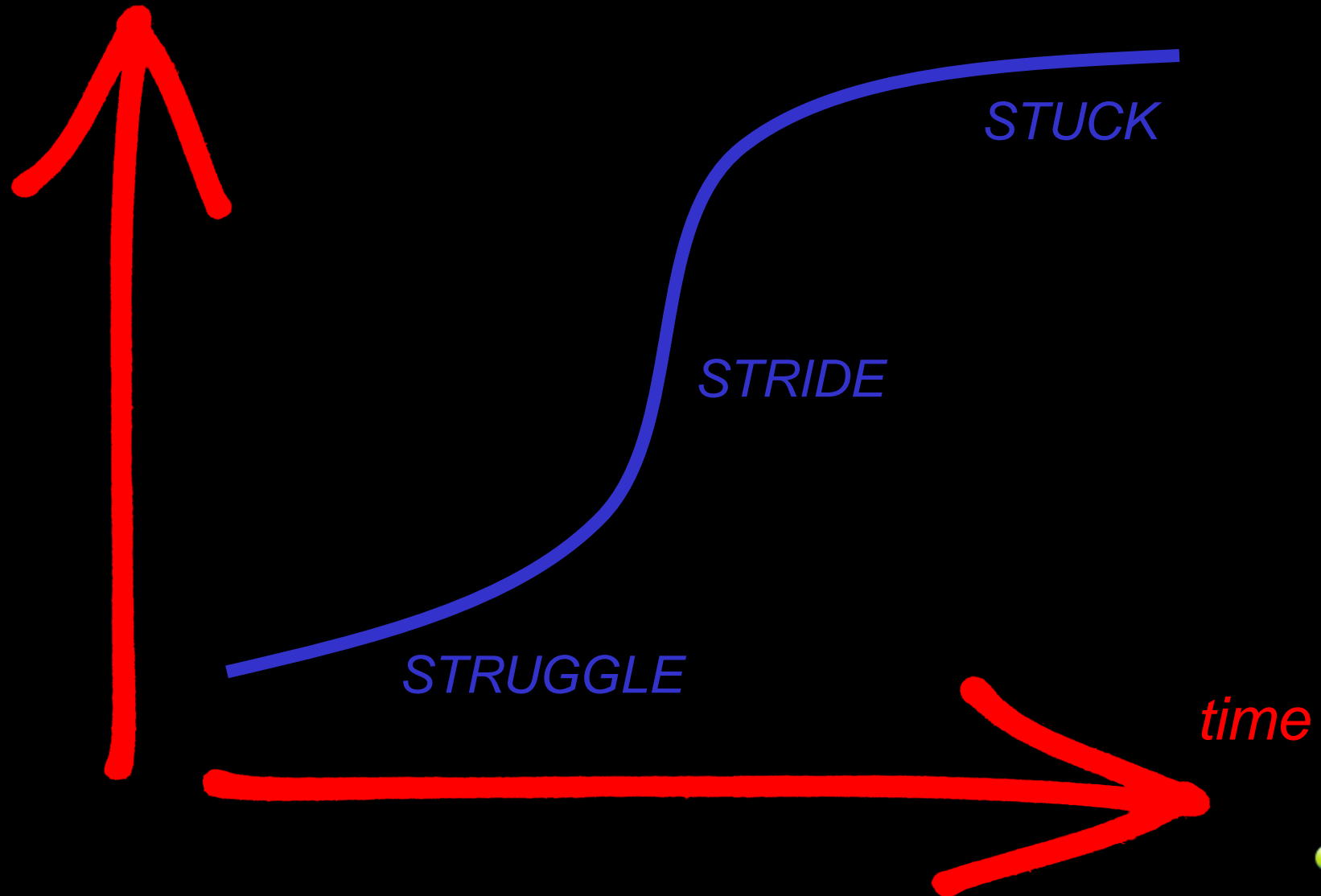


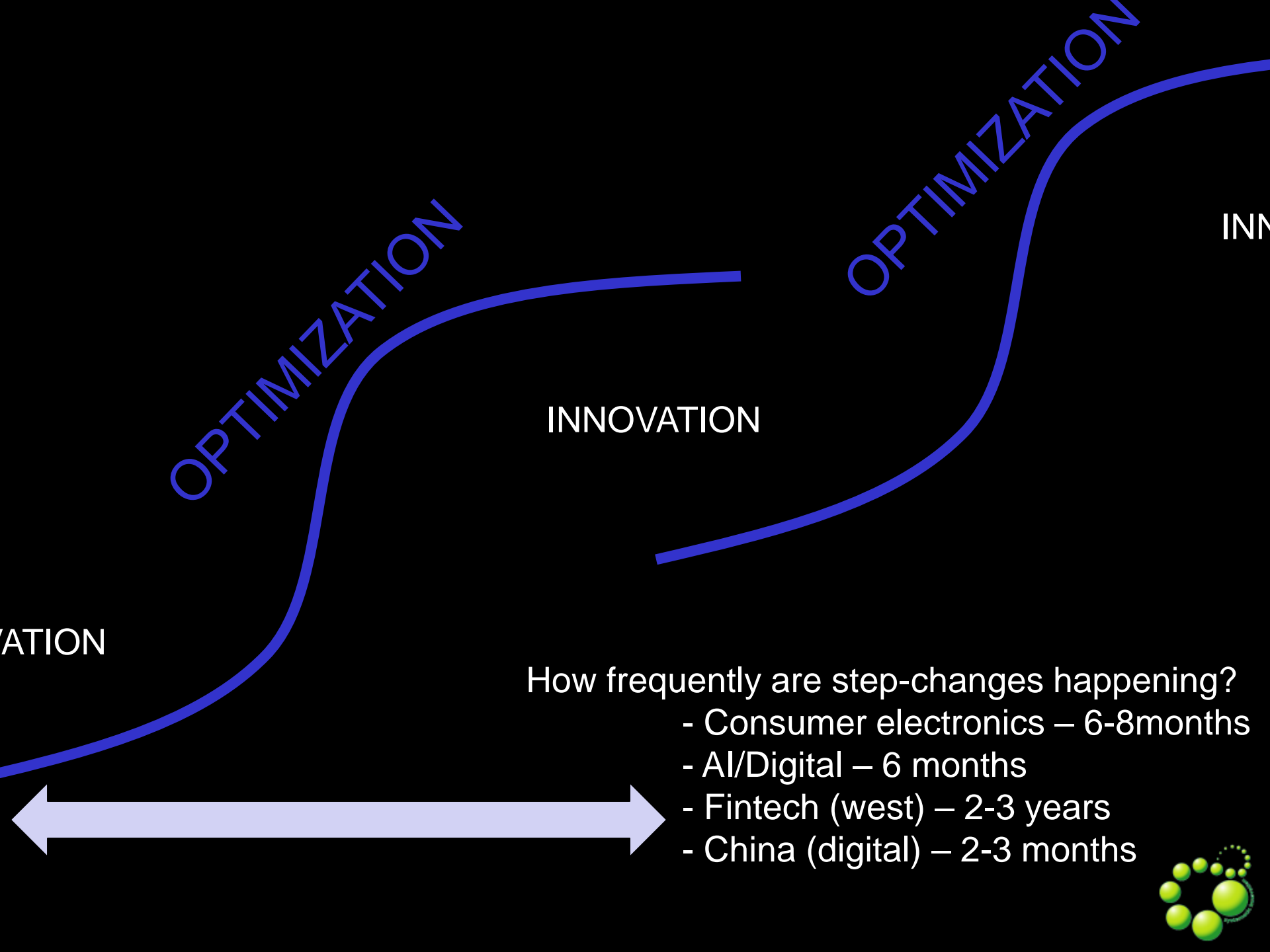
Source : IAAF



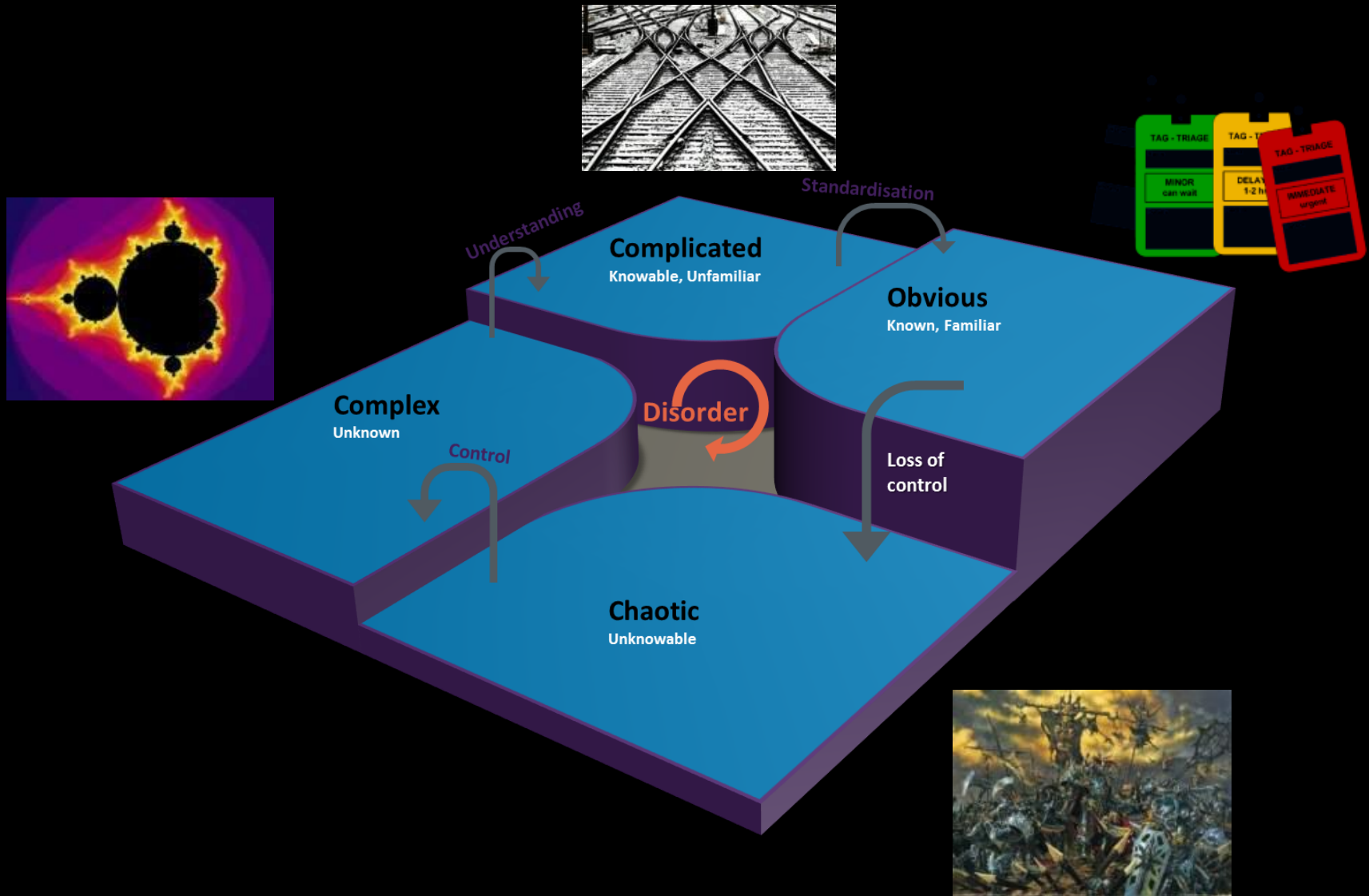


*stuff we'd like  
to improve*

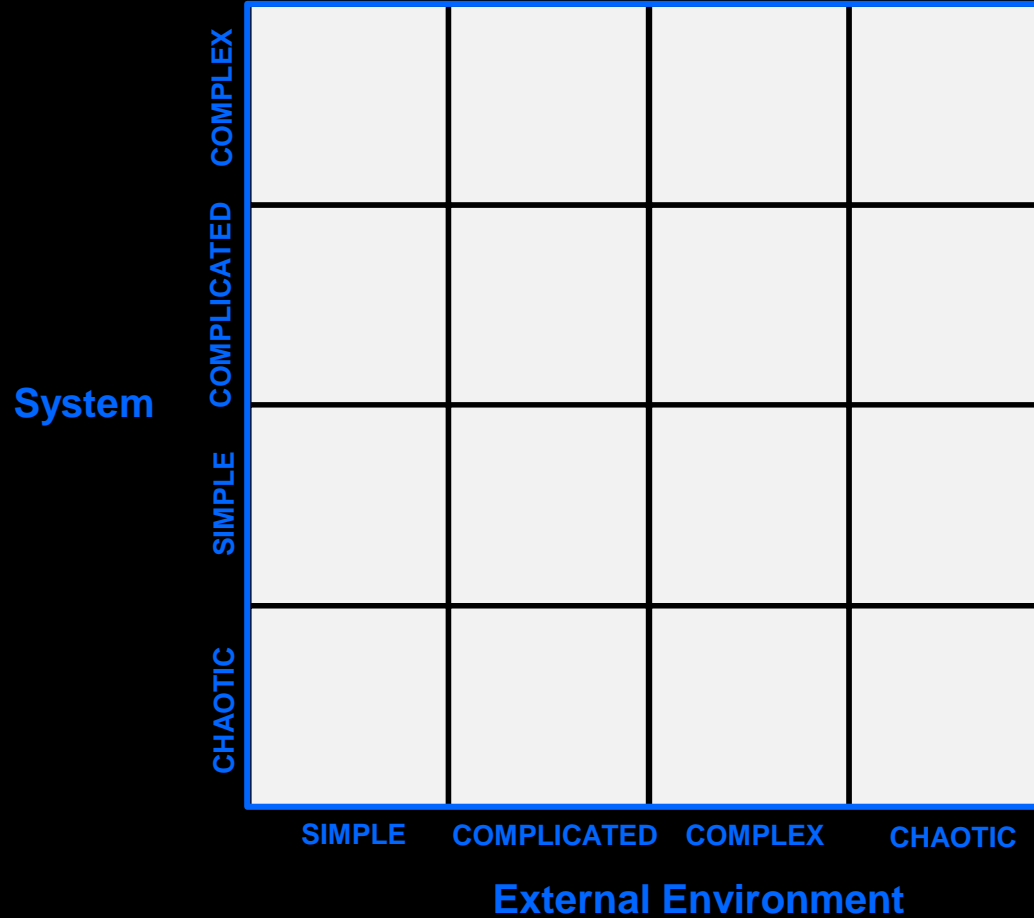




