



COVID-19 ; Risk, Uncertainty, and Judgement

Tan Suee Chieh

**A Personal Narrative and Discussion with IFoA
Singapore and SAS**

8 April 2020

Structure

Risk

- People (p)
- Risk of mortality and morbidity (q)
- Transmission (T)
- Reproduction Rate (R_0)
- D.O.T.S & Attack Rate

Uncertainty

- Fat Tails
- Unknown Unknowns
- Societal Responses
- Fear & Madness of Crowds
- Suppression & Risk Mitigation

Judgement

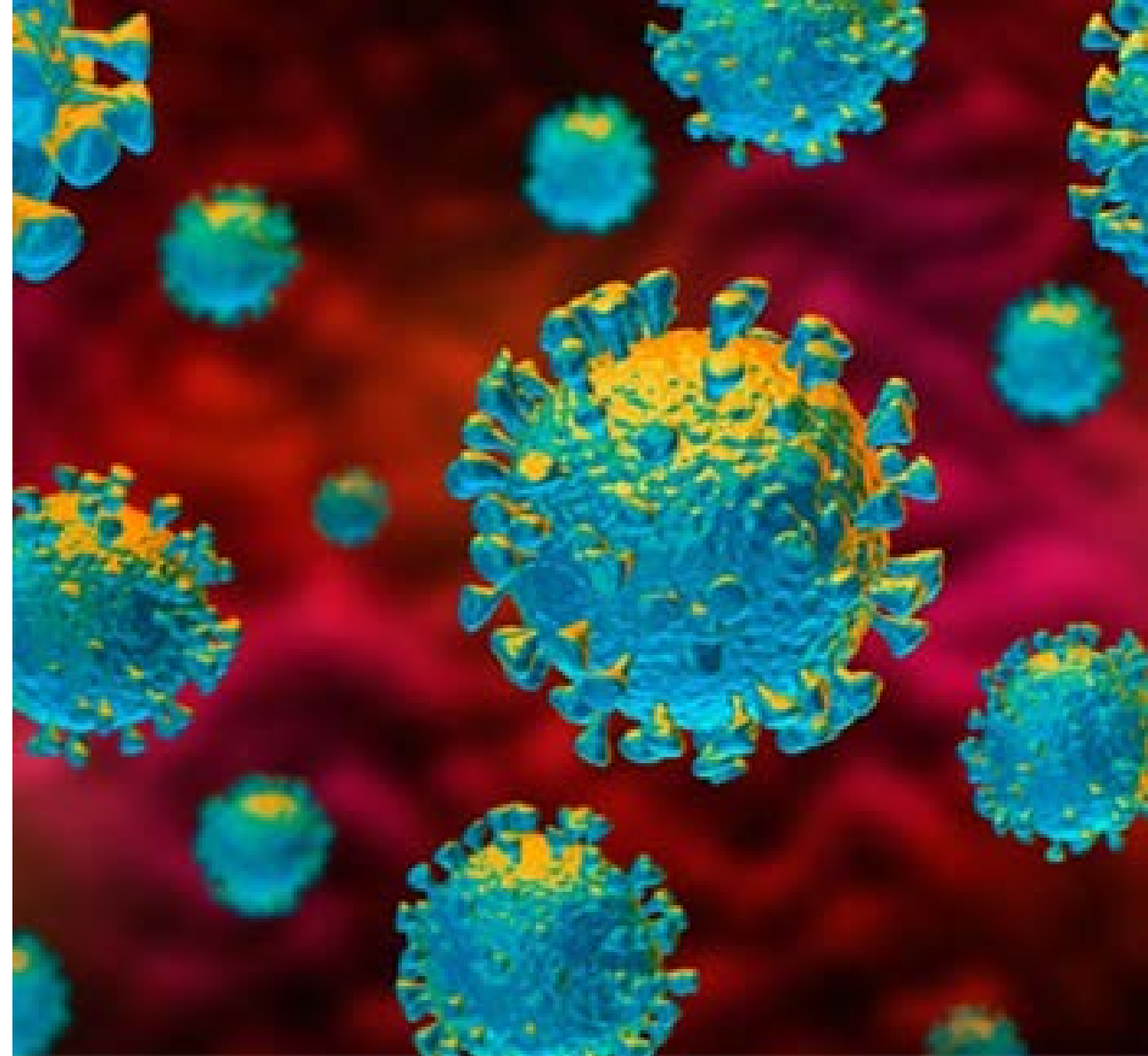
- Personality Types and Risk Preferences
- Culture and Governance Systems
- Top Down and Bottom Up
- Self Awareness and Reflection
- The Longer Term



Personal Narrative

The Second Wave – COVID-19

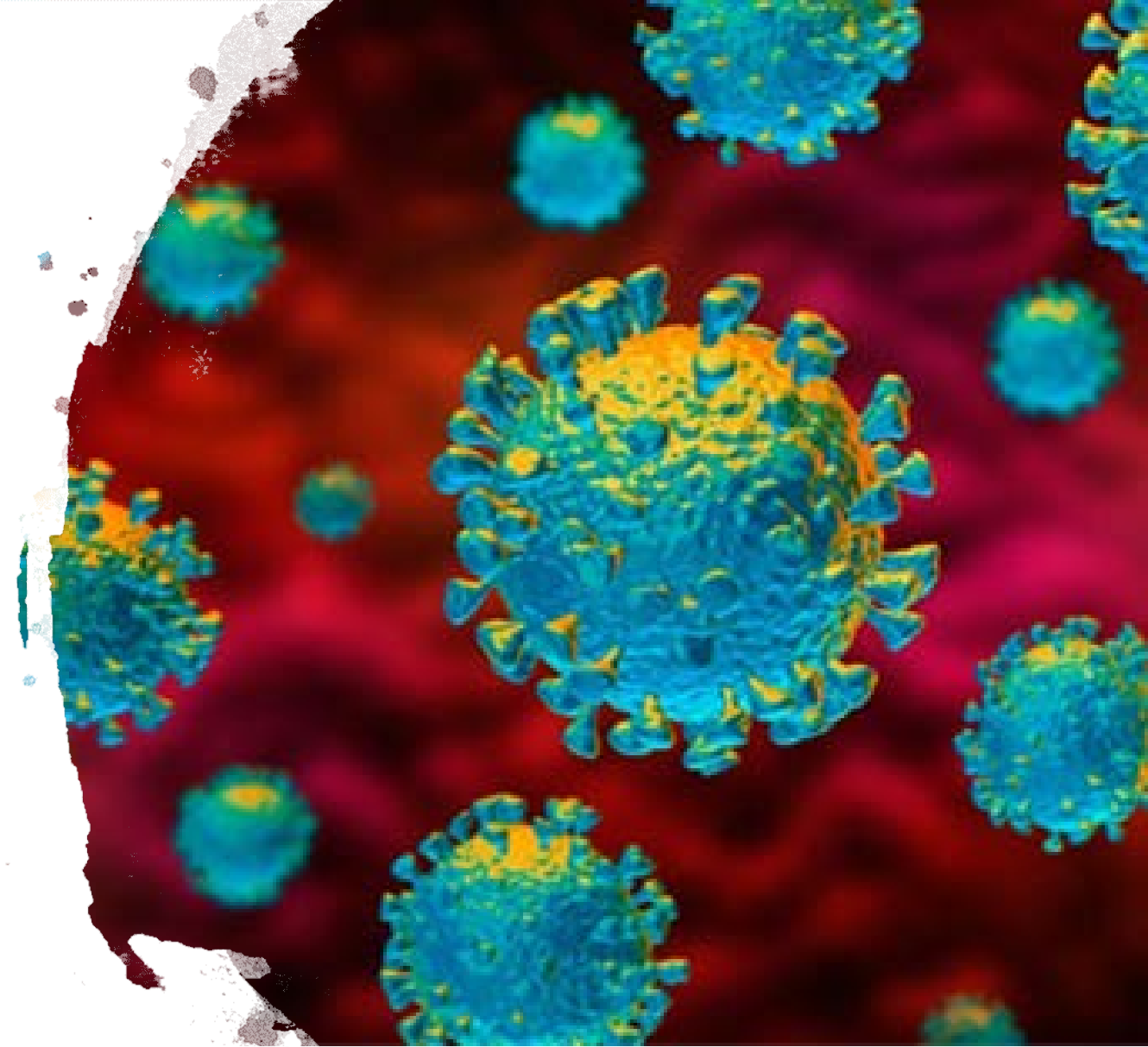
- **22 January** China lock down Hubei. Sharp rise in xenophobia in the West.
- **7 February** Singapore saw panic buying in the supermarkets following the arising of DORSCON to orange.
- **12 February** Economic activity and travel slowed down sharply across East Asia and now the epidemic has spread to Europe. The West is bracing for a sharp rise in panic and fear, as the media present asymmetric information negative and dramatic news.
- **26 February** Invitation to speak at ASM (SUSS and DBS)
- **7-8 March** Italy Lockdown on Lombardy and Italy. OPEC
- **9 March** Predicting 1 million Infections
- **11 March** Presentation at SUSS
- 11 March Trump bans all travel from 26 European countries.
- **12 March** Johnson speech to the nation



