

Extreme risks, the irreversibility of time and the retirement anomaly

Pension Research Council Conference

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Retirement...

- Is a very modern invention

Is it sustainable, or a passing anomaly?

A retirement system...

- Must survive multiple decades, at least
- A lot will happen
- Some events could be extreme

Extreme risks matter

1) Could the probability be higher than we think?

2) How useful is probabilistic thinking anyway?

The world as a complex adaptive system

Traditional world-view

Individual action in isolation

Equilibrium

Stable parameters

Linear

Normal distribution

iid

Systemic market risk doesn't exist

Reductionism is widely applied

Complex adaptive system thinking

Coupled / interacting

Punctuated equilibria

Phase transition

Non-linear

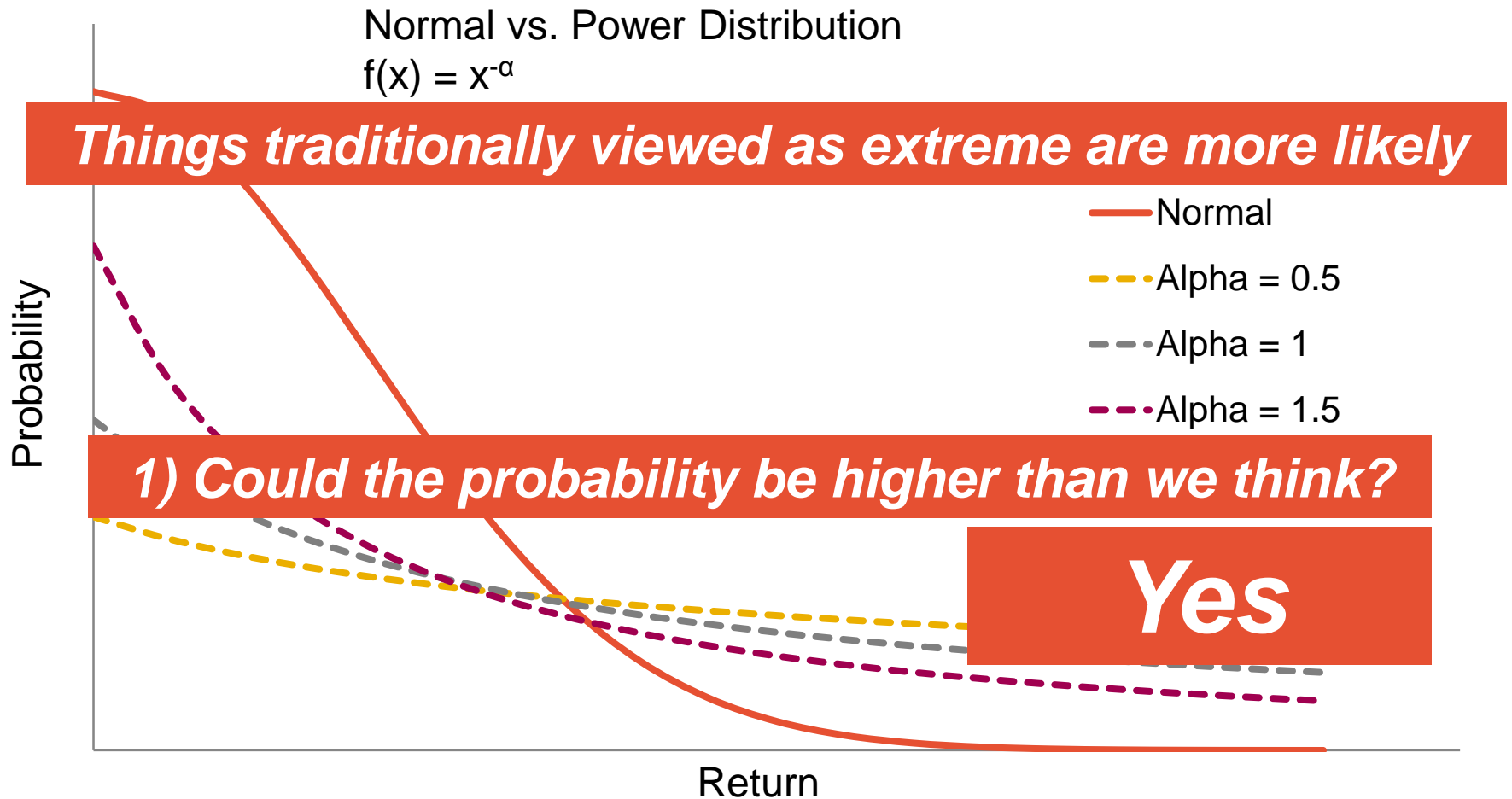
Power law distribution

Path-dependent

Market can collapse from inside

Reductionism is dead

Power law vs. normal distribution – fatter tails



The irreversibility of time

- Roll a fair die
 - roll 1-5 and win 50% of your wealth
 - roll 6 and pay me all your wealth