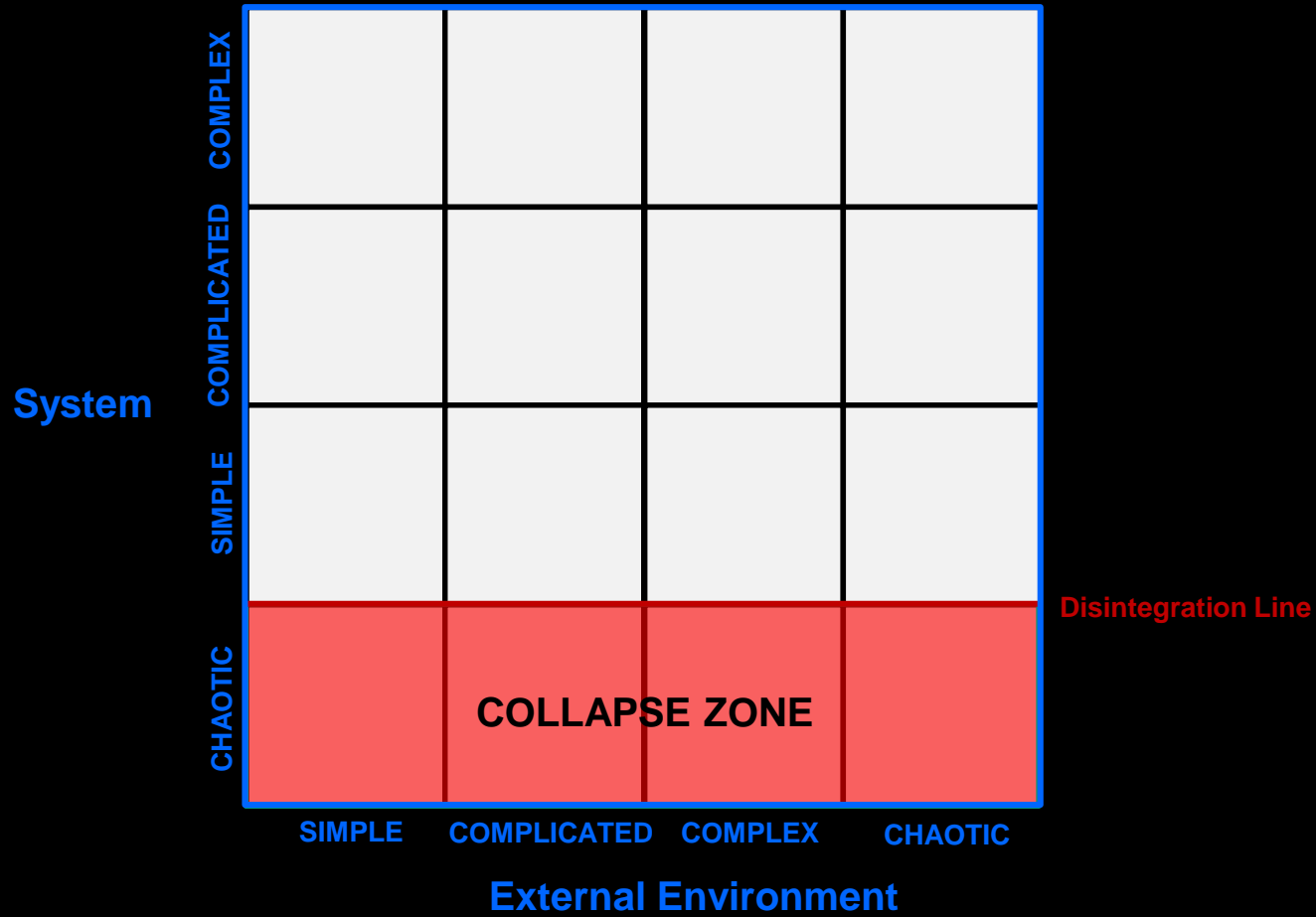
# Cynefin



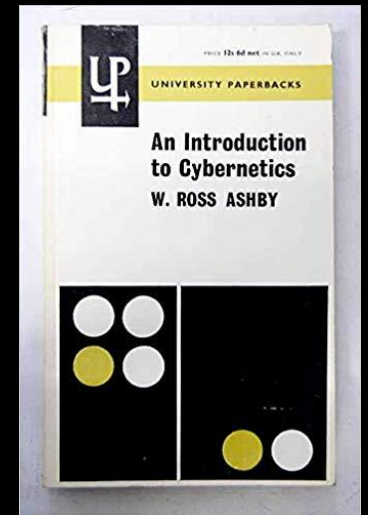
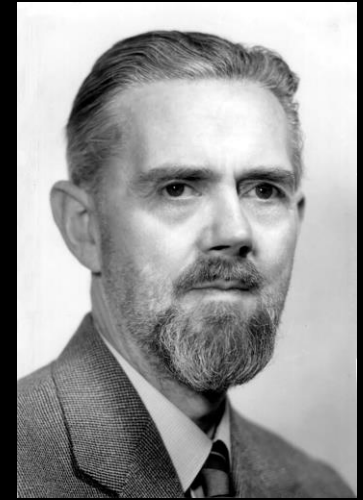
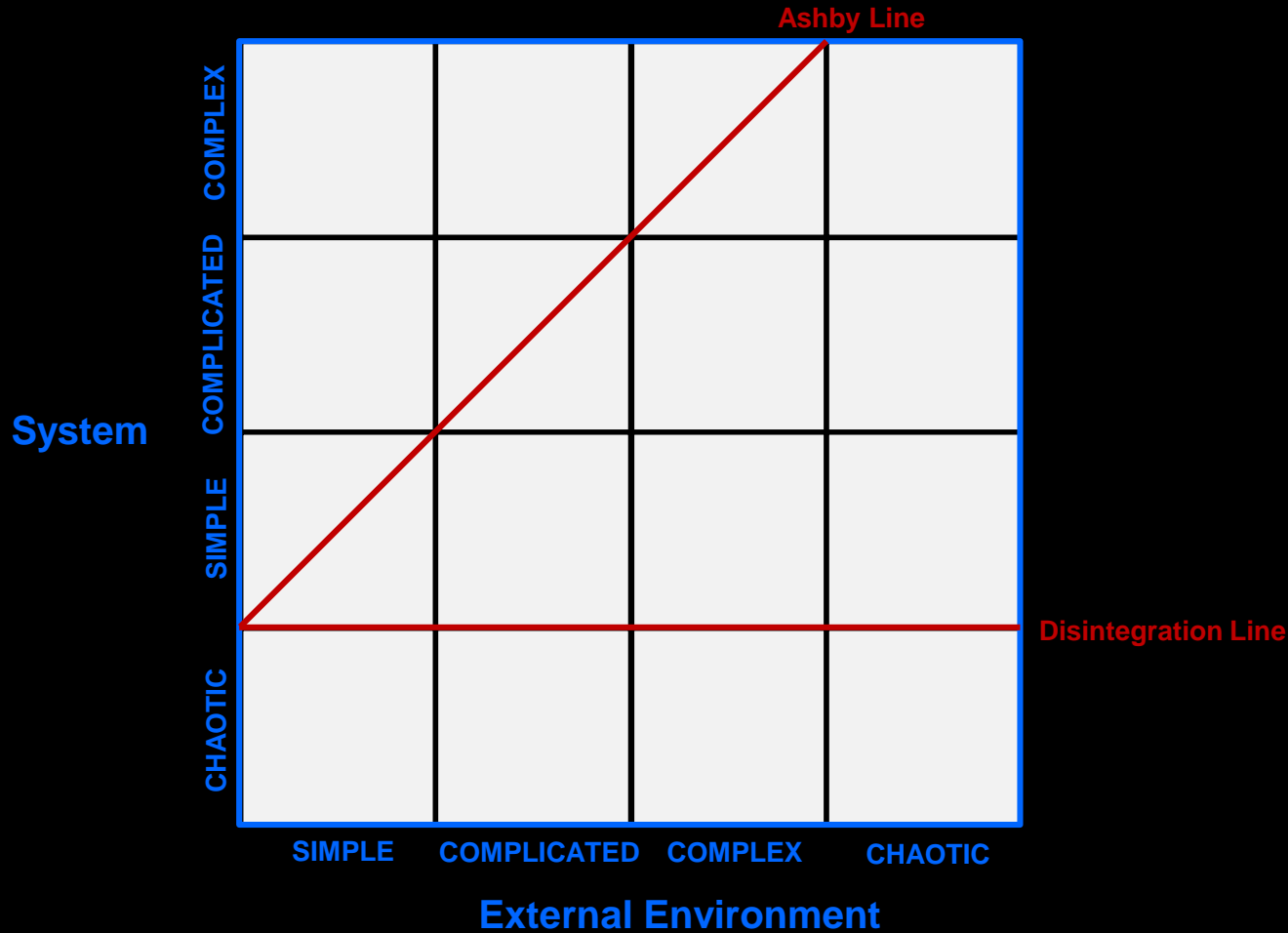
# Complexity Landscape Model