COVID-19 Coronavirus

The Third Wave - UK shuts down; and Singapore

- **16-30 March** Malaysia MCO –Ban on Events, Economic Stimulus, Panic Buying, Stay at Home
- **20-24 March** Johnson Shuts down UK
- **22 March** Launch of IFoA COVID-19 Actuaries Response Group
- **25-26 March** IFoA Online Exams
- **27-28 March** Numbers going up. Singapore Tightening of Suppression. Lifts and entertainment places.
- **9 to 31 March** Trump capitulation and false optimism
- **12 March** (Thursday)–
• Stock Markets - Bloodbath
- **3-7 April** Singapore



2019 Coronavirus

The Countries on Full Nationwide Lockdown

| Country | Date | Country | Date |
|----------------|---------------|--------------|----------|
| Italy | Since March 9 | Poland | March 20 |
| Norway | March 12 | Slovenia | March 20 |
| Denmark | March 13 | Rwanda | March 21 |
| Lebanon | March 15 | Bolivia | March 22 |
| Spain | March 15 | Iraq | March 22 |
| Czech Republic | March 16 | Tunisia | March 22 |
| France | March 16 | Greece | March 23 |
| Malaysia | March 18 | Colombia | March 24 |
| Belgium | March 17 | El Salvador | March 24 |
| Venezuela | March 17 | UK | March 24 |
| Argentina | March 20 | India | March 25 |
| Morocco | March 20 | New Zealand | March 25 |
| | | South Africa | March 26 |

12 March Trump Bans Europe entries. NBA cancelled matches. WHO declare pandemics

12 March Johnson and PM Lee Herd immunity speech

20 March Johnson closes pubs

26 March Olympics cancelled

27-28 March Singapore tightens further

7 April Singapore shuts down

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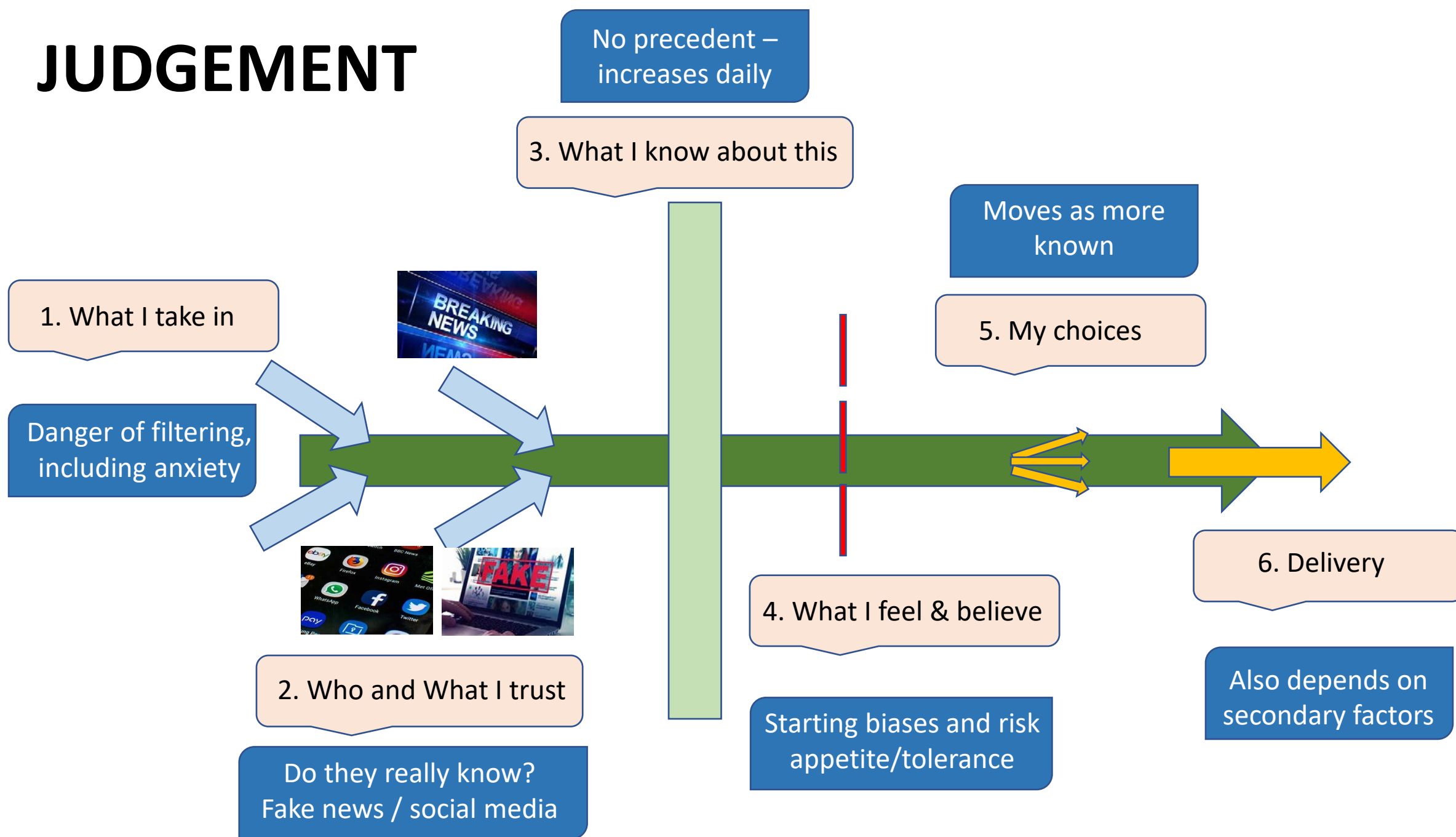
Judgement

- Personality Types and Risk Preferences
- Culture and Governance Systems
- Top Down and Bottom Up
- Self Awareness and Reflection
- The Longer Term

Judgement

- **Judgement ; when we do not and cannot know what to do**
- **Use of personal qualities, knowledge and experience, to make decision and opinions.**