\$1.5W



\$1.5W



\$1.5W



\$1.5W



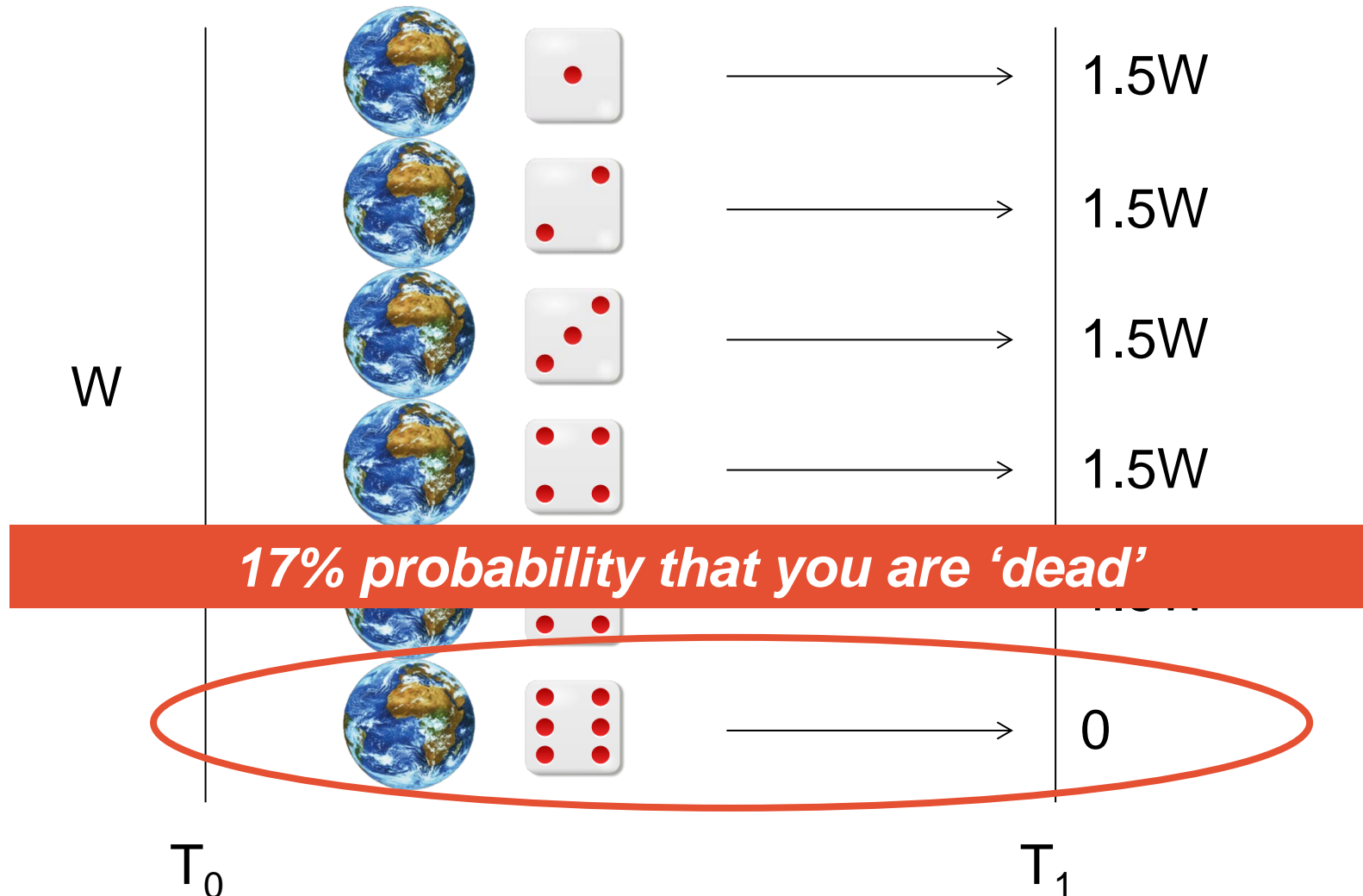
\$1.5W



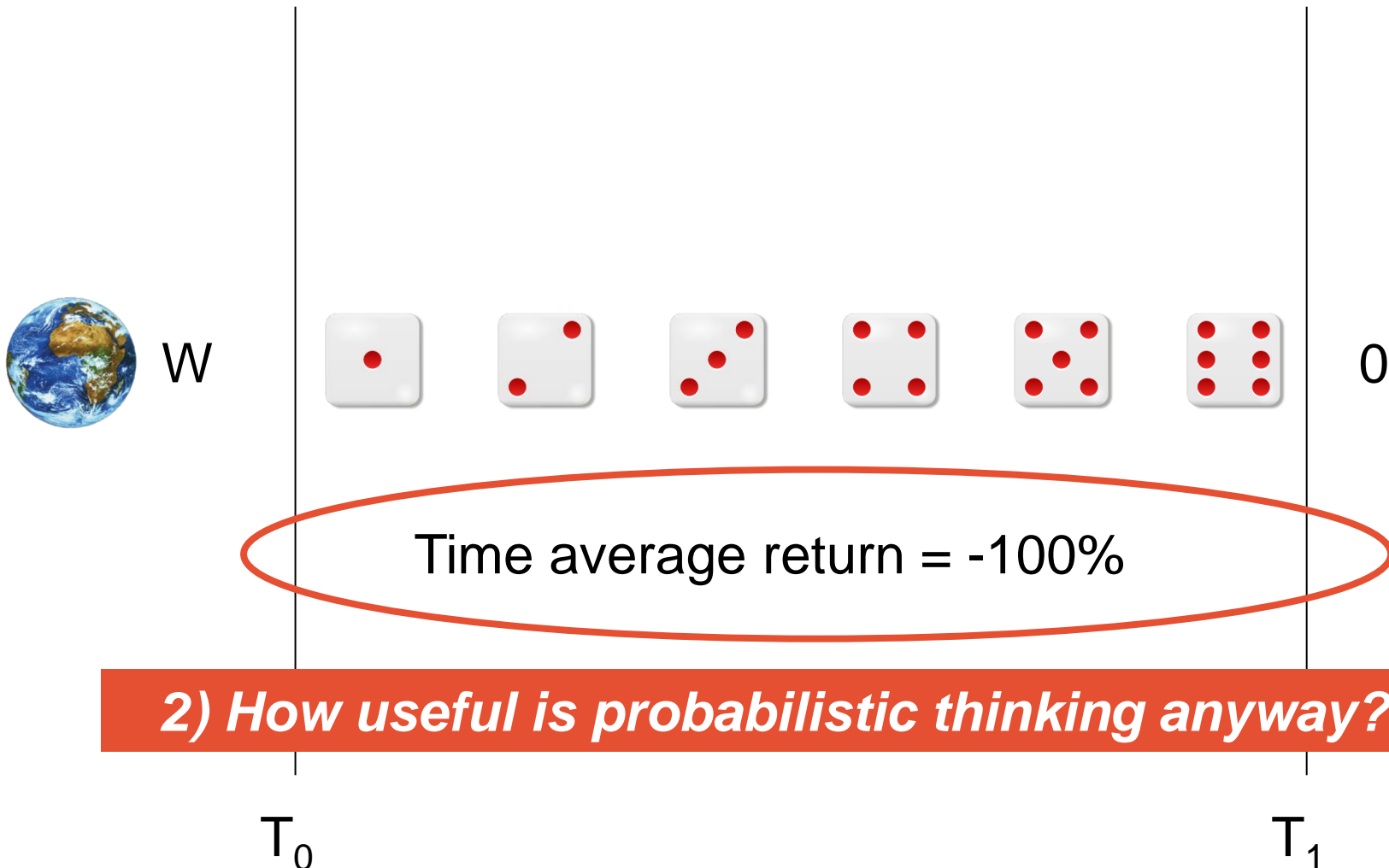