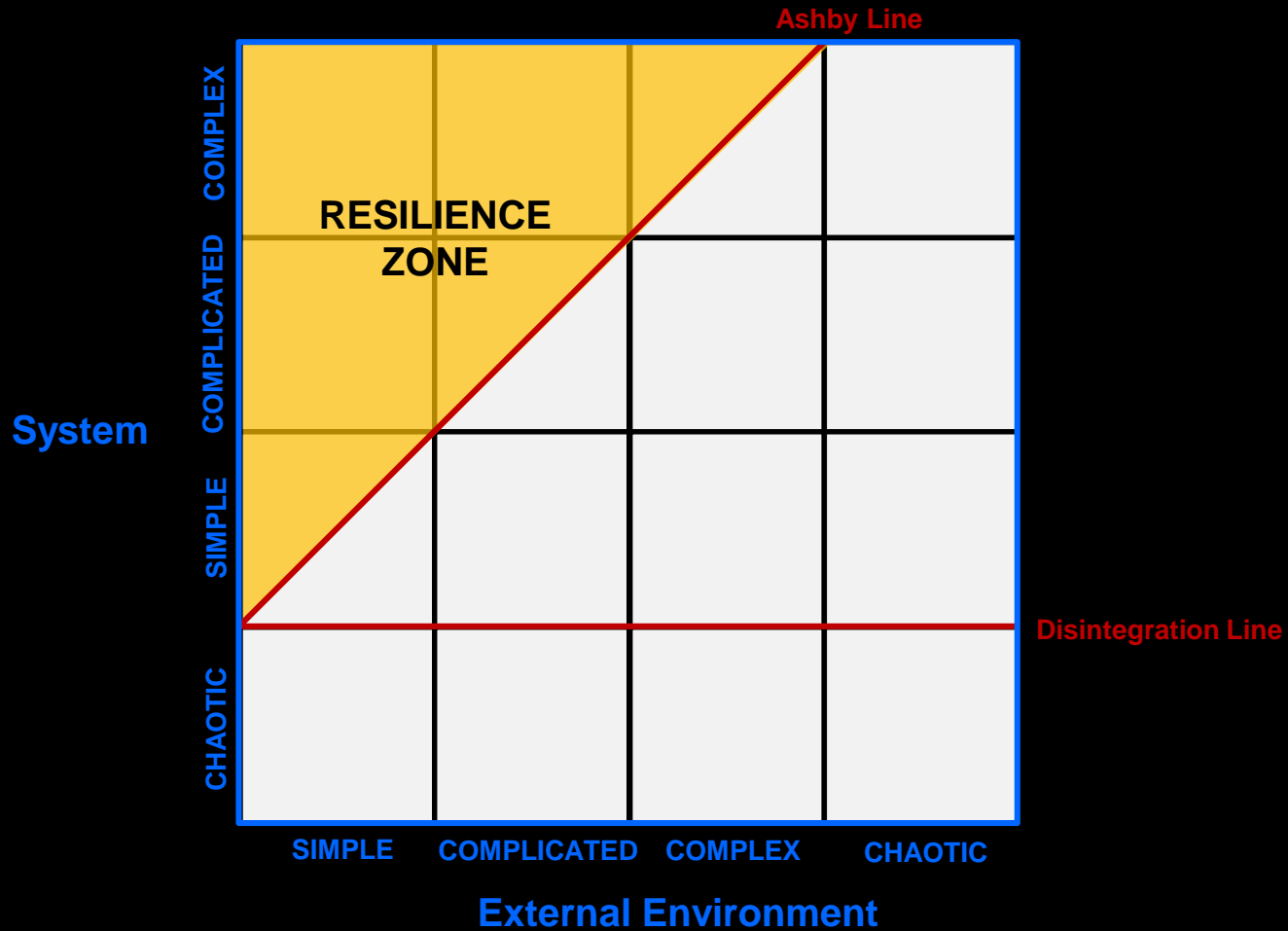
# Complexity Landscape Model



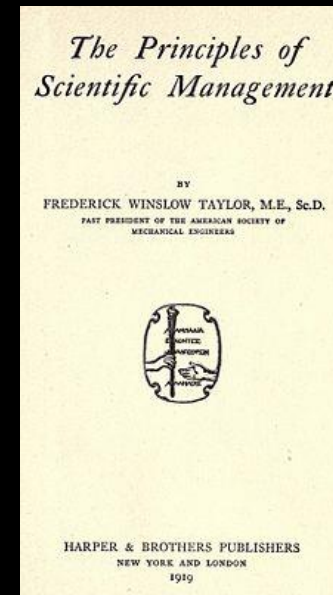
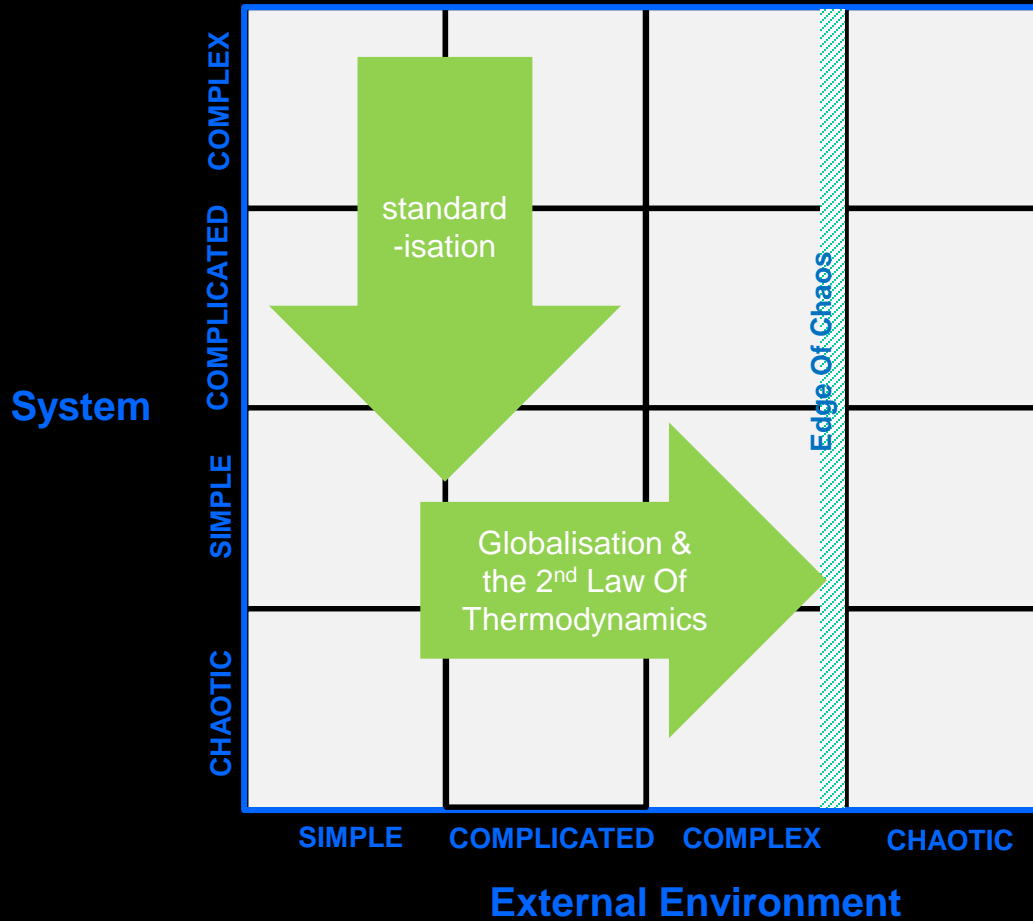
# Complexity Landscape & W. Ross Ashby



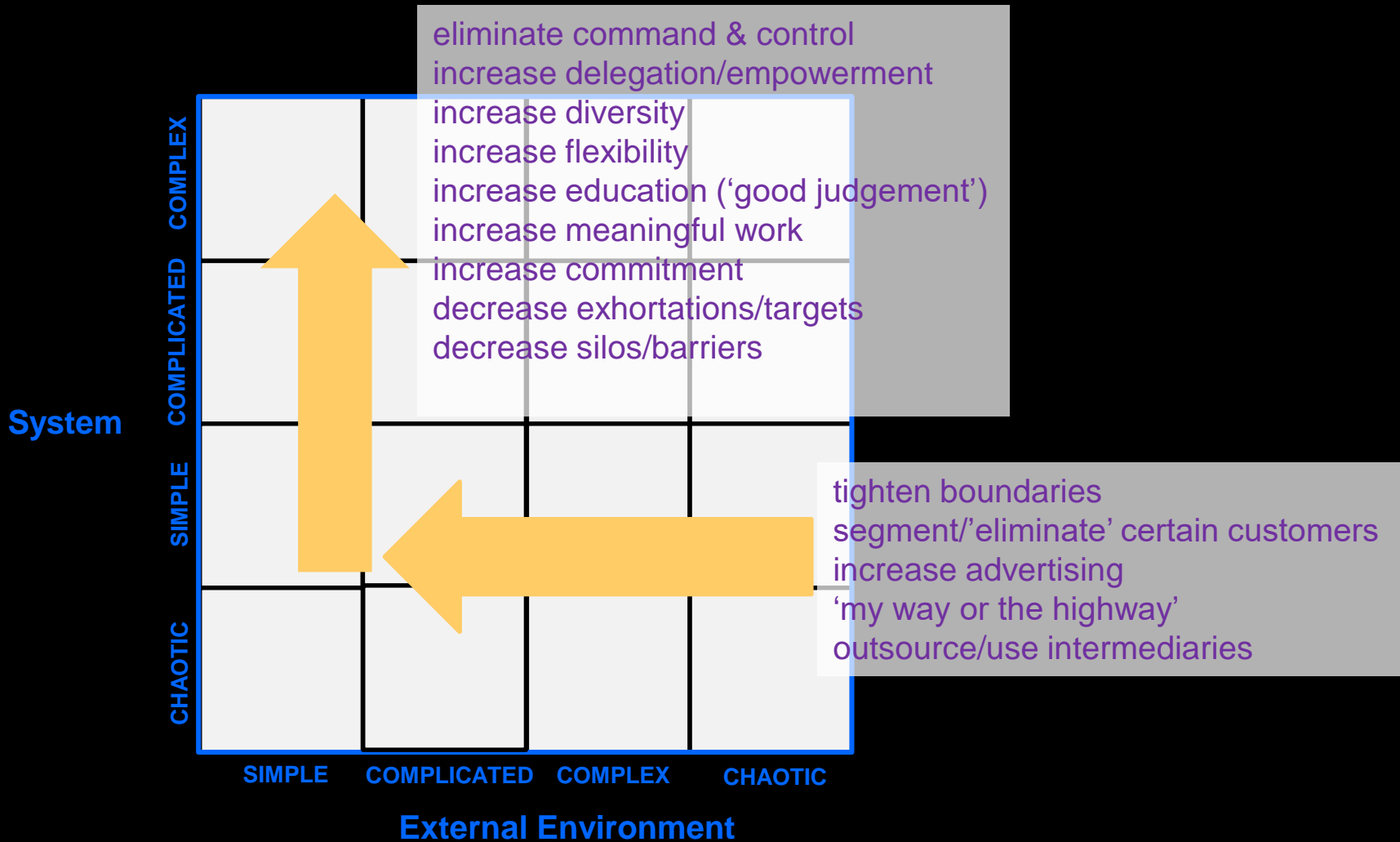
# Complexity Landscape - Resilience Zone



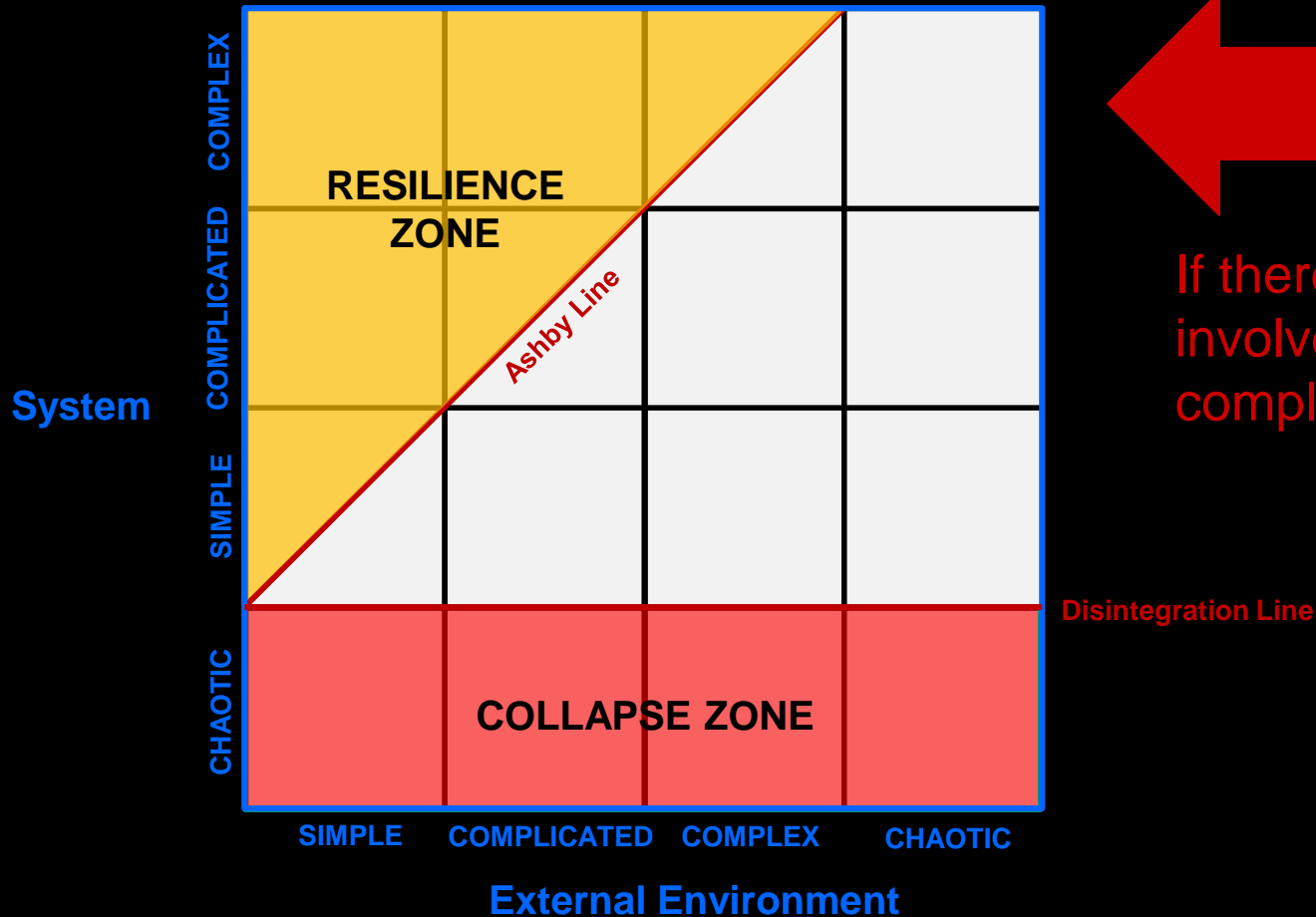
# Complexity Landscape - 'Natural' Forces