JUDGEMENT



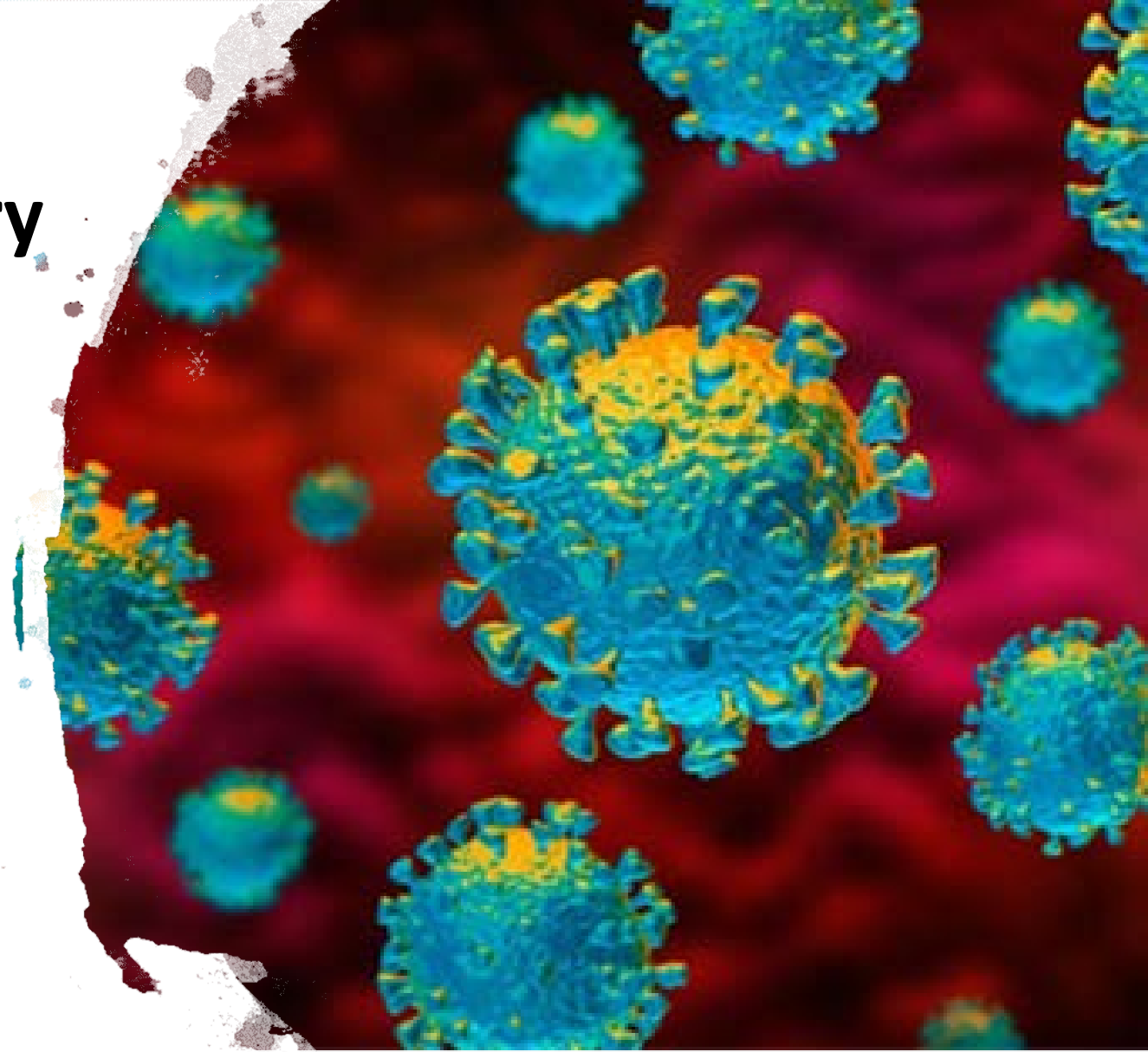


Risk

COVID-19 Risk In Summary

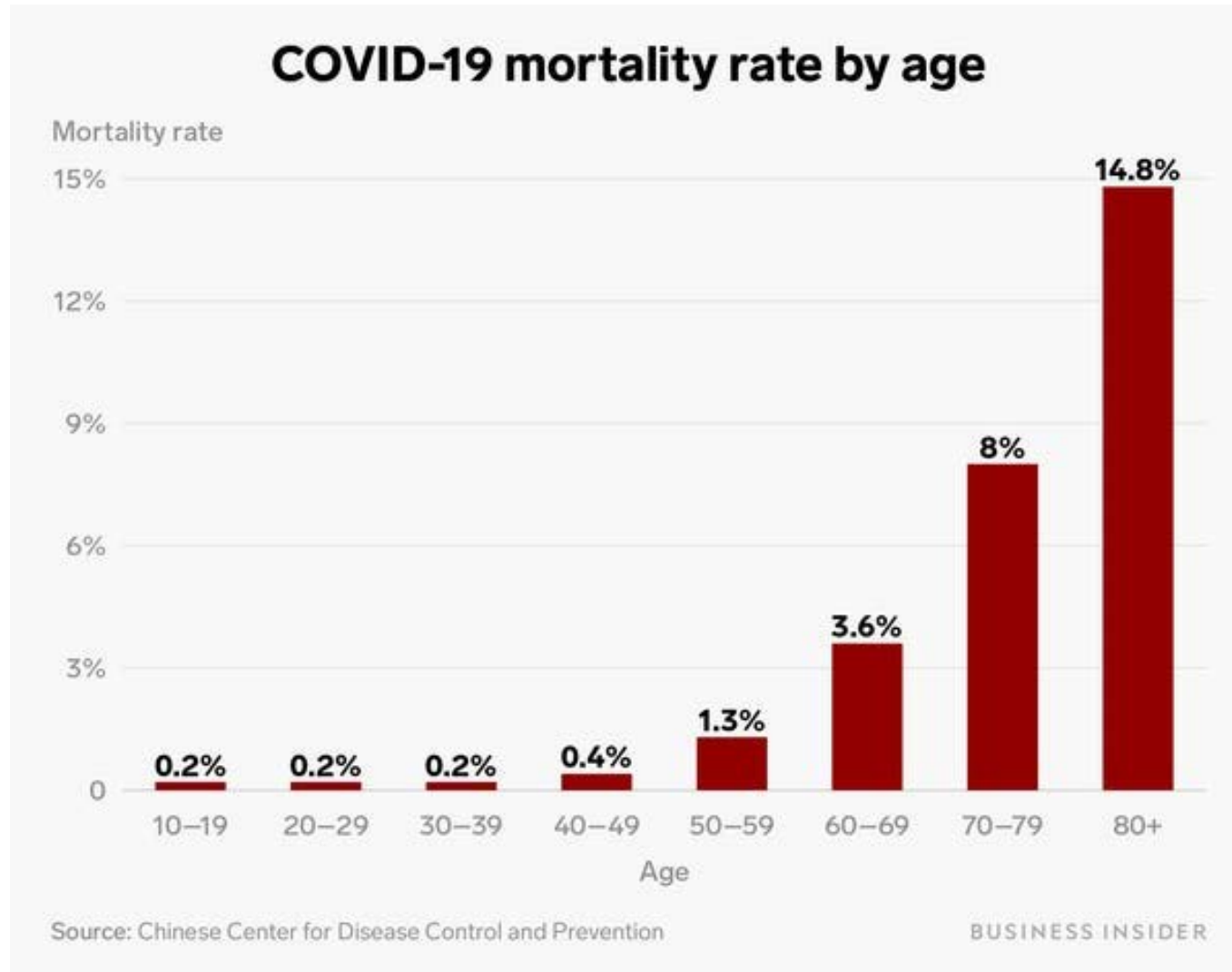
- Bottom Up

- Risk of mortality low
- Majority of infections are mild
- The bulk of people recover
- Most at risk are people above age 65
- Especially those with pre-existing conditions
- ~~Compared to other diseases, the number of deaths are still low~~
- Fatality rate varies by country



COVID-19 Coronavirus

Risk of Mortality



Worldometer 2020

Risk Based Approach

For comparison, mortality rates of Singaporean males are:

Age 60 – 0.686%

Age 65 – 1.076%

Age 70 – 1.842%

Age 75 – 3.034%

Age 80 – 5.172%



2018 Life table
Singapore Dept of Statistics

Risk of Morbidity and Severity

- **80.9%** of infections are mild and can recover at home.
- **13.8%** are severe, developing severe diseases including pneumonia and shortness of breath.
- **4.7%** as critical and can include: respiratory failure, septic shock, and multi-organ failure.
- in about **2%** of reported cases the virus is fatal.

Risk of death increases the older you are.

Relatively few cases are seen among children.

Mortality by Co-Morbidity (as at 3 March 2020)

| PRE-EXISTING CONDITION | DEATH RATE confirmed cases* | DEATH RATE all cases # |
|-----------------------------|--------------------------------|---------------------------|
| Cardiovascular disease | 13.2% | 10.5% |
| Diabetes | 9.2% | 7.3% |
| Chronic respiratory disease | 8.0% | 6.3% |
| Hypertension | 8.4% | 6.0% |
| Cancer | 7.6% | 5.6% |
| no pre-existing conditions | | 0.9% |

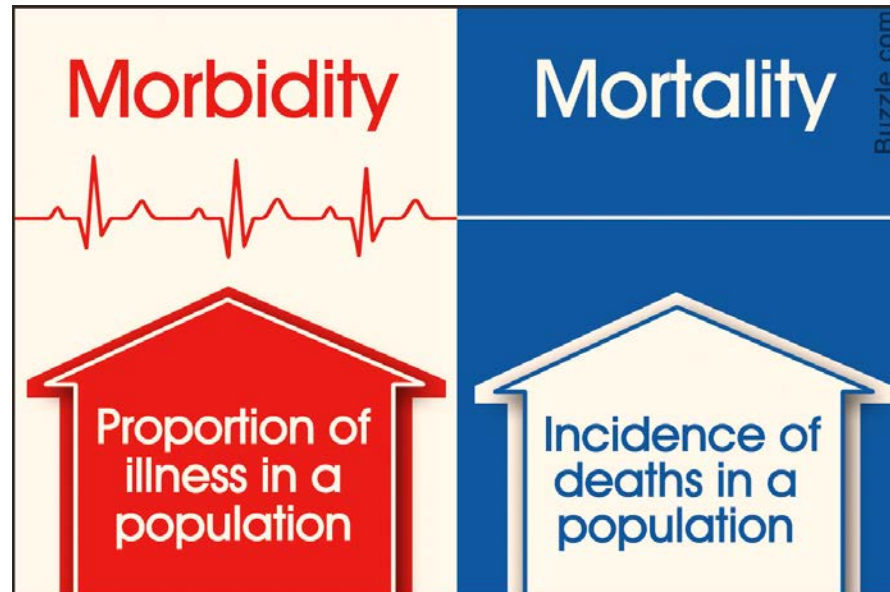
WHO and CDC China

The percentages do not have to add up to 100%, as they do NOT represent share of deaths by condition * laboratory confirmed # incl. suspected or asymptomatic cases