\$0

$$\frac{[(5/6 * 1.5W) + (1/6 * 0)] - W}{W} = 25\%$$

We don't do time travel – ensemble average



We don't do time travel – time average



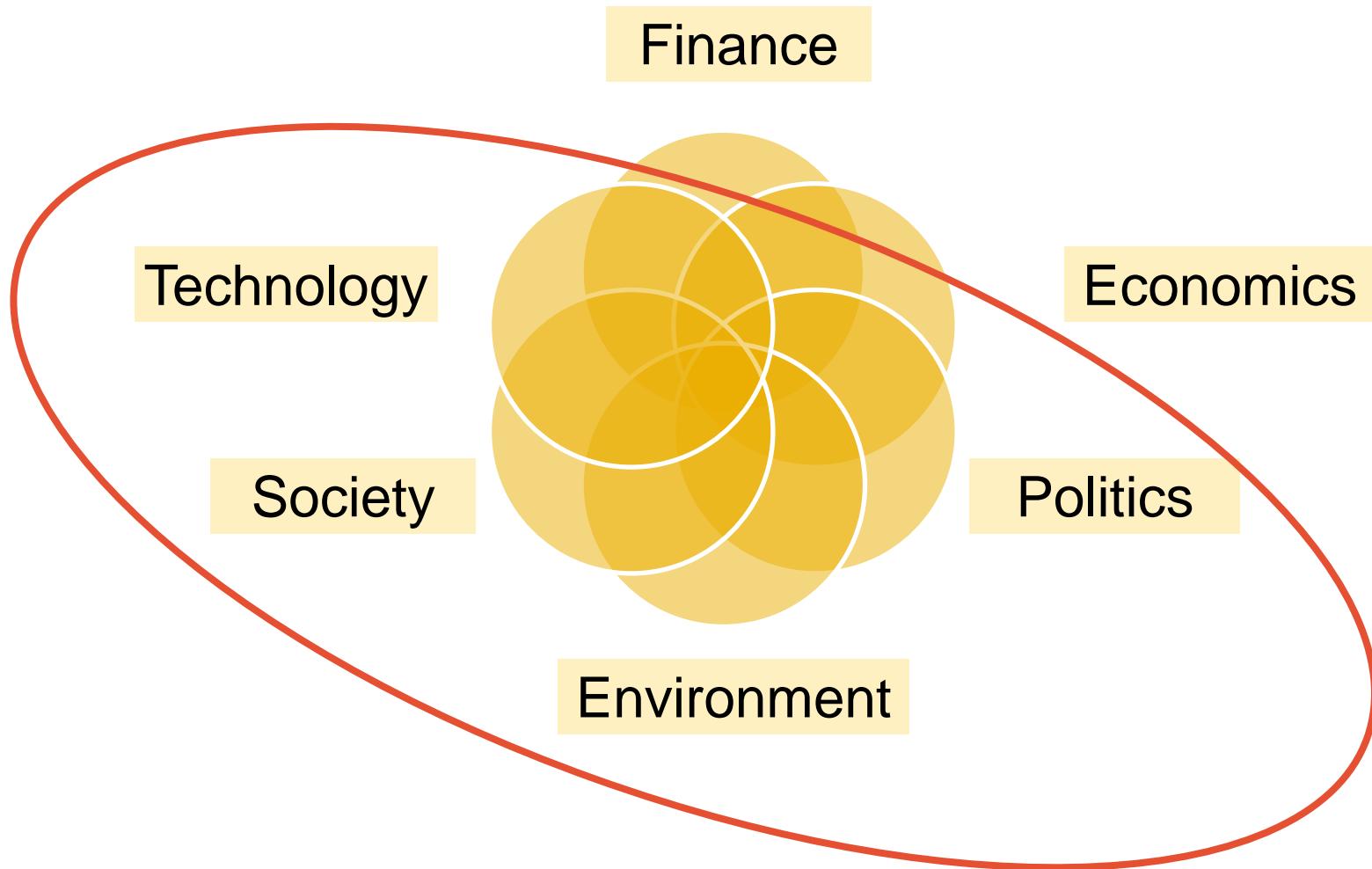
2) How useful is probabilistic thinking anyway?