# Complexity Landscape - Management



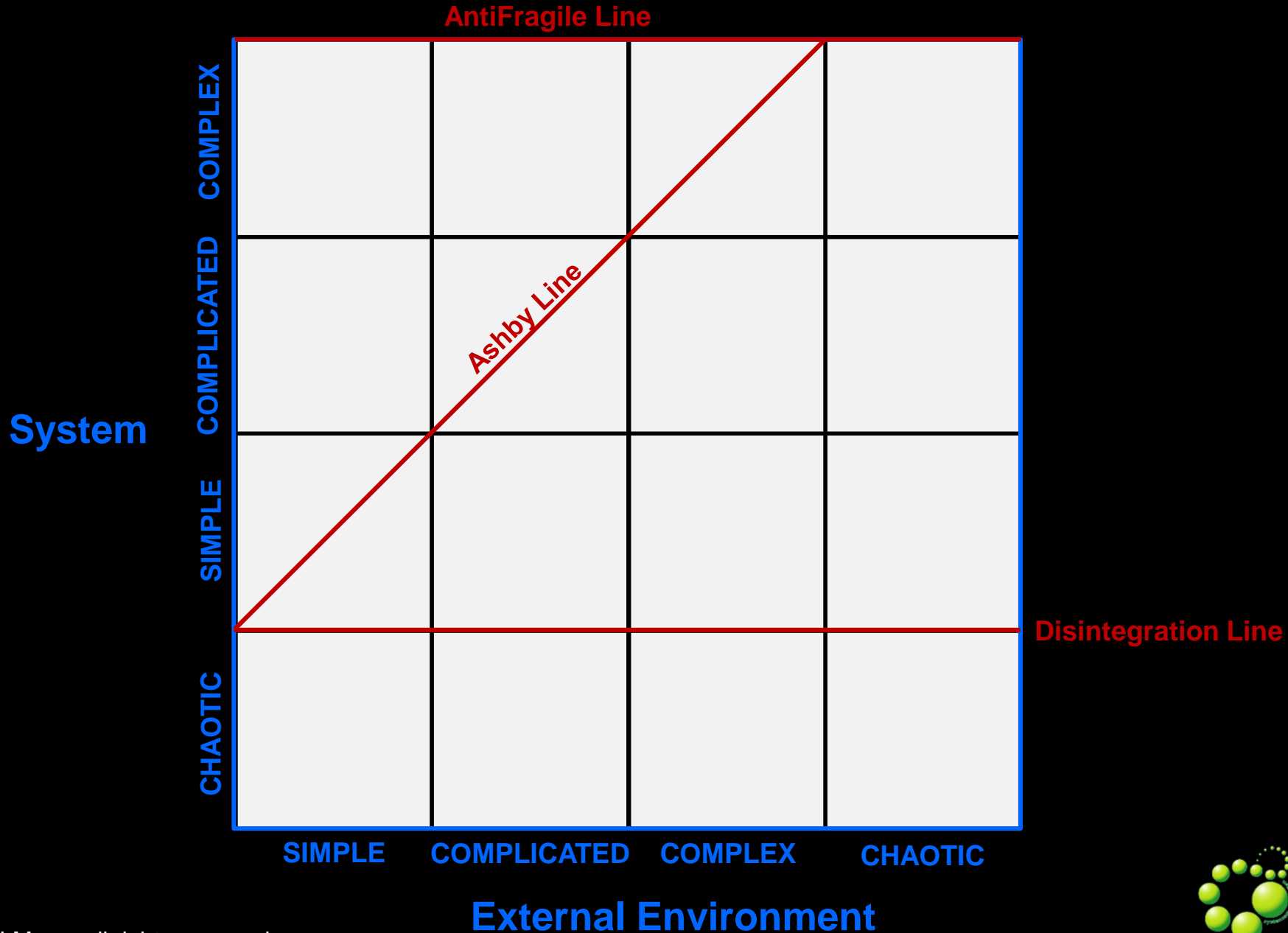
# Complexity Landscape - Heuristic #1



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



# AntiFragility



# Boeing 737



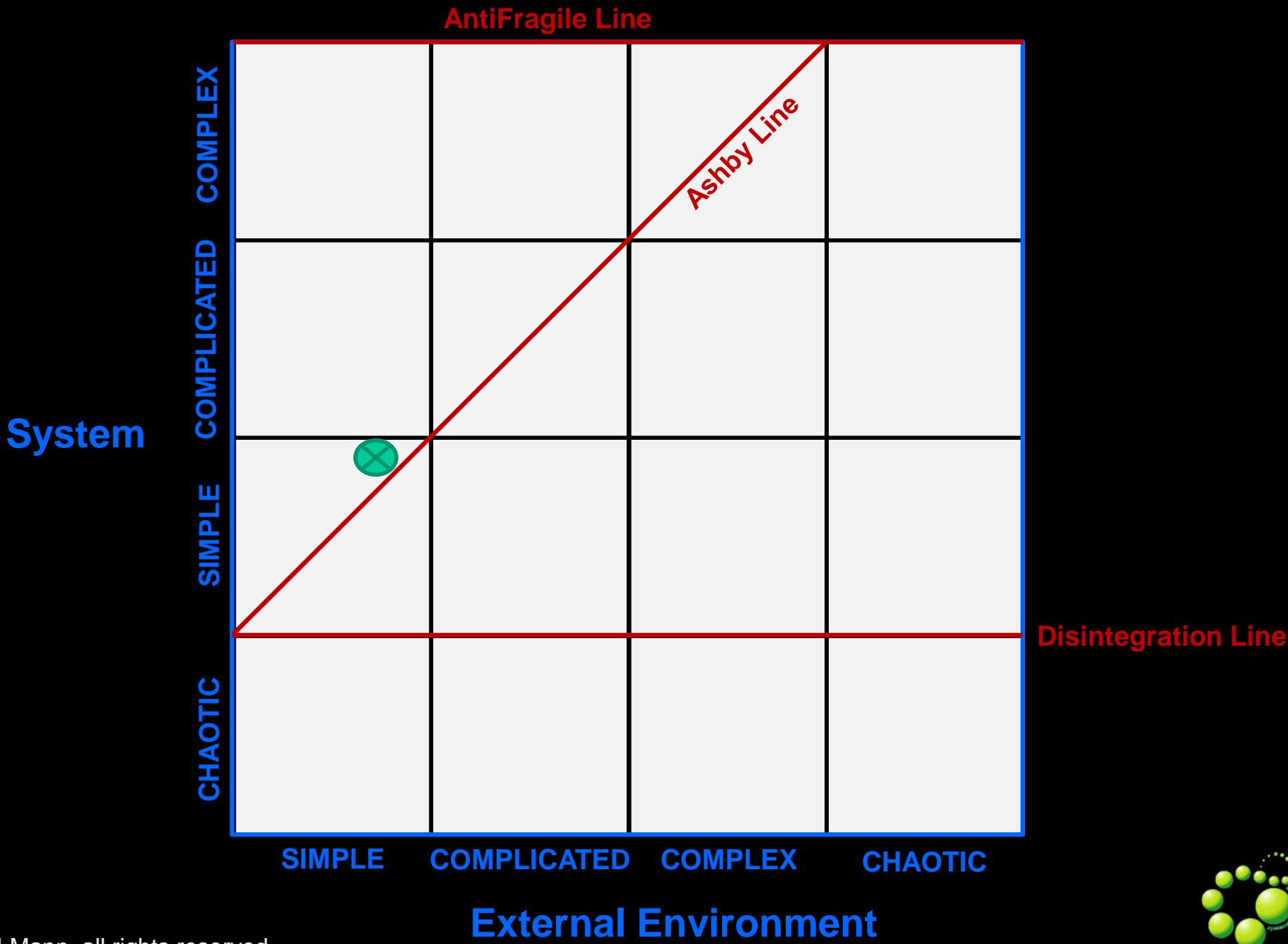
100/200 Series



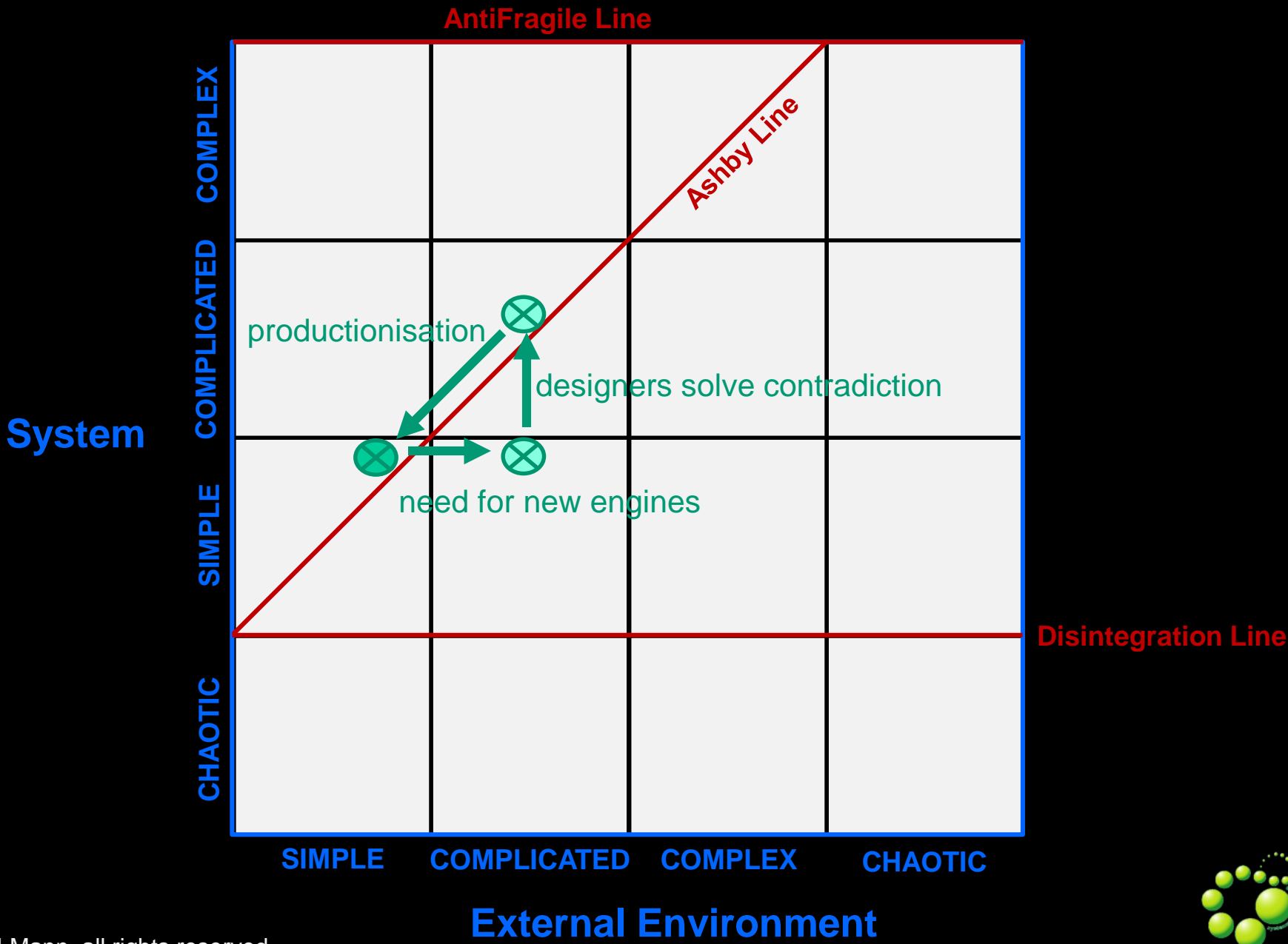
300 Series



# Boeing 737

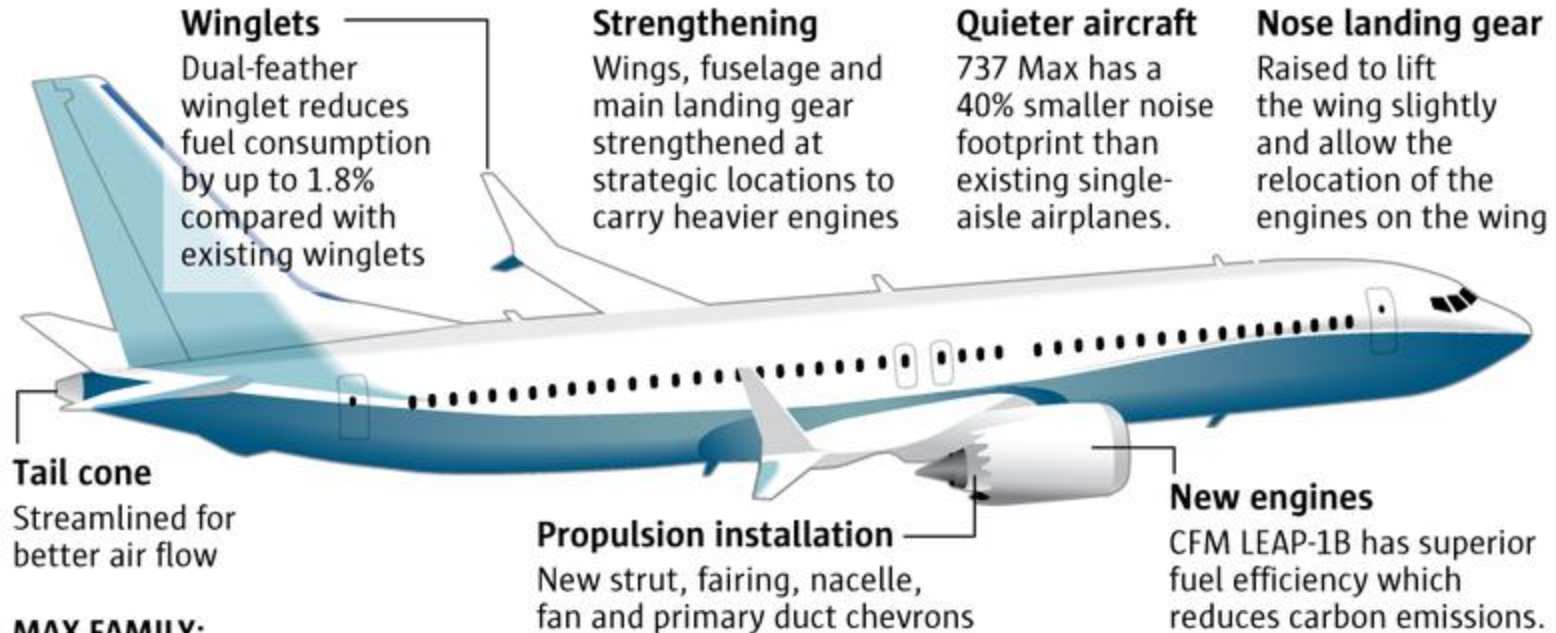


# Boeing 737



# Boeing 737 Max

## What is new on Boeing's 737 MAX



### MAX FAMILY:



**737-MAX 7**

Wingspan: 117 feet, 10 inches

Length: 116 feet, 8 inches

Passengers: 172 (maximum seating)



**737-MAX 8**

117 ft., 10 in.