Risk of Mortality and Morbidity

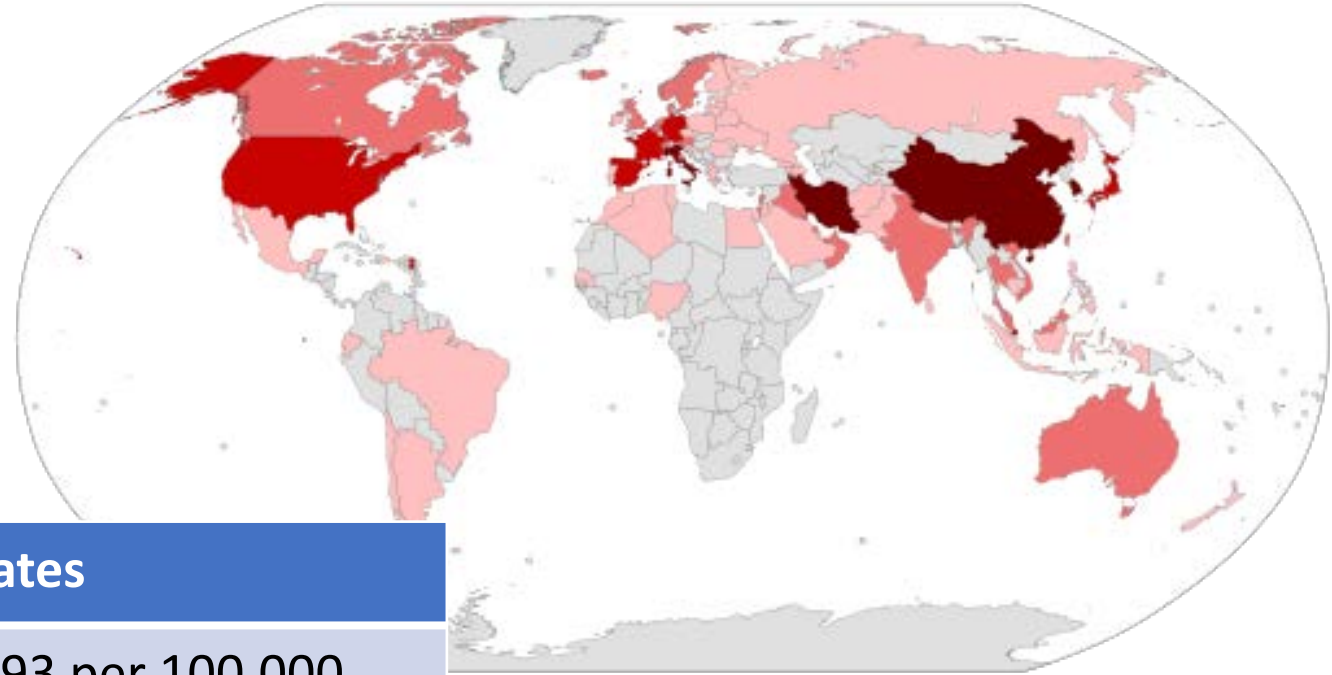
Risk of morbidity = People (O) x Prob of Transmission (T) x Risk of morbidity (i_x)

Risk of death = People (O) x Prob of Transmission (T) x Risk of (q_x)



Data on Countries

Number of infections as of 4 March 2020

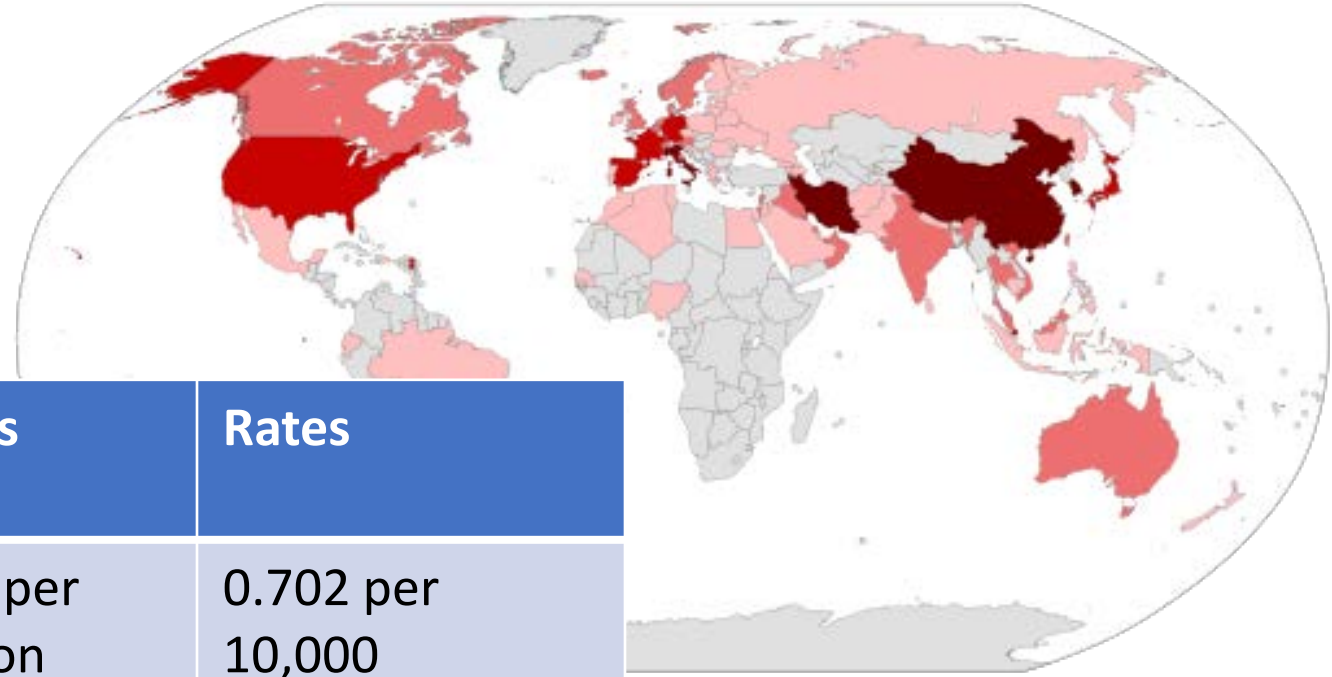


| Countries | Infection | Population | Rates |
|-----------|-----------|---------------|--------------------|
| Singapore | 110 | 5,700,000 | 1.93 per 100,000 |
| Hong Kong | 101 | 7,210,000 | 1.4 per 100,000 |
| India | 22 | 1,444,000,000 | 0.02 per 1,000,000 |
| China | 80,270 | 1,435,000,000 | 5.59 per 100,000 |
| World | 93,186 | 7,700,000,000 | 1.21 per 100,000 |









Worldometer and Wikipedia

Data on Countries

Number of infections as of 25 March 2020



| Countries | Active Cases | Population | Rates | Rates |
|----------------|--------------|---------------|--------------------|-------------------|
| Singapore | 400 | 5,700,000 | 70.2 per million | 0.702 per 10,000 |
| Malaysia | 1,425 | 31,620,000 | 45.06 per million | 0.451 per 10,000 |
| United Kingdom | 7,520 | 66,870,000 | 112.45 per million | 1.1245 per 10,000 |
| China | 80,270 | 1,435,000,000 | 55.9 per million | 0.559 per 10,000 |
| World | 294,855 | 7,700,000,000 | 38.3 per million | 0.383 per 10,000 |