Introducing the concept of extreme risks

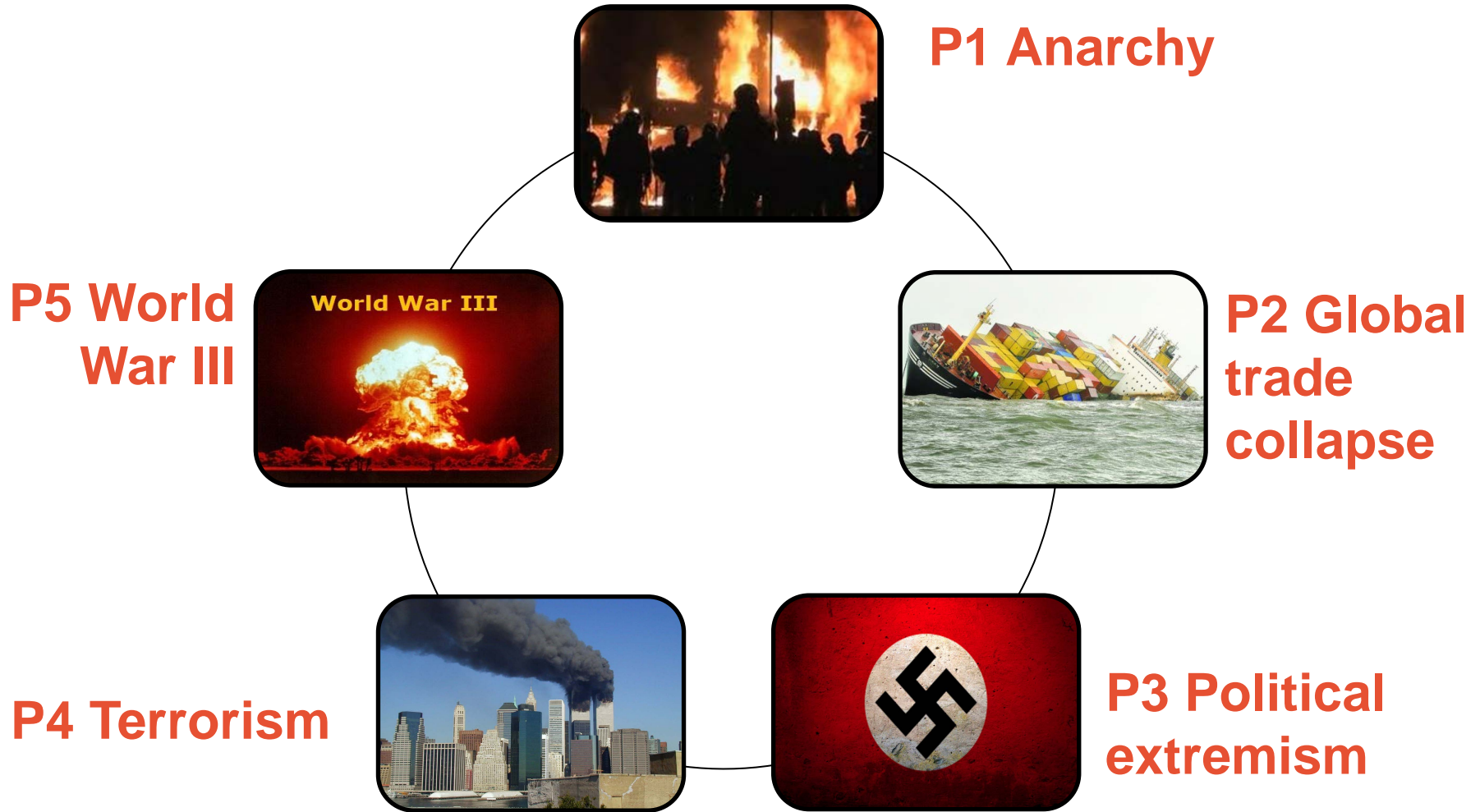
- Extreme risks
 - very unlikely
 - significant impact should they happen
 - matter because we live in a single universe
 - assessment depends on our state of knowledge
 - more frequent than we previously thought