129 ft., 8 in.

189 (maximum seating)



**737-MAX 9**

117 ft., 10 in.

138 ft., 4 in.

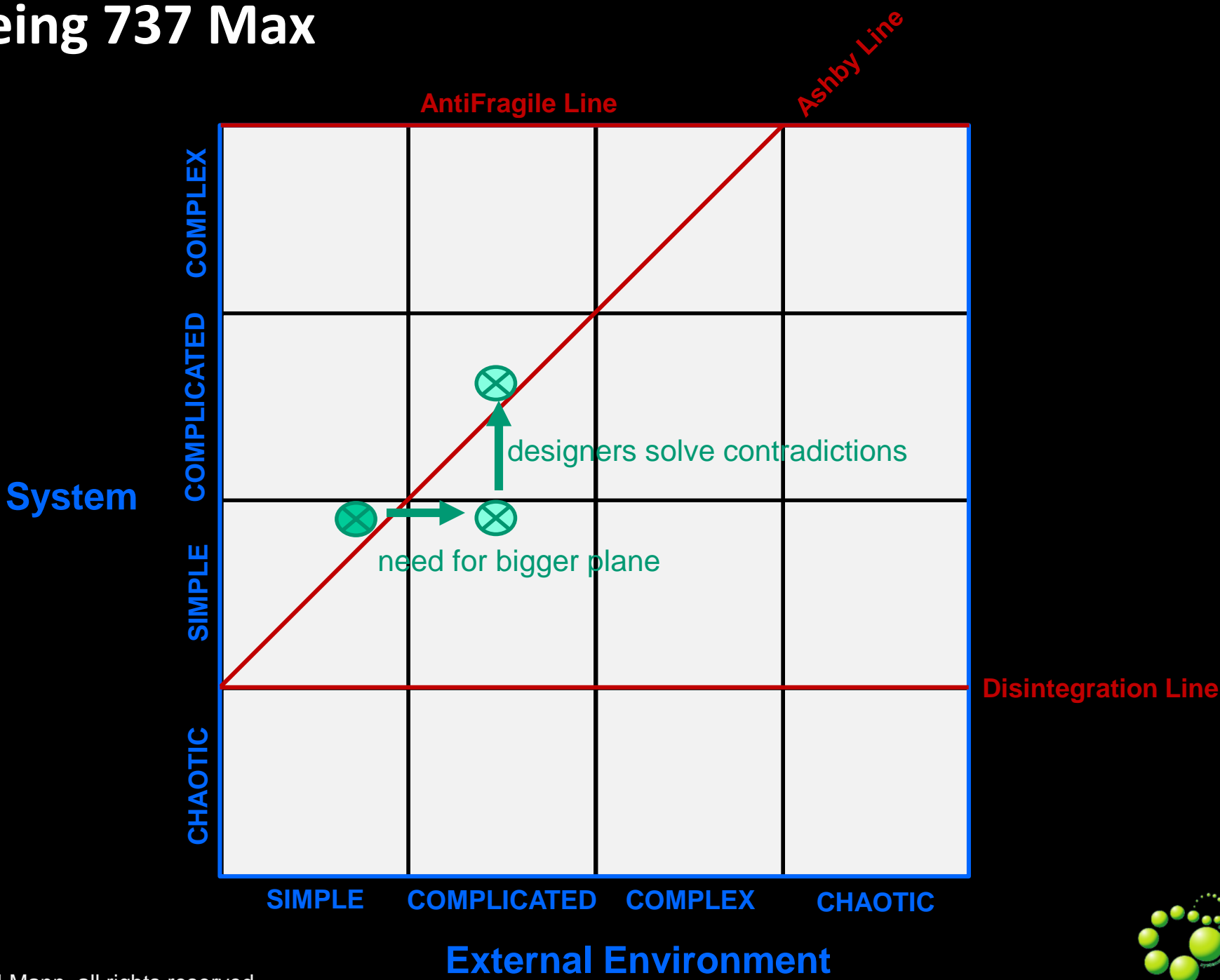
220 (maximum seating)

Source: Boeing

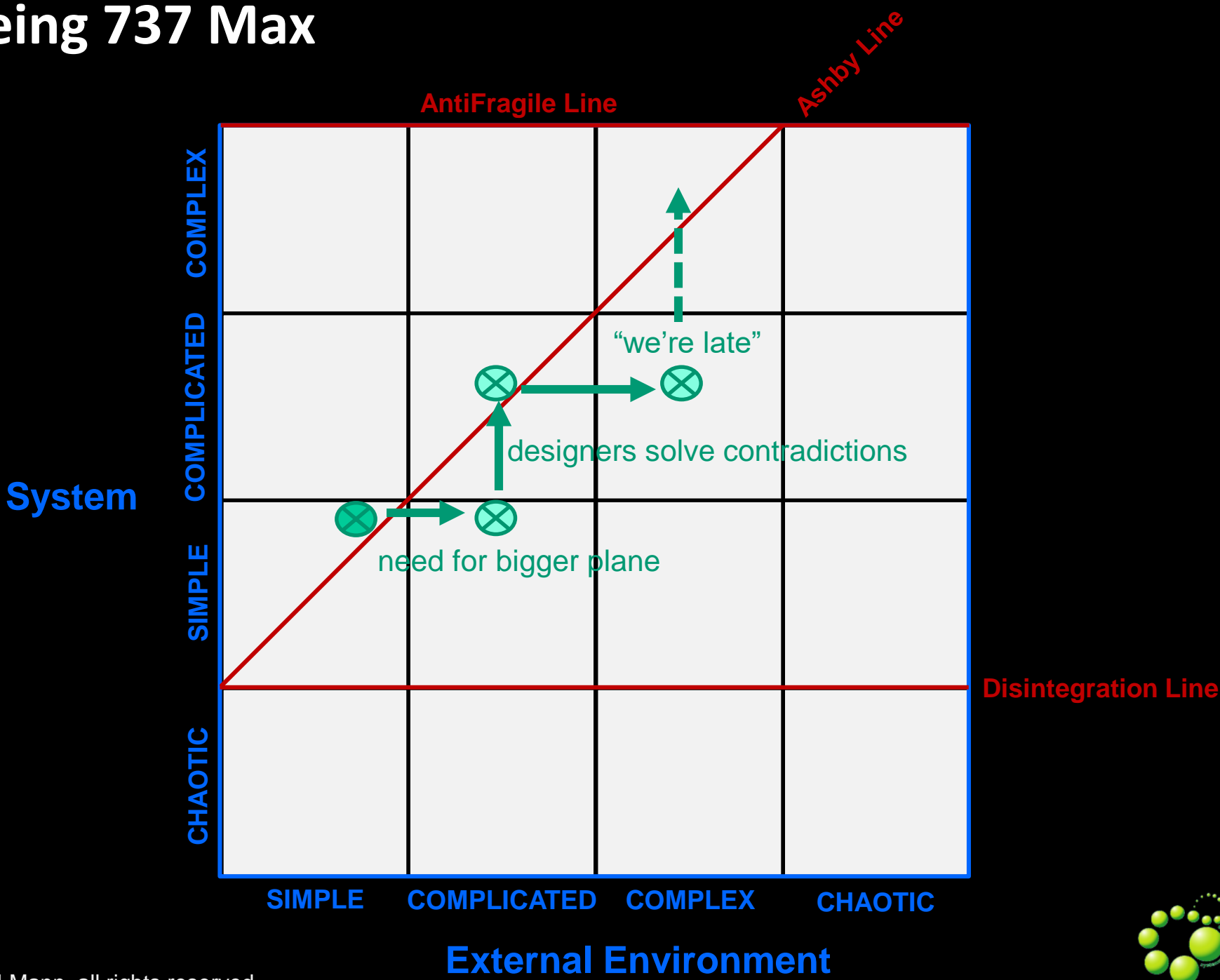
MARK NOWLIN / THE SEATTLE TIMES



# Boeing 737 Max



# Boeing 737 Max



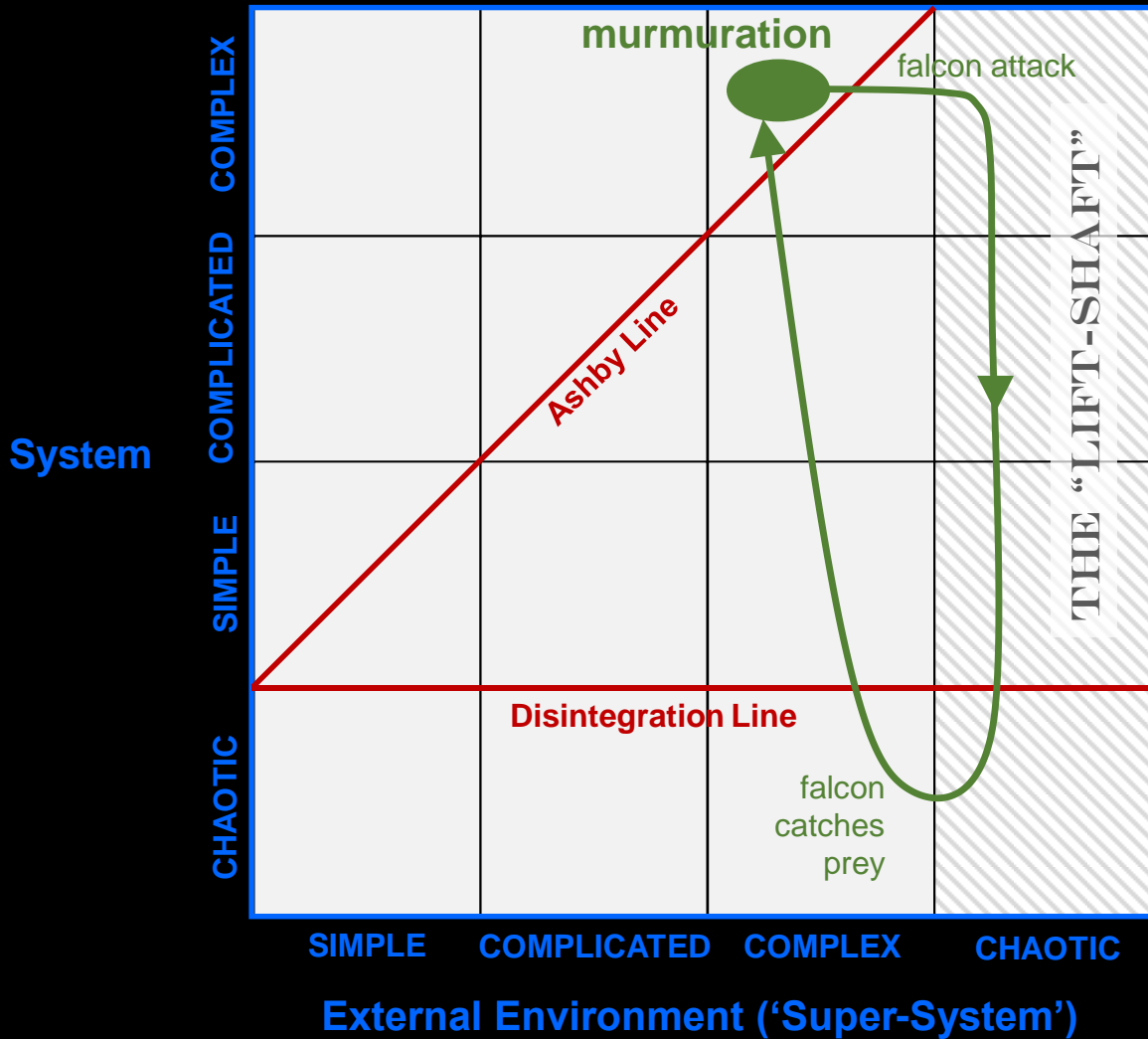
“fly as close to your neighbours as possible”