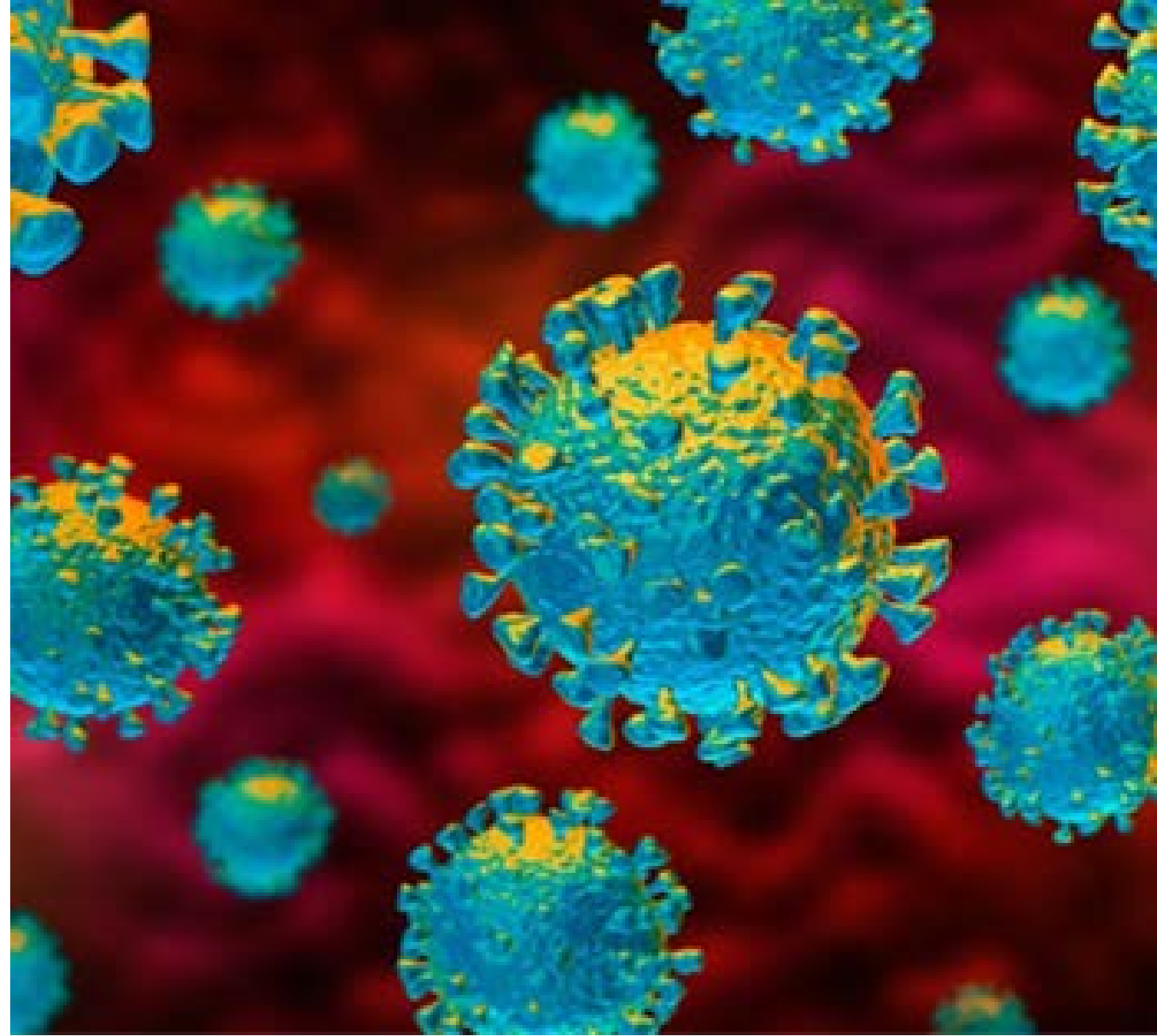
| COMPLIMENTARY 2019 CORONAVIRUS INSURANCE COVERAGE | | | | |
|---|---|---|--|--|
|  |  中国太平 CHINA TAIPING |  中国平安 360° |  DBS |  |
| \$200/DAY (HOSPITALISATION) \$20,000 (DEATH) | \$100/DAY (HOSPITALISATION) \$10,000 (DEATH) | \$130/DAY (HOSPITALISATION) \$80,000 (DEATH) | \$100/DAY (HOSPITALISATION) \$1,000 (ICU) | \$100/DAY (HOSPITALISATION) \$50,000 (DEATH) |
|  HSBC Insurance |  Manulife |  income INSURANCE COMPANY |  PRUDENTIAL |  TOKAI INSURANCE |
| \$200/DAY (HOSPITALISATION) \$10,000 (DEATH) | \$2,000 (HOSPITALISATION) \$30,000 (DEATH) | \$100/DAY (HOSPITALISATION) \$10,000 (DEATH) | \$200/DAY (HOSPITALISATION) \$500 (QUARANTINE) | \$5,000 (DIAGNOSIS) |
| MORE INFORMATION IN THE ARTICLE | | | | |

 Seed

Insurance
Companies
(end Feb
2020)

COVID-19 Risk In Summary - Bottom Up

- Risk of mortality low
- Majority of infections are mild
- The bulk of people recover
- Most at risk are people above age 65
- Especially those with pre-existing conditions
- ~~Compared to other diseases, the number of deaths are still low~~
- Fatality rate varies by country



COVID-19 Coronavirus

WHO, MoH and Medical Authorities

Reduce your risk of **coronavirus** infection:



Clean hands with soap and water
or alcohol-based hand rub

Cover nose and mouth when coughing and
sneezing with tissue or flexed elbow



Avoid close contact with anyone with
cold or flu-like symptoms

Thoroughly cook meat and eggs



No unprotected contact with live wild
or farm animals



World Health
Organization



R_0 and D.O.T.S

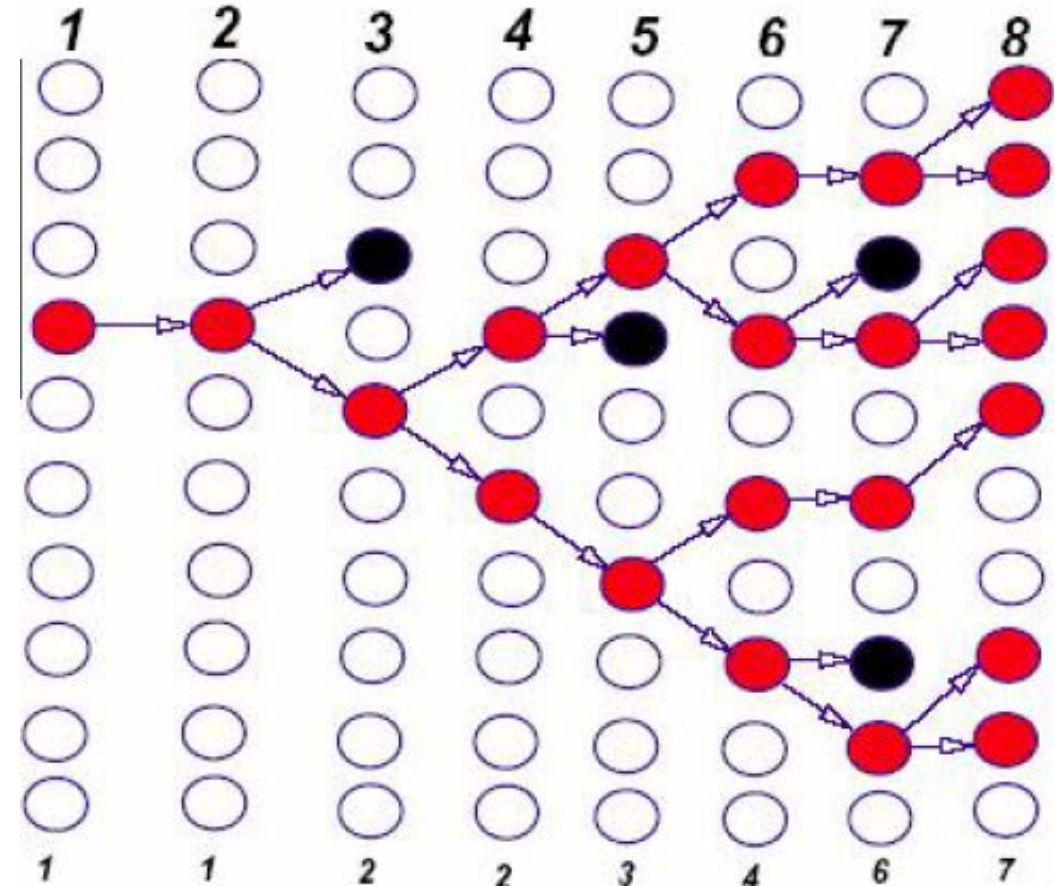
Reproductive Rate R_0

Reproductive Rate R a function of

- *Duration (D)*
- *Opportunity to Infect (O)*
- *Probability of Transmission (T)*
- *Susceptibility (S)*

D. O. T. S.

Chains of transmission between hosts



Important Parameters

REPRODUCTION RATE (R_0)

(estimated range)

2 – 4

(average number of people to which a single infected person will transmit the virus)

FATALITY RATE (CFR)

(WHO EARLY estimate)

2% (?)

(a precise estimate of the case fatality rate is therefore impossible at present)

INCUBATION PERIOD

(estimated)

2 – 14 days

(possible outliers: 0 – 27 days)