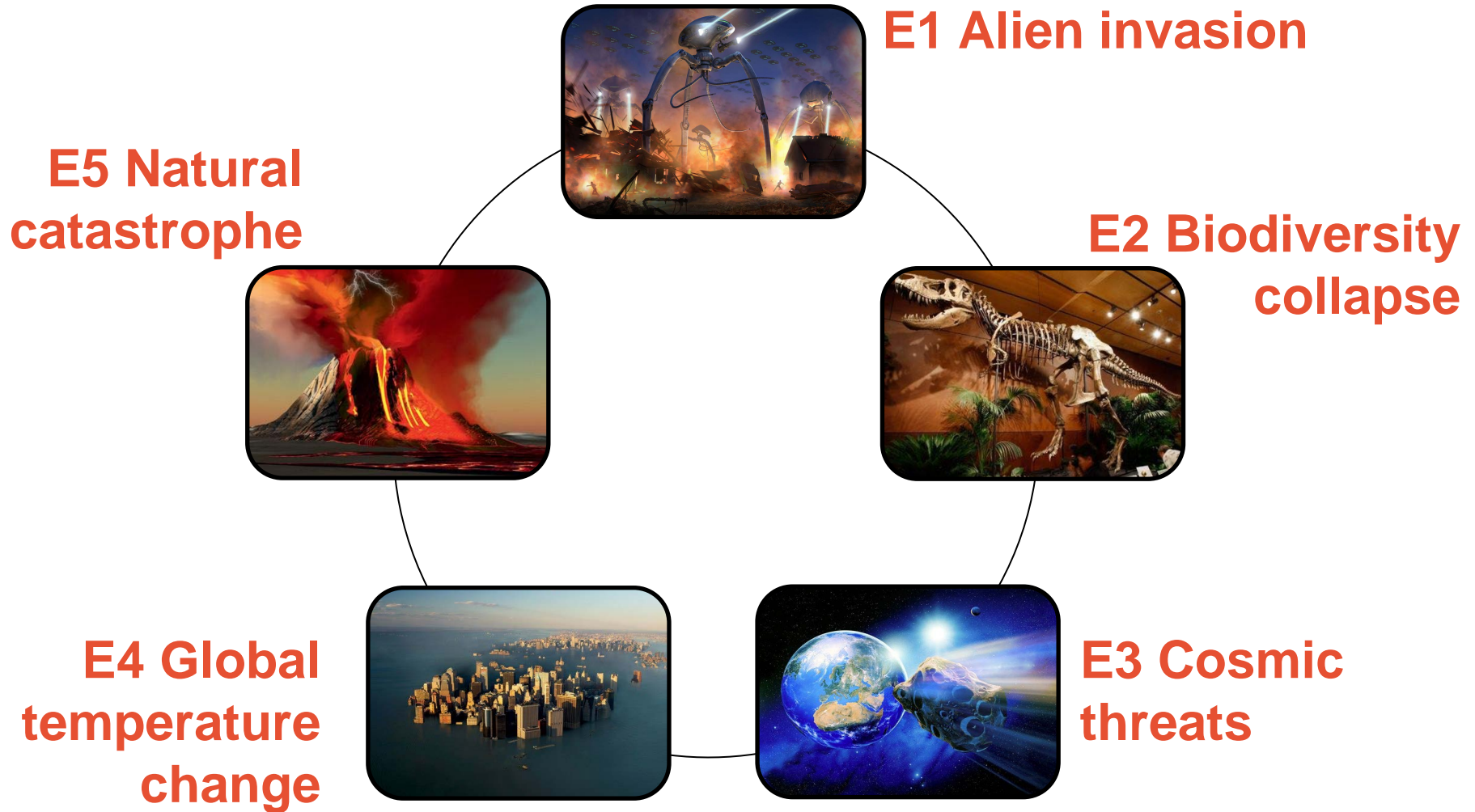
How we see the world



Political extreme risks



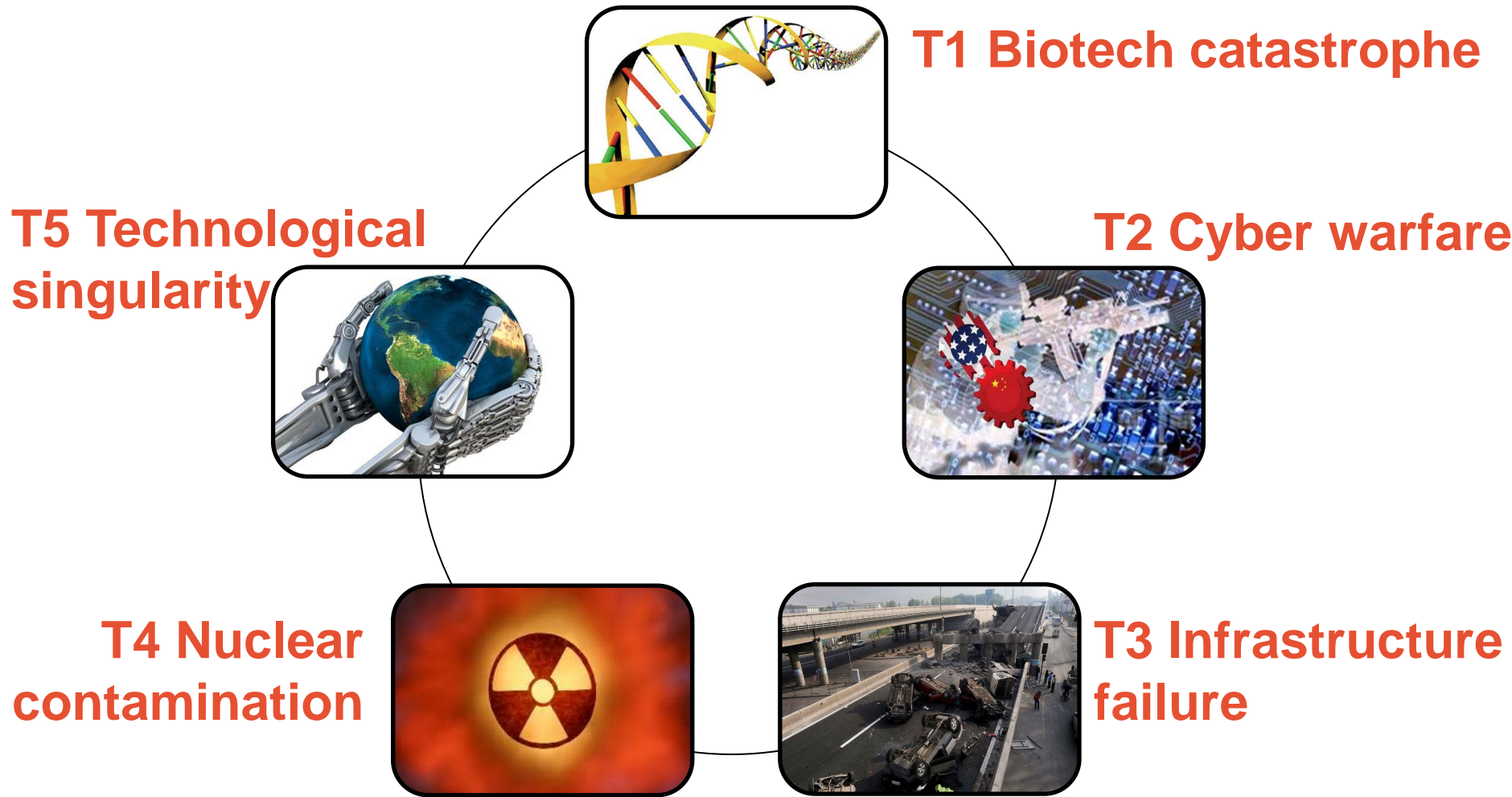
Environmental extreme risks



Social extreme risks