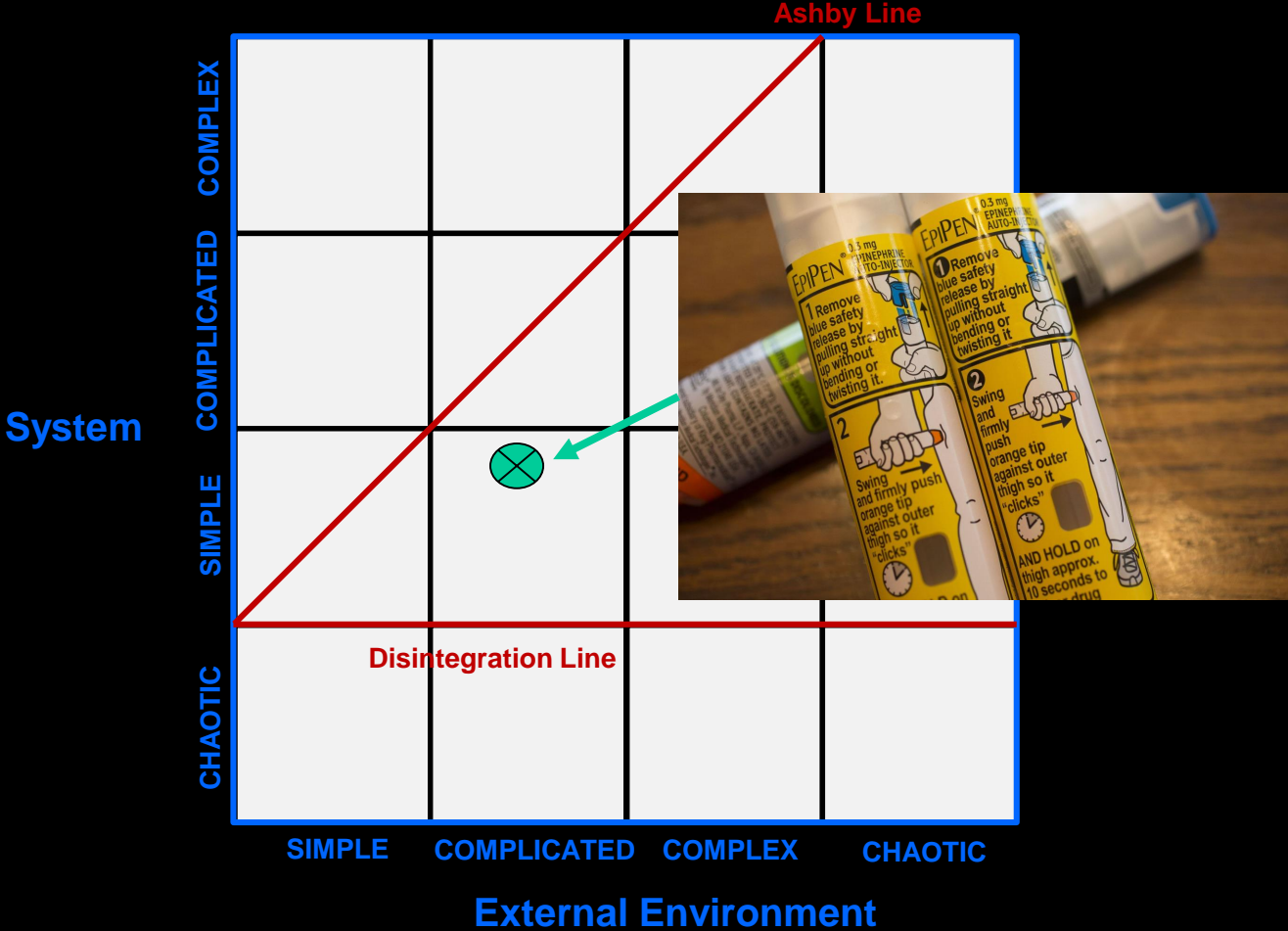
“get away from the falcon”



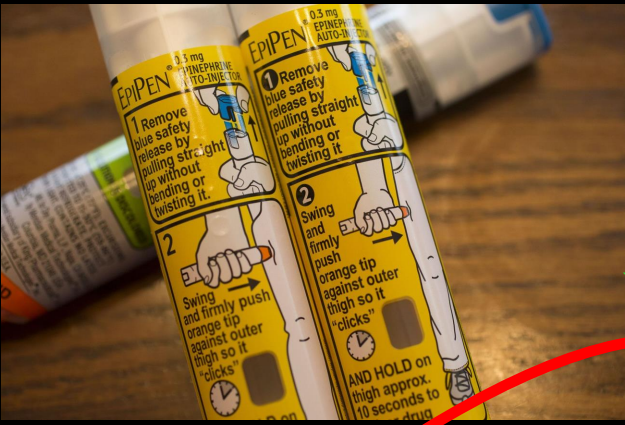
# Complexity Landscape - Starlings I



# Complexity Landscape - EpiPen



# Safety, Safetyism & EpiPen



Safety

Safetyism  
Threshold



Safety Measures





**For every complex problem  
there is an answer that is  
clear, simple, and wrong.**

*H. L. Mencken*



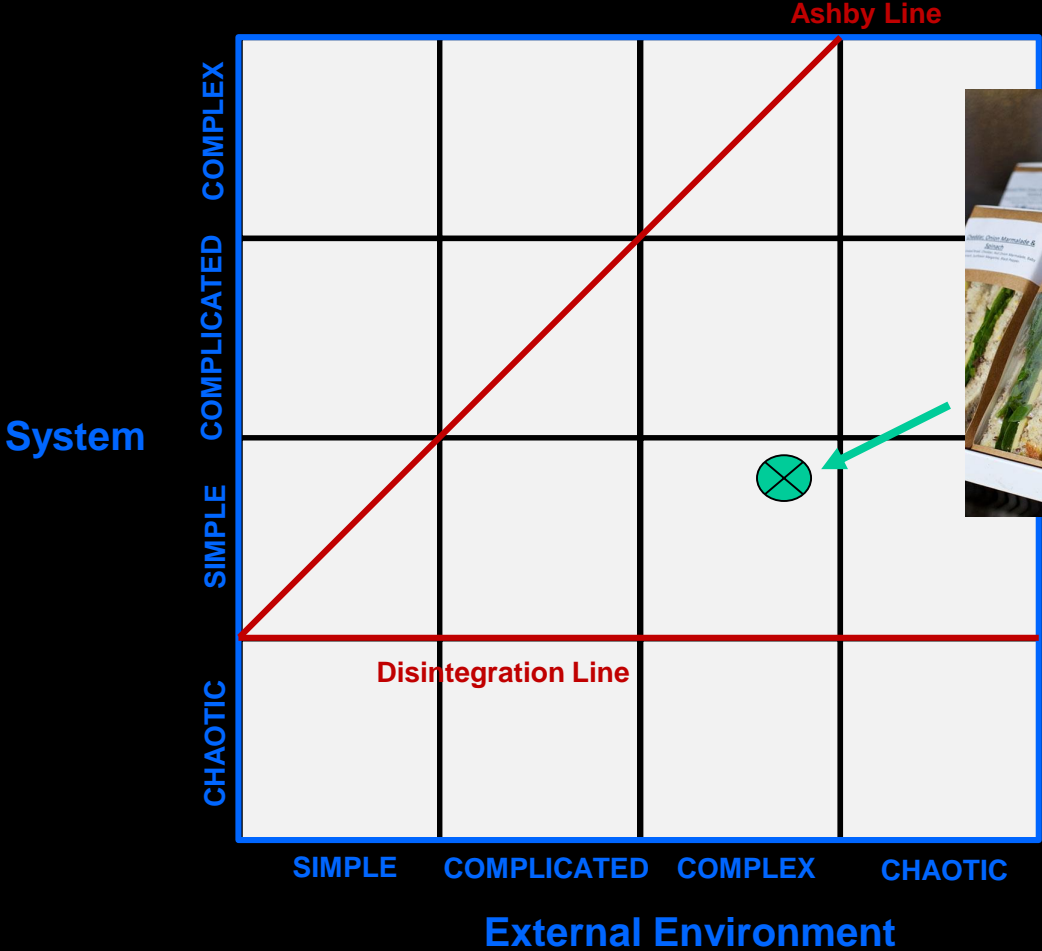
# Natasha's Law



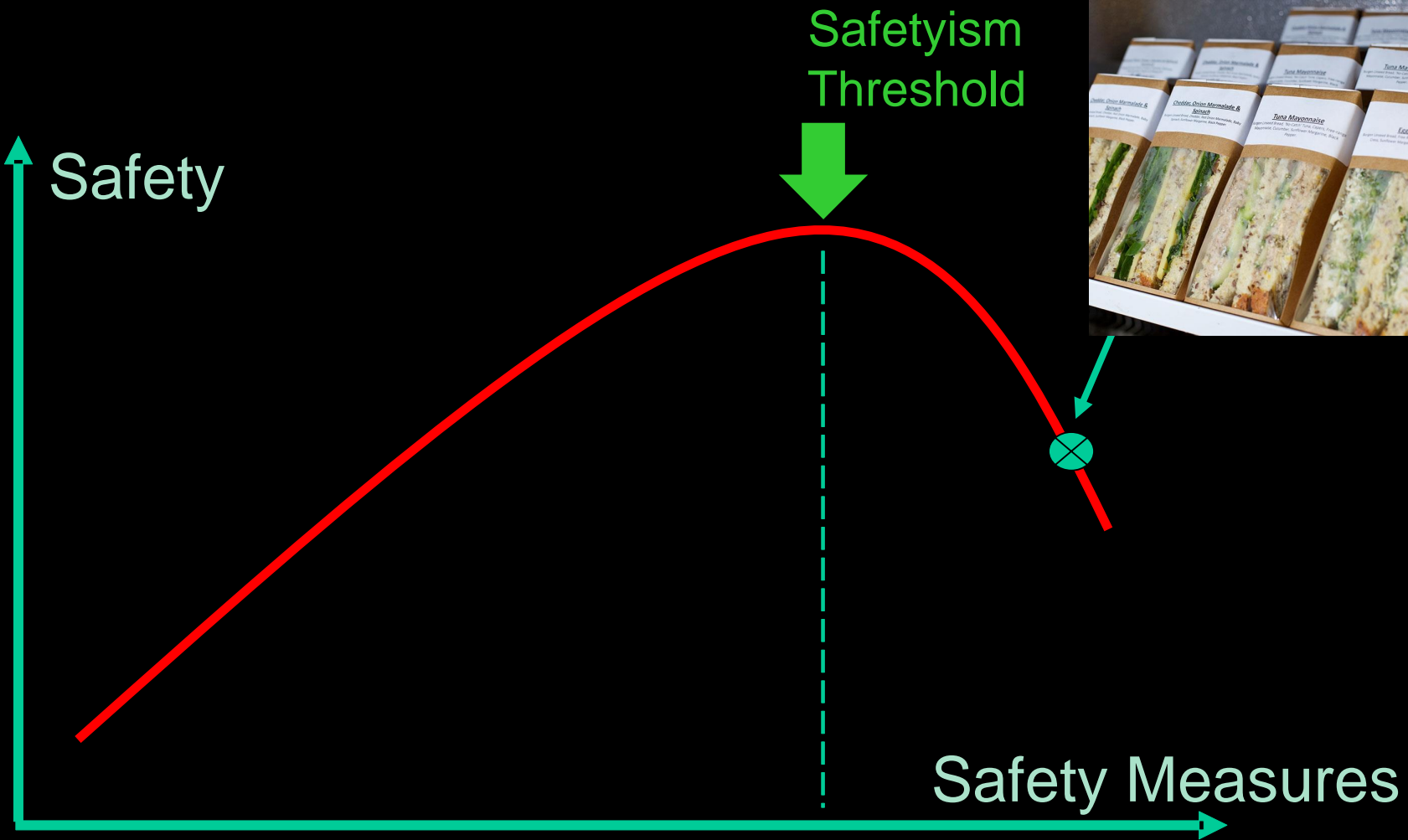
All food from all outlets will require ingredient labelling'