COUNTRIES AND TERRITORIES

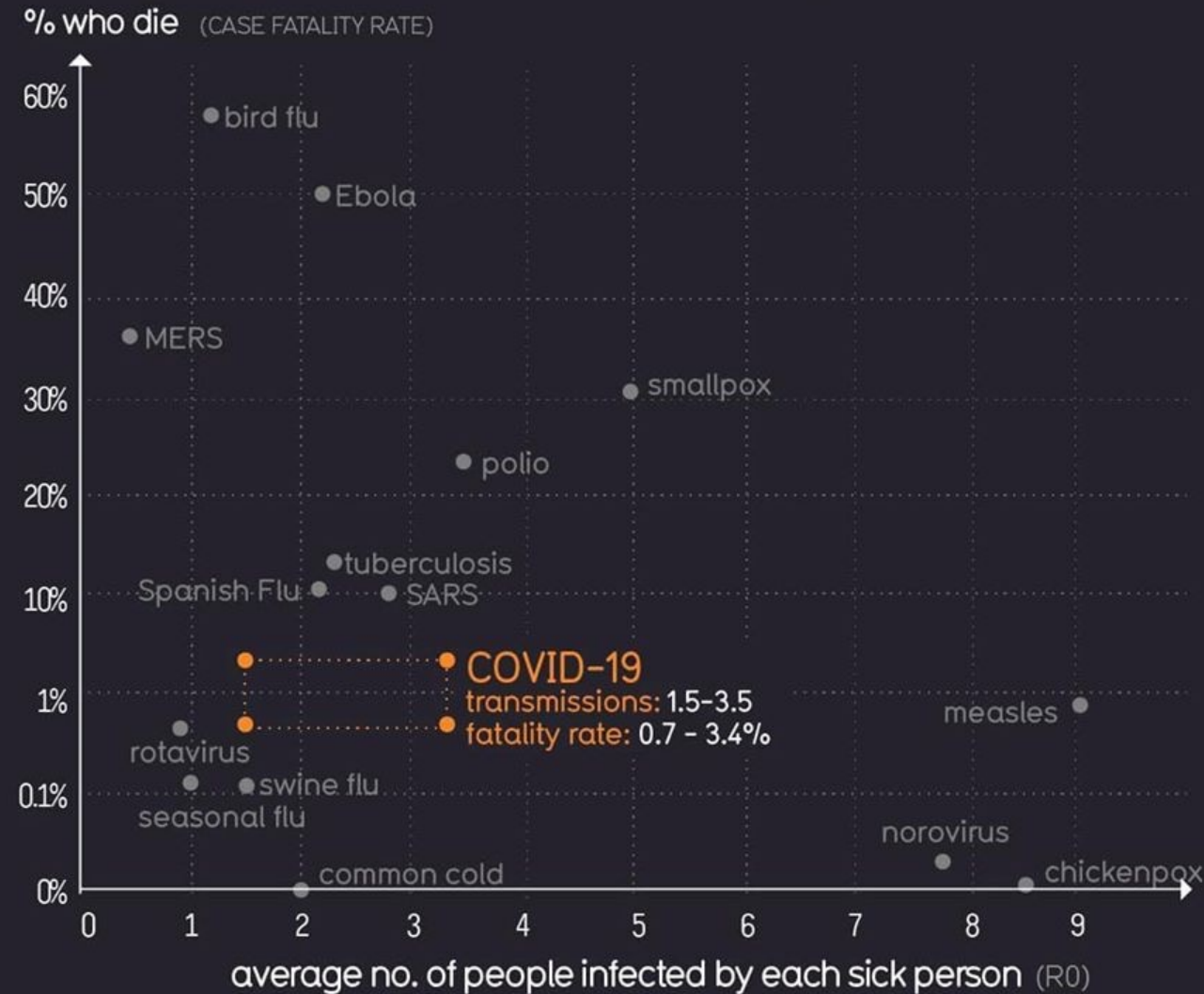
(affected by COVID-19)

80

(expected to increase)

How Contagious & Deadly is It?

We don't fully know yet but it's in **this range**



sources: Centres for Disease Control, WHO, New York Times

Tan Chuan Jin
10 March 2020

FB Linked-in Posting – Getting R0 Down 7 March

Getting to 1 million infections within the next month.

Two parameters drive the COVID-19 spread. Assume $R_0 = 2$. $N = 6$ days. If $R_0 = 2$, then the 3rd generation will have 2^3 infected i.e. 8 persons, and the 4th generation will have 2^4 infections i.e. 16 persons.

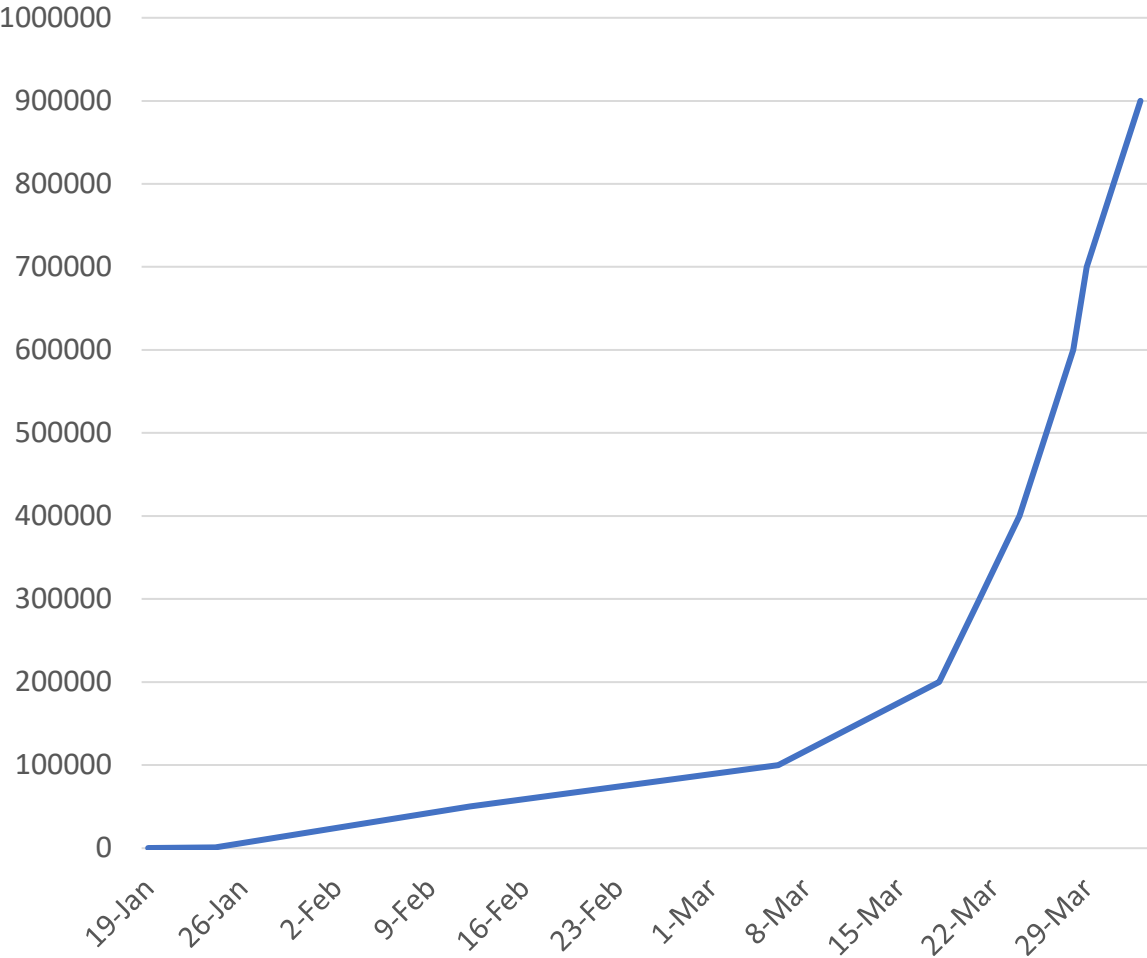
So, infections will be 10 times between the 3rd and 4th interval, i.e. between 18 and 24 days.

On January 22, there were 580 infections, at the end of 45 days on 6 March, 102,000 cases.

$(102,000/580)^{(1/45)}$ is a growth rate of 1.12. **In 21 days from having 102,000 you would expect to have $102,000 * 1.12^{21}$ cases, or 1.1 million.** In 30 days, there would be over 3 million!

Actual epidemiological modelling suggest that we will hit a million in April.

Cases will double in 3 – 4 cycles



| Date | Cases |
|-------------|-----------|
| 19 January | 100 |
| 24 January | 1,000 |
| 12 February | 50,000 |
| 6 March | 100,000 |
| 18 March | 200,000 |
| 21 March | 300,000 |
| 24 March | 400,000 |
| 26 March | 500,000 |
| 28 March | 600,000 |
| 29 March | 700,000 |
| 31 March | 800,000 |
| 1 April | 900,000 |
| 2 April | 1,100,000 |

The Attack Rate

$$\text{Attack Rate} = 1 - 1/R_0$$

If R_0 is 2.5, Attack rate is 60%



Uncertainty

Epicentre Moves to Italy

Risk and Uncertainty

In **risk** you can predict the possibility of a future outcome, while in **uncertainty** you cannot.

Risks can be managed while **uncertainty** is uncontrollable. **Risks** can be measured and quantified while **uncertainty** cannot.