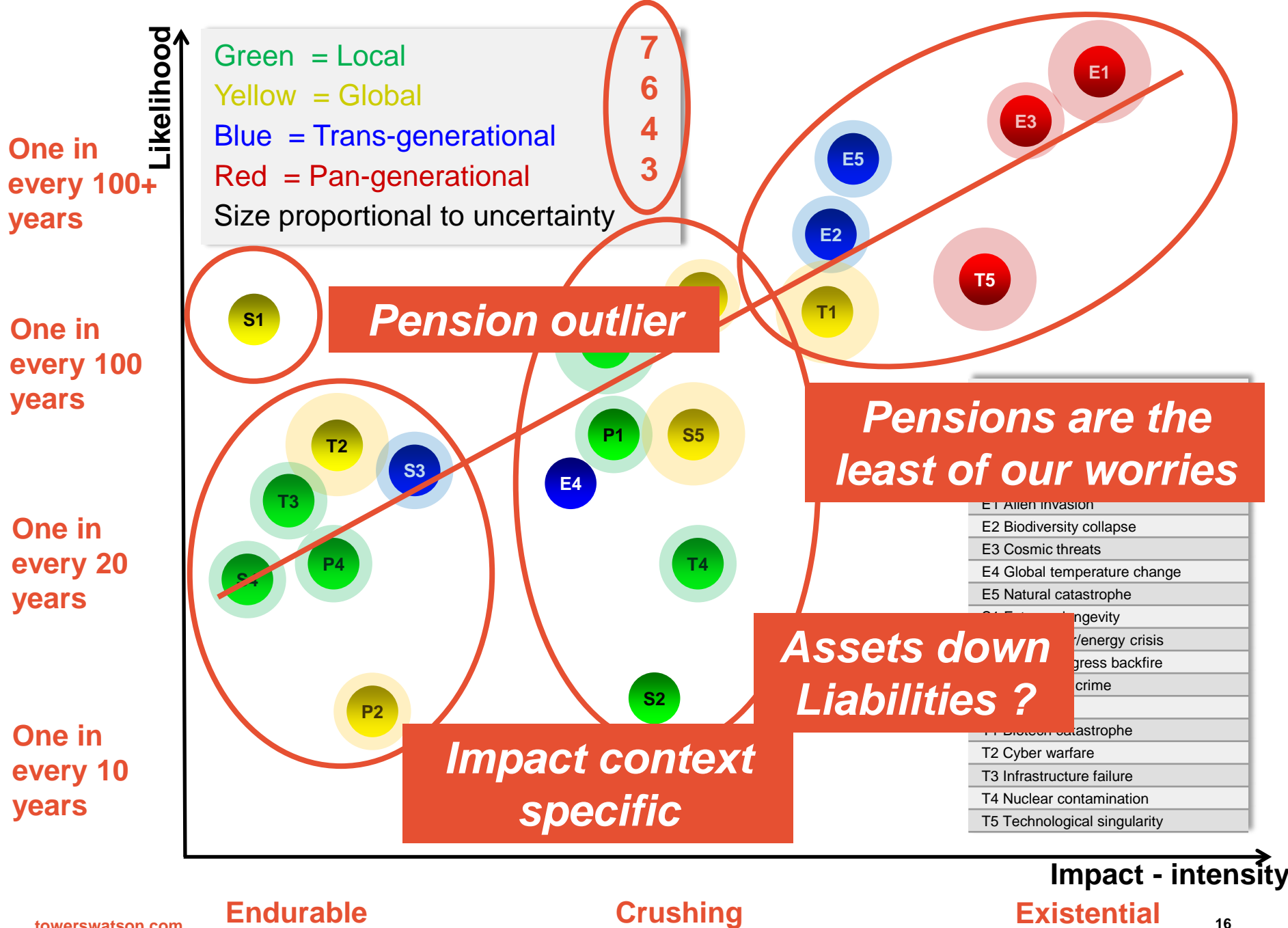


Technological extreme risks



Assessment

- Qualitative / deductive – influenced by evidence where available
 - Likelihood
 - Intensity of impact
 - Uncertainty
 - Scope of impact