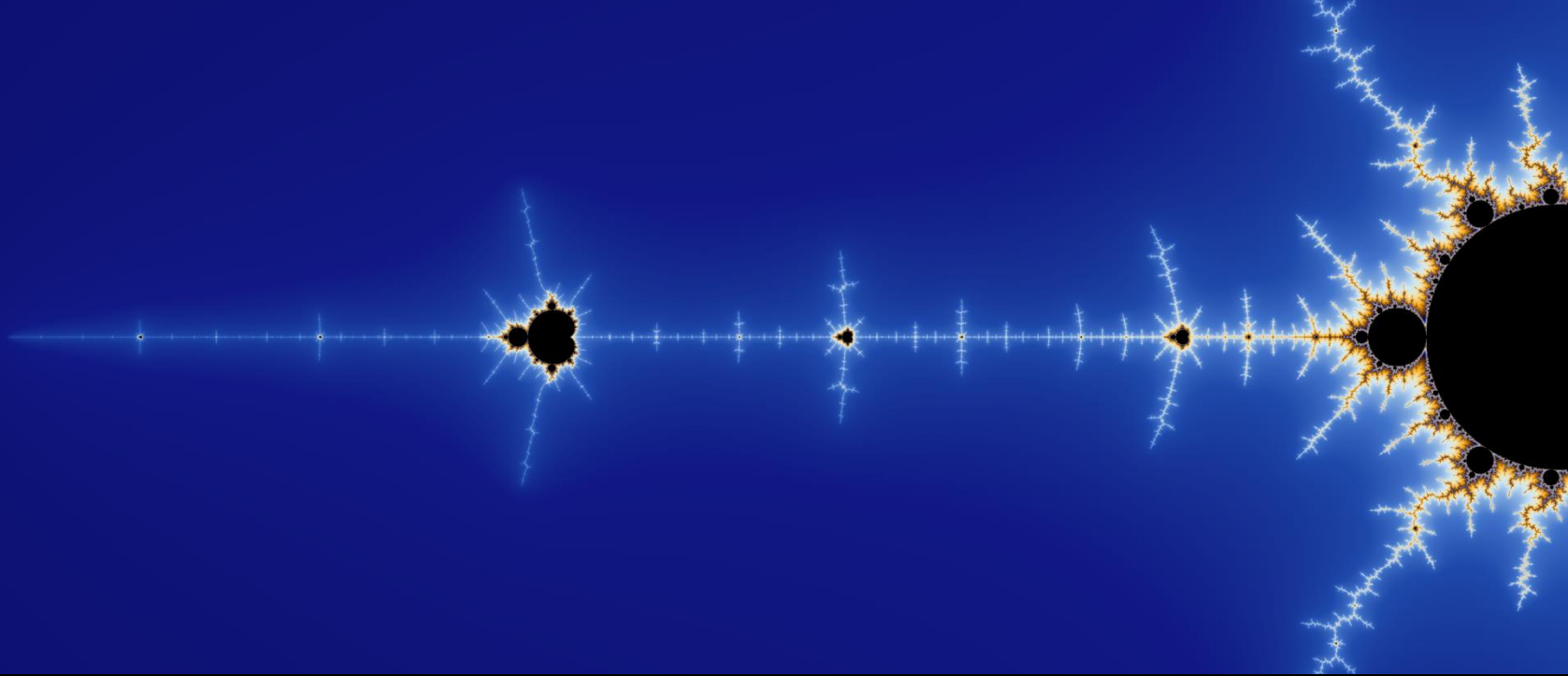
# Complexity Landscape - Natasha's Law



# 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**.

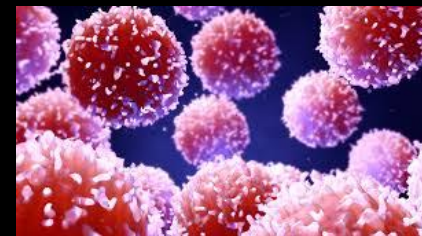


# First Principles

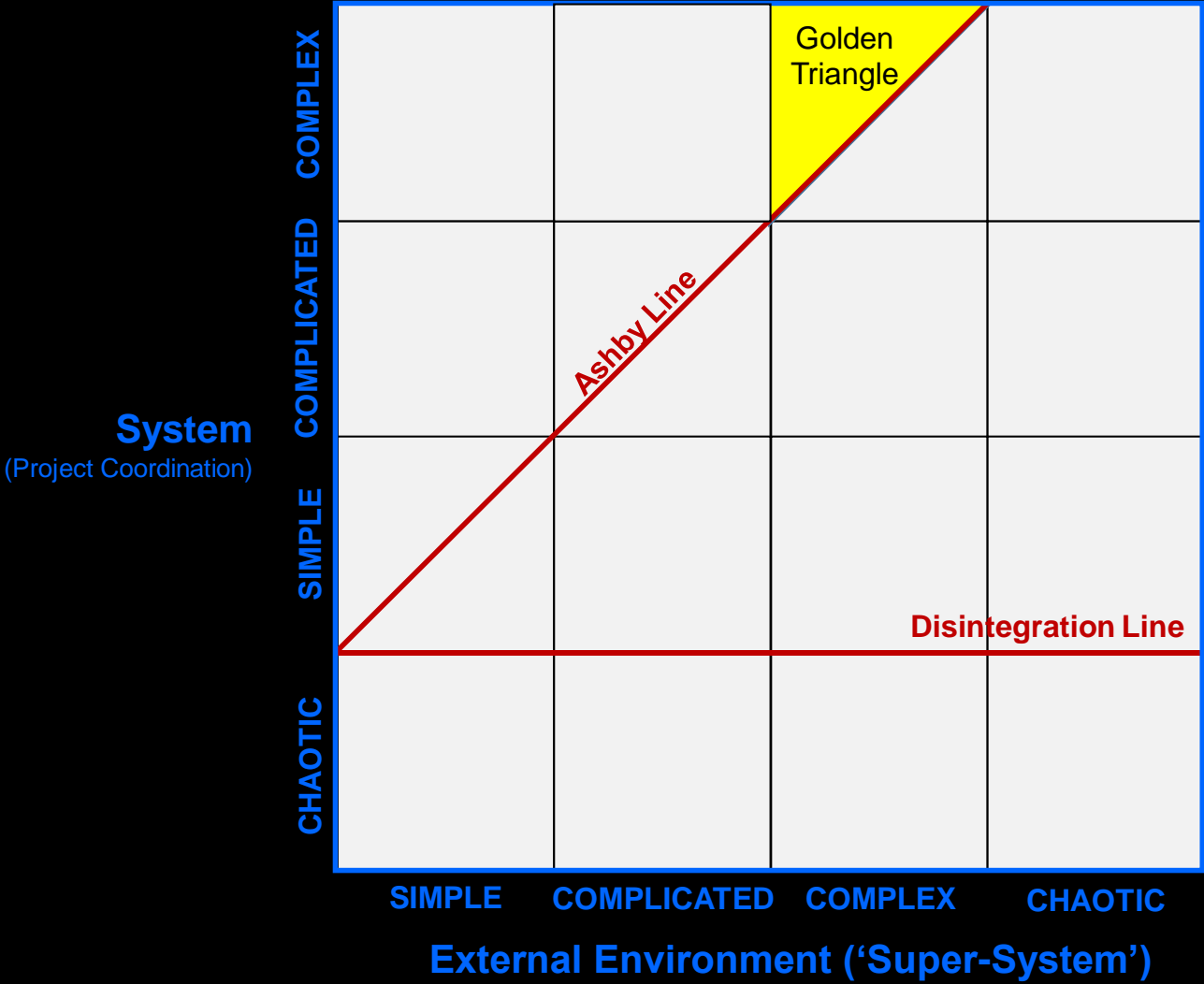


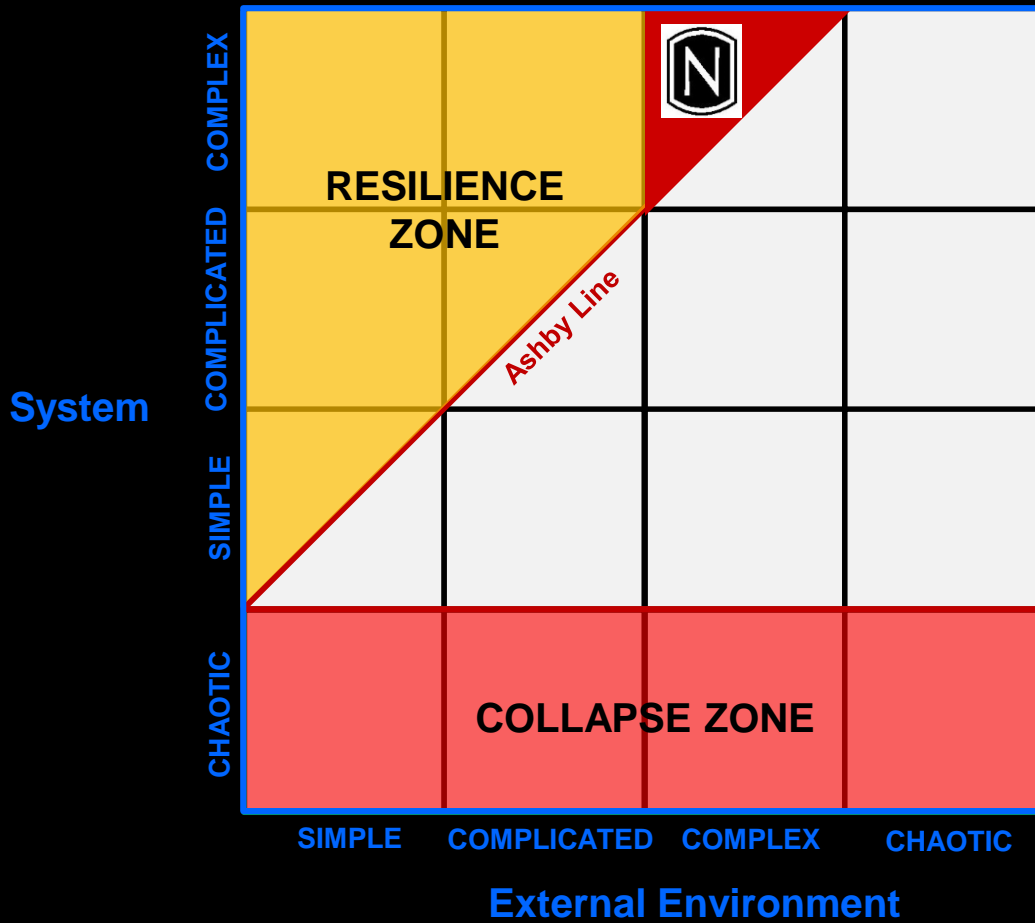
Kids need to eat dirt to develop immune system

The human body is antifragile...  
if correctly primed  
("use it or lose it")



# Complex Change - The Golden Triangle





# Nordstrom: Managing Complexity

## EMPLOYEE HANDBOOK

Our number one goal is to provide outstanding customer service. Set both your personal and professional goals high. We have great confidence in your ability to achieve them, so our employee handbook is very simple. We have only one rule...

NORDSTROM

OUR ONE RULE  
**Use good judgment  
in all situations.**

Please feel free to ask your department manager, store manager or Human Resources any questions at any time.