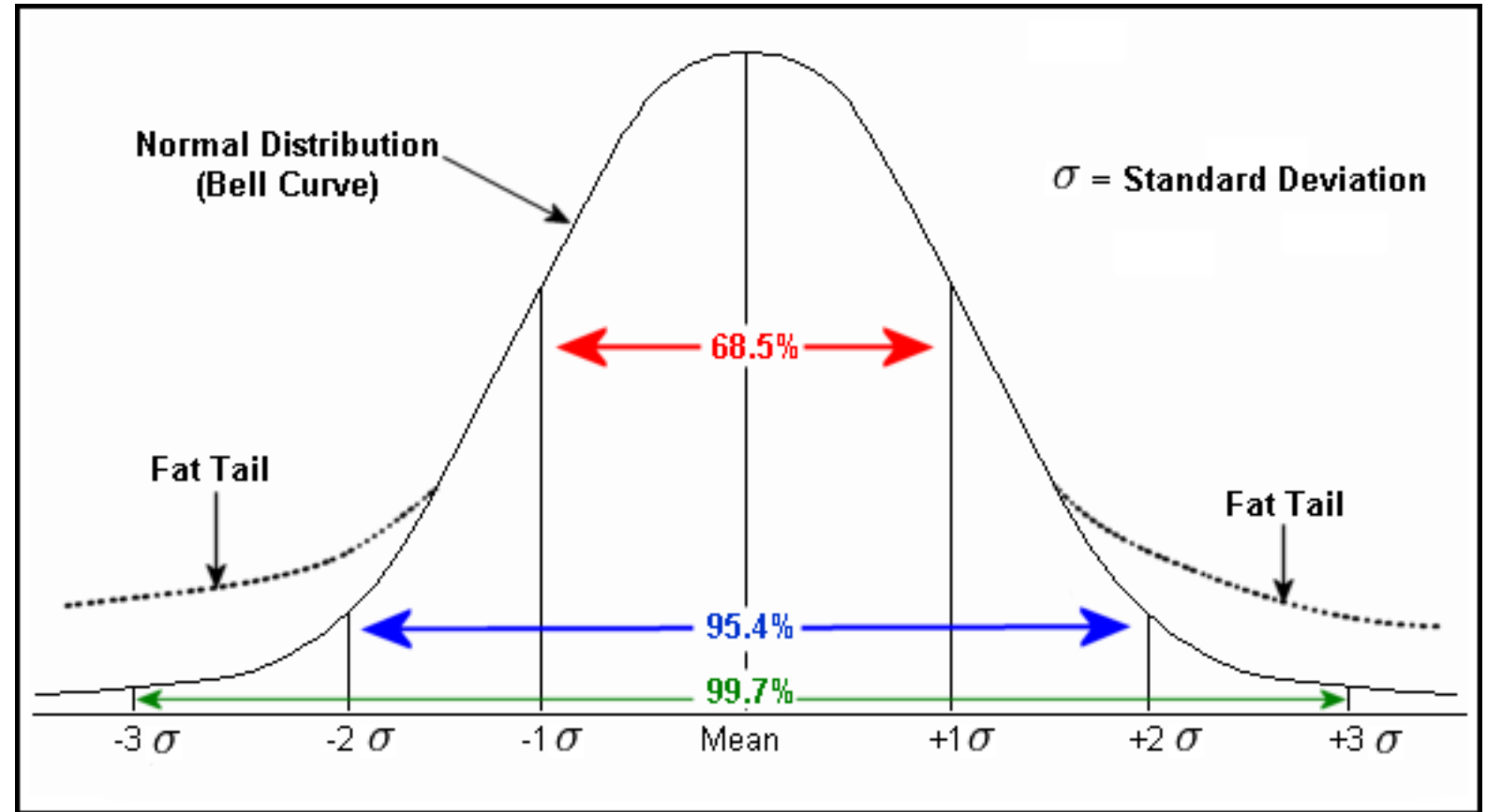
Unknown Unknowns

- Infection (p) –concern about asymptomatic carriers
- Reproduction Rates (R_0) [estimated 2 – 4]
- Survival of virus on surfaces
- Vaccines and Weather Conditions

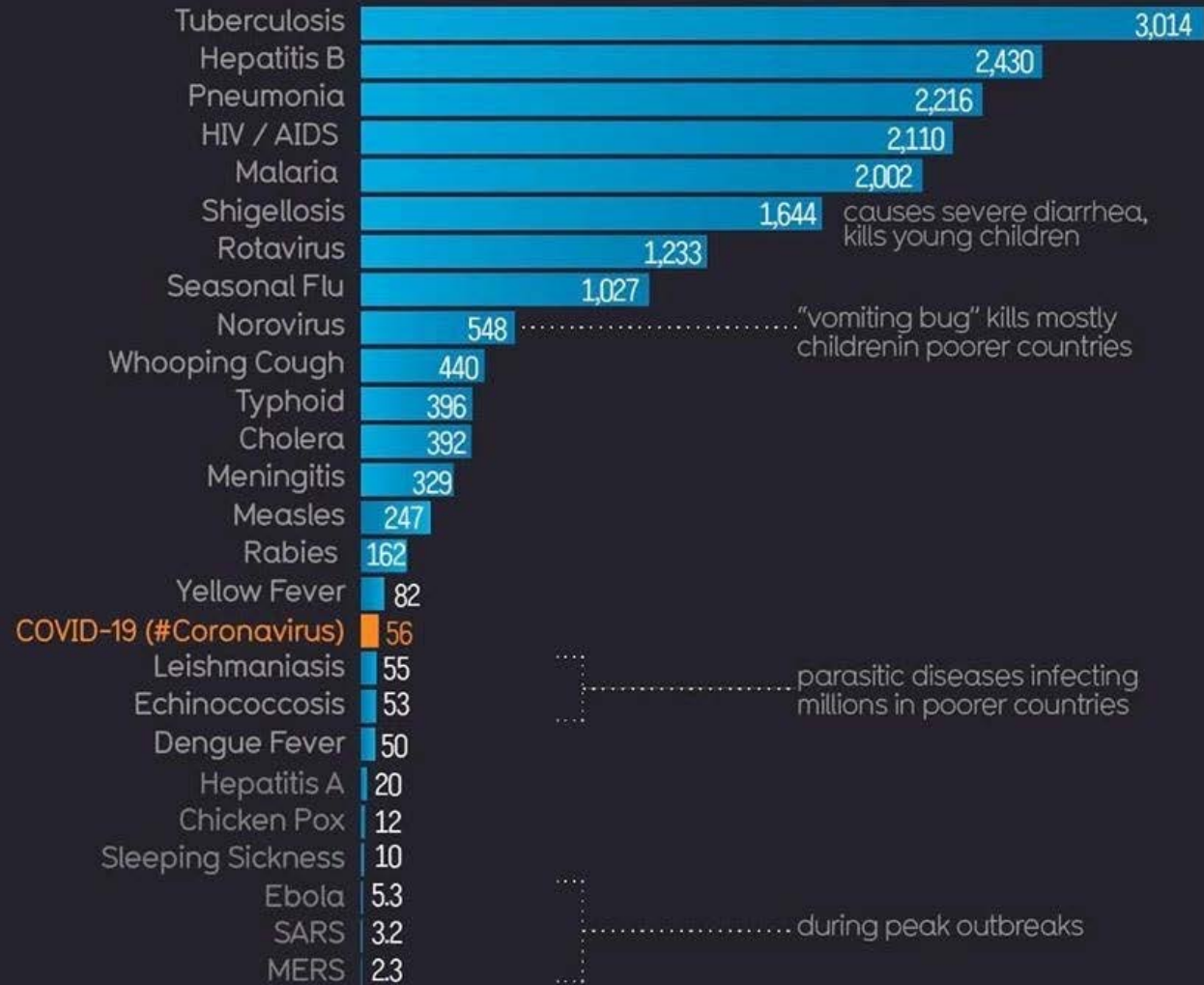


Uncertainty and Fat Tails

- We are dealing with an extreme fat-tailed process owing to an increased connectivity, which increases the spreading in a nonlinear way
- Fat tailed processes have special attributes, making conventional risk-management approaches inadequate



Disease Deaths per Day Worldwide



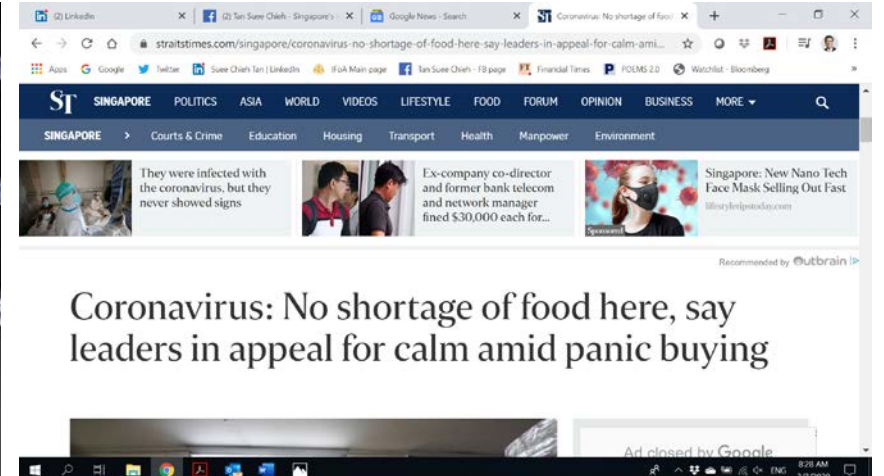
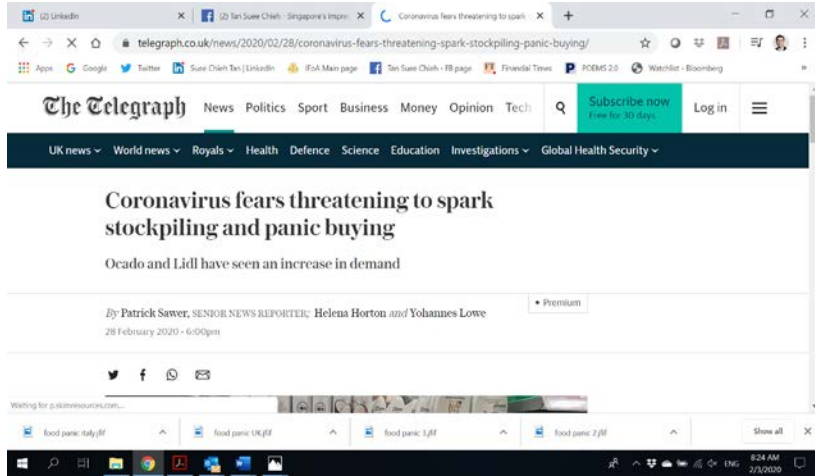
sources: Centres for Disease Control, WHO, The Lancet