Extreme risks ranking

1

**S2
Food/water/energy
crisis**

2

**E4 Global
temperature
change**

3

**P2 Global trade
collapse**

4

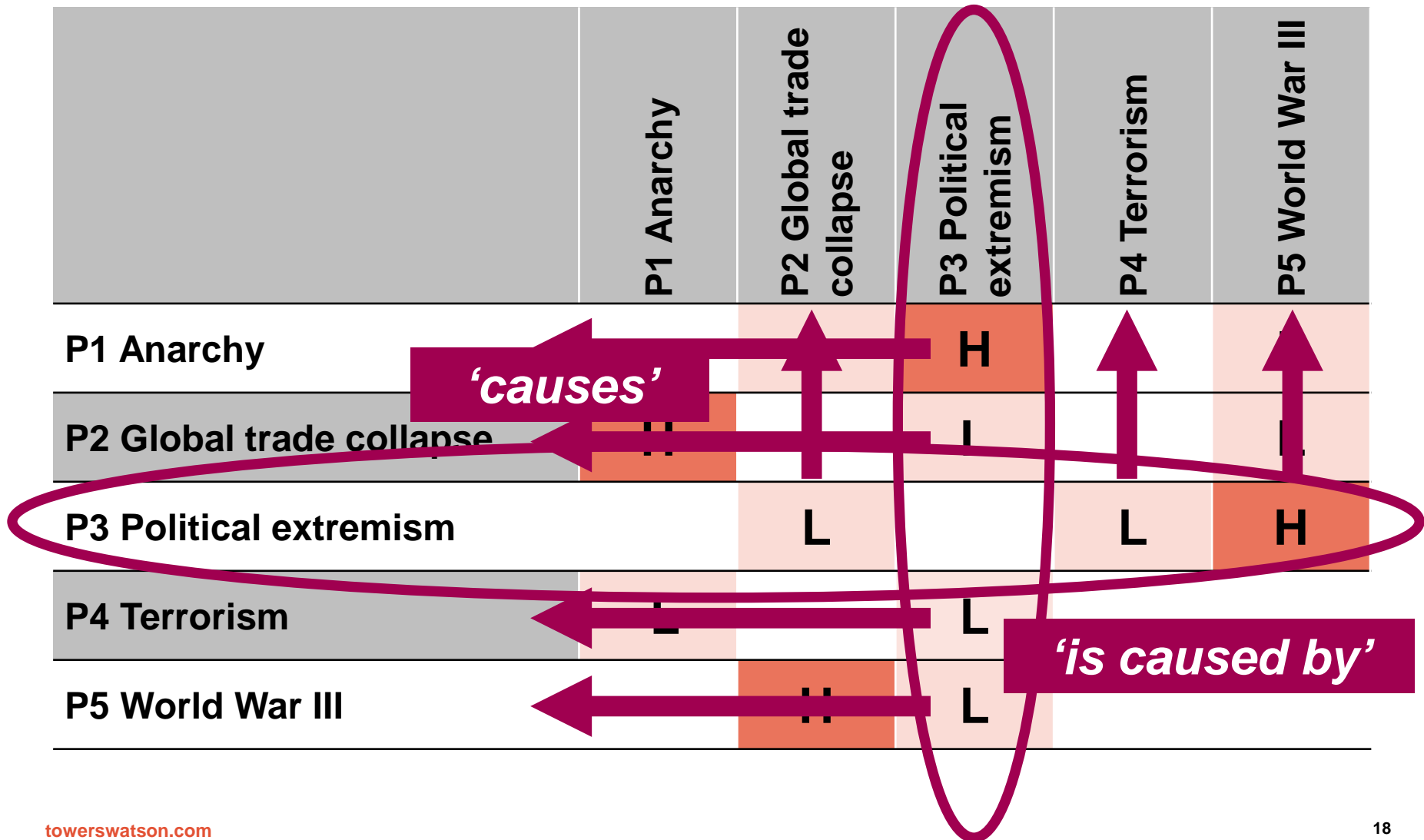
**S3 Health progress
backfire**

5

**T4 Nuclear
contamination**

Risk ranking as at February 2013

Association matrix (part of)



The retirement anomaly

- Global pension assets amount to **78%** GDP
- They need to be of the order of **235%** of GDP

Is it possible to increase the amount, without reducing the rate of return?

- Retirement will be rationed / expectations reduced

Implications for retirement

- Extreme risks pose a threat to retirement – quality and quantity
- Need better beliefs and risk management process
 - Time spent on “pre mortems”
 - Stress-testing or scenario planning
 - Selective hedging may be possible, but most non-economic risks are hard to hedge
 - Valuing the option-value of cash
 - Larger risk (capital) buffers

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