# AntiFragile



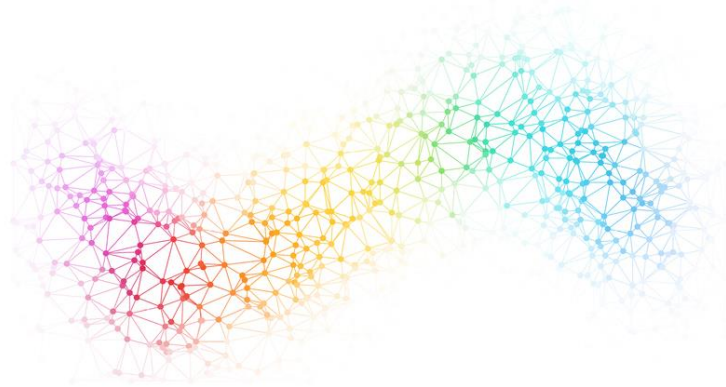
PLEASE MISHANDLE

**ANTIFRAGILE**

THANK YOU

## Antifragile Software

Building Adaptable Software  
with Microservices



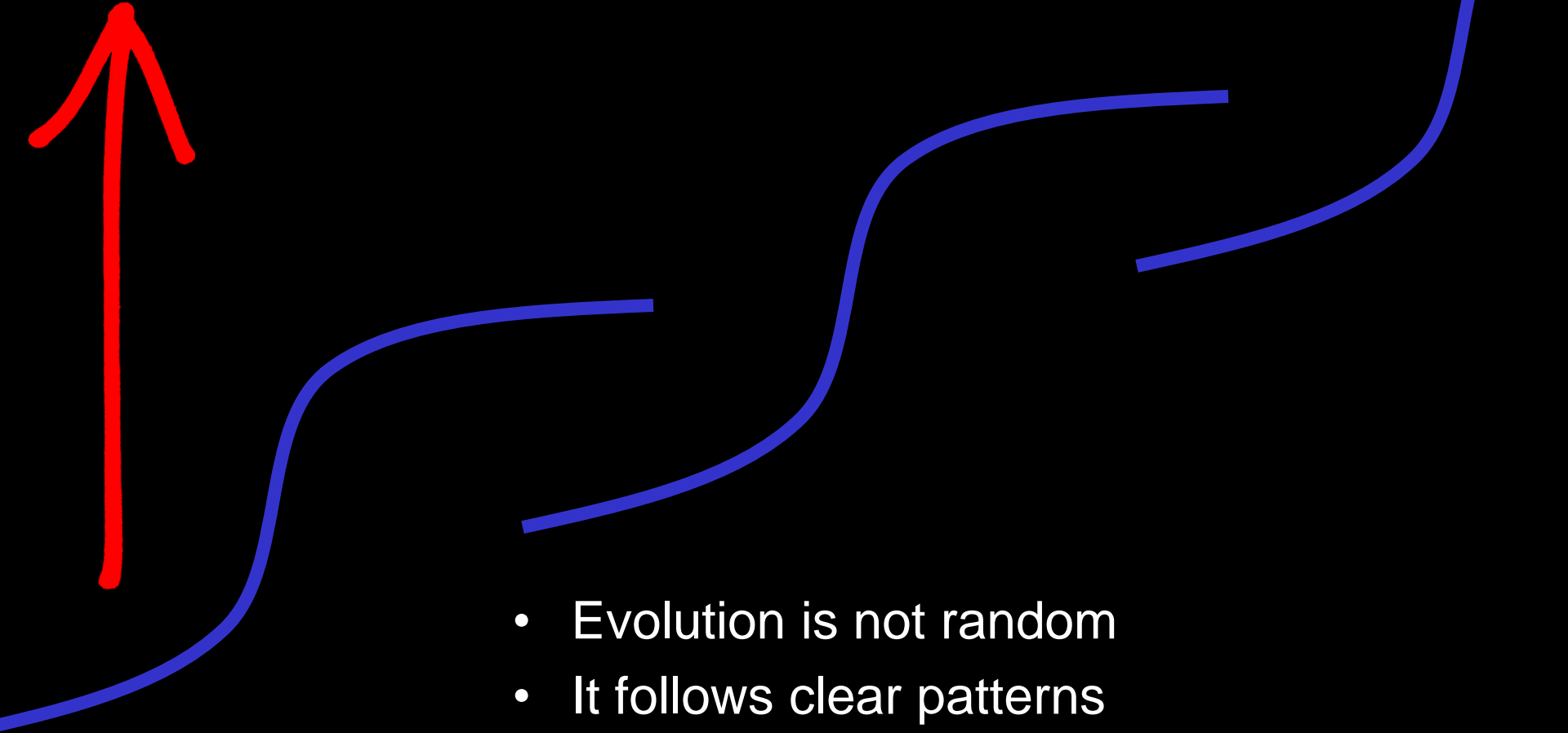
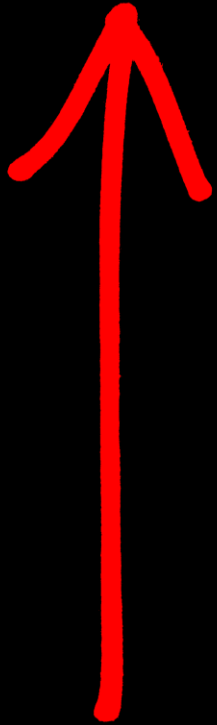
Russ Miles

Grant Tarrant-Fisher  
Sylvain Hellegouarch



Perfect

**IDEALITY**  
**= Benefits/(Costs + Harms)**



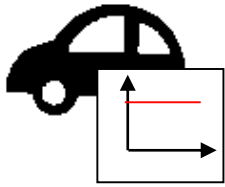
- Evolution is not random
- It follows clear patterns
- Different Stages can be predicted
- There is a 'road-map' to perfect



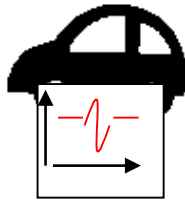
# RESILIENT DESIGN



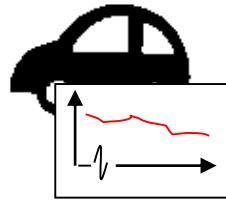
**Trial & Error**



**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.

© NTSB

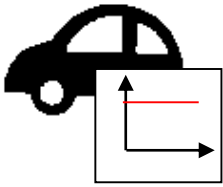
aviation-safety.net



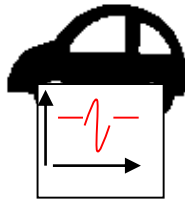
# RESILIENT DESIGN/ANTIFRAGILE



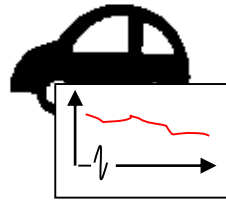
**Trial & Error**



**Steady-State**



**Transient**



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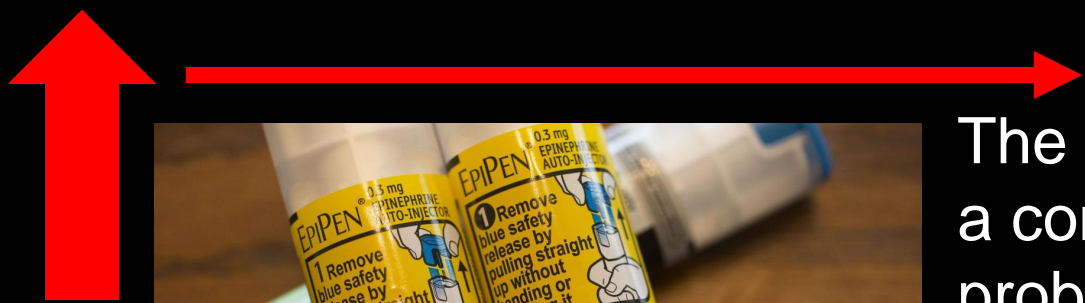
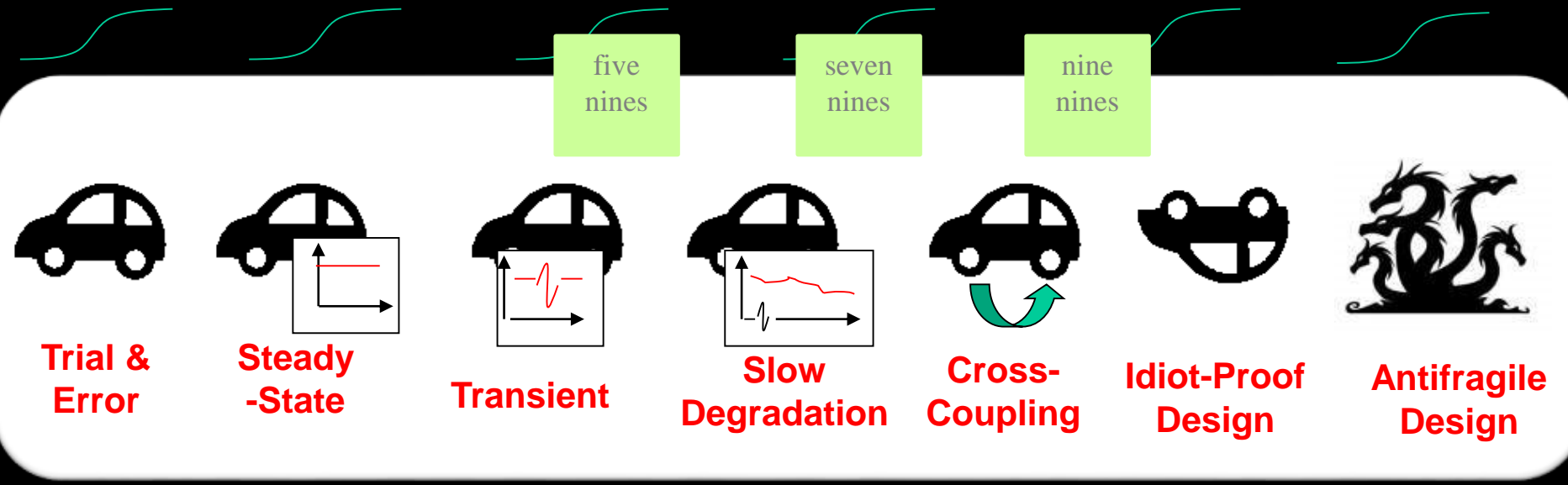
- improve reliability
- enable easy shift to 'functional sales model'

nine  
nines

ten  
nines



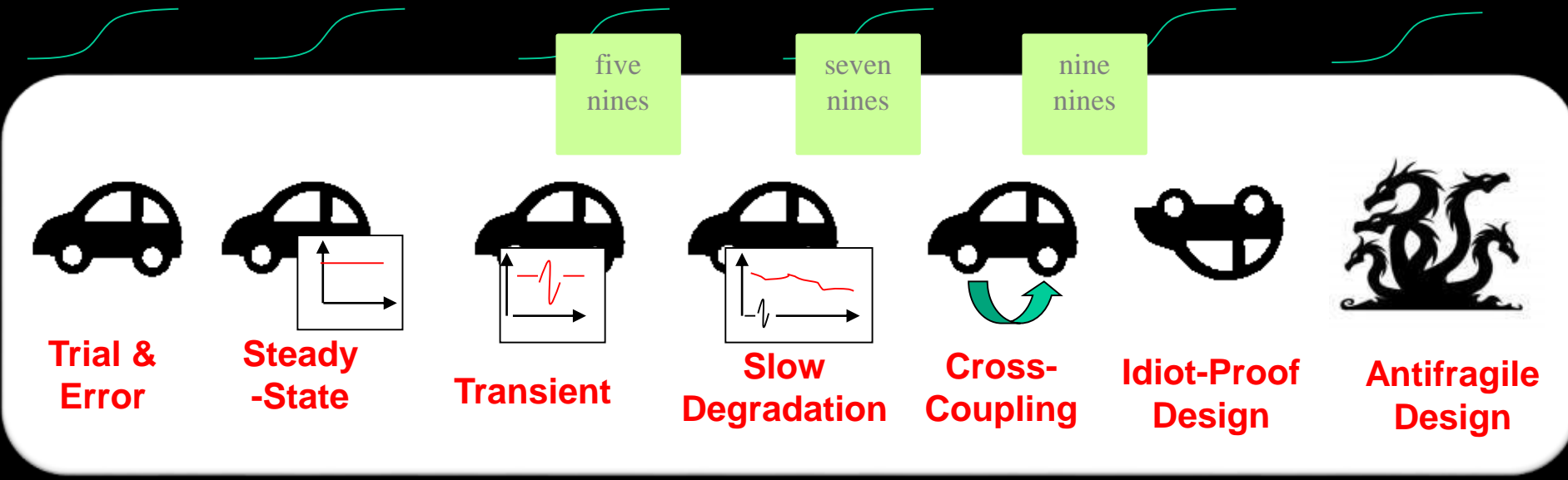
# EpiPen...



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



# Natasha's Law...



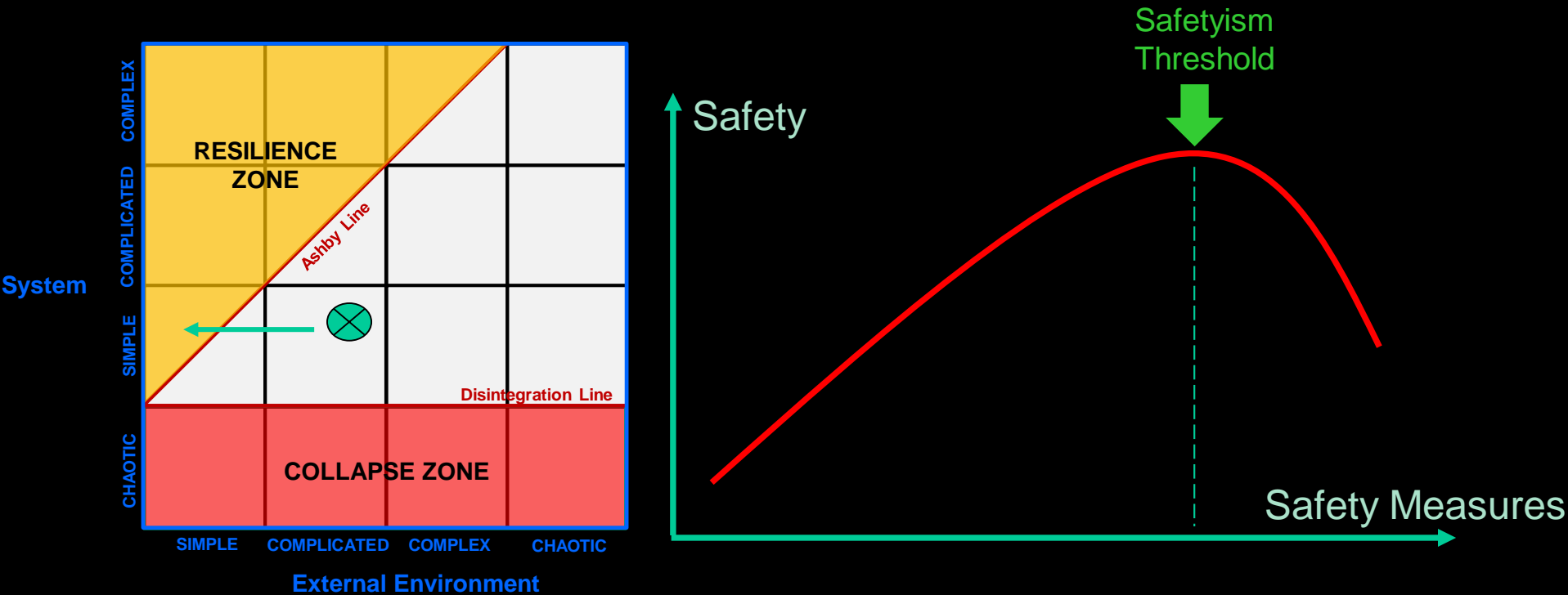
In a complex environment, achieving antifragility is the only way to ensure long-term survival

(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