Tan Chuan Jin
10 March 2020



Societal Responses

Societal Responses and Food Panic (after 7 Feb 2020)

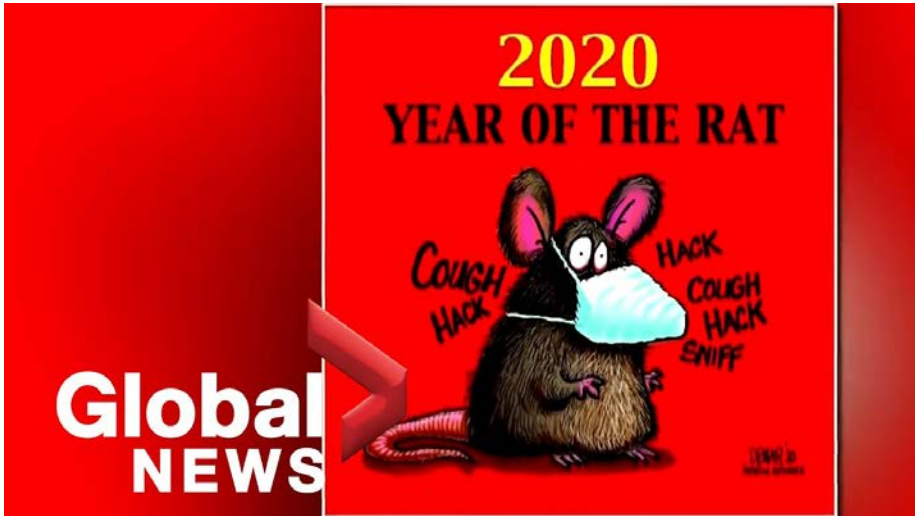


COVID-19 Racist Attack in London (Mar 2020)

A Singaporean student in London said he was assaulted after he reacted to passers-by who were making comments about his race and COVID-19.



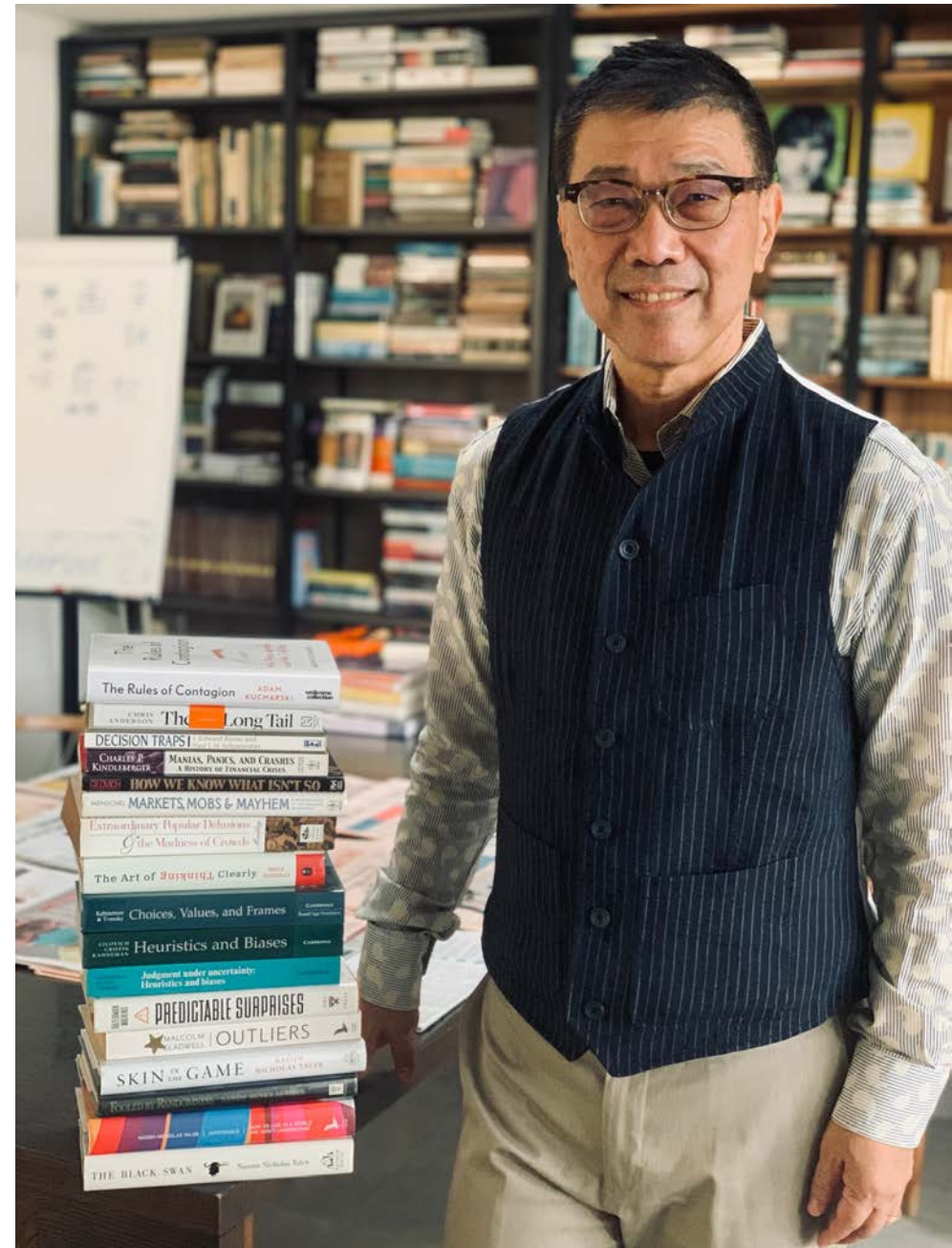
Xenophobia and Media Response (end Feb 2020)



Second Wave in the UK and US (end Feb 2020)



Behavioural Psychology





COVID-19 Actuaries Response Group 10 March

The screenshot shows a web browser window with multiple tabs open, including 'Coronavirus Update (Live)', 'COVID-19 Actuaries Response Group', and 'Tan Suee Chieh'. The main content is the LinkedIn profile of the 'COVID-19 Actuaries Response Group'. The profile banner features a space-themed image with the text 'COVID-19 Actuaries Response Group'. The profile picture is a circular logo with 'C19' and 'Actuaries Action Group'. The group is located in 'Financial Services · London' and has '586 followers'. The description states: 'To help actuaries in understanding and responding to the COVID-19 crisis. Learn. Share. Educate. Influence.' Below the description, there are tabs for 'Home', 'About', 'Jobs', and 'People'. The 'Home' tab is selected, showing a post from the group. The post is titled 'COVID-19 Actuaries Response Group' and mentions '586 followers' and '10h · Edited'. The text of the post reads: 'This LBS presentation is a comprehensive introduction to the COVID-19 crisis covering scientific and epidemiological aspects, and economic consequences. It discusses contagion patterns in various parts of the world taking into acc ...see more'. To the right of the post, there is an advertisement for 'Great Eastern' featuring a photo of Tan Suee Chieh. At the bottom of the browser window, the Windows taskbar is visible, showing the search bar and various application icons. The system clock indicates '10:59 AM 26/3/2020'.

Coronavirus Update (Live): 471,031 x COVID-19 Actuaries Response Group x (4) Tan Suee Chieh x Search | London Business School x andrew likierman lbs "slides" part x

linkedin.com/company/covid-19-actuaries-response-group/?viewAsMember=true

Apps Google Twitter IFoA Main page Suee Chieh Tan | LinkedIn Tan Suee Chieh - FB page Financial Times POEMS 2.0 Watchlist - Bloomberg YouTube Personal Study@INSEAD

Search

Home My Network Jobs Messaging Notifications Me Work Learning

COVID-19
Actuaries Response Group

C19
Actuaries Action Group

COVID-19 Actuaries Response Group
Financial Services · London · 586 followers

✓ Following ...

To help actuaries in understanding and responding to the COVID-19 crisis. Learn. Share. Educate. Influence.

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COVID-19 Actuaries Response Group
586 followers
10h · Edited ·

This LBS presentation is a comprehensive introduction to the COVID-19 crisis covering scientific and epidemiological aspects, and economic consequences. It discusses contagion patterns in various parts of the world taking into acc ...see more

Tan Suee Chieh
Great Eastern

Messaging

Type here to search

10:59 AM 26/3/2020



Implications of Johnson's Speech and the Imperial College Model

- Case isolation in the home - CI
- Voluntary home quarantine - HQ
- Social distancing of those over 70 years of age - SDO
- Social distancing of entire population - SD
- Closure of schools and universities - PC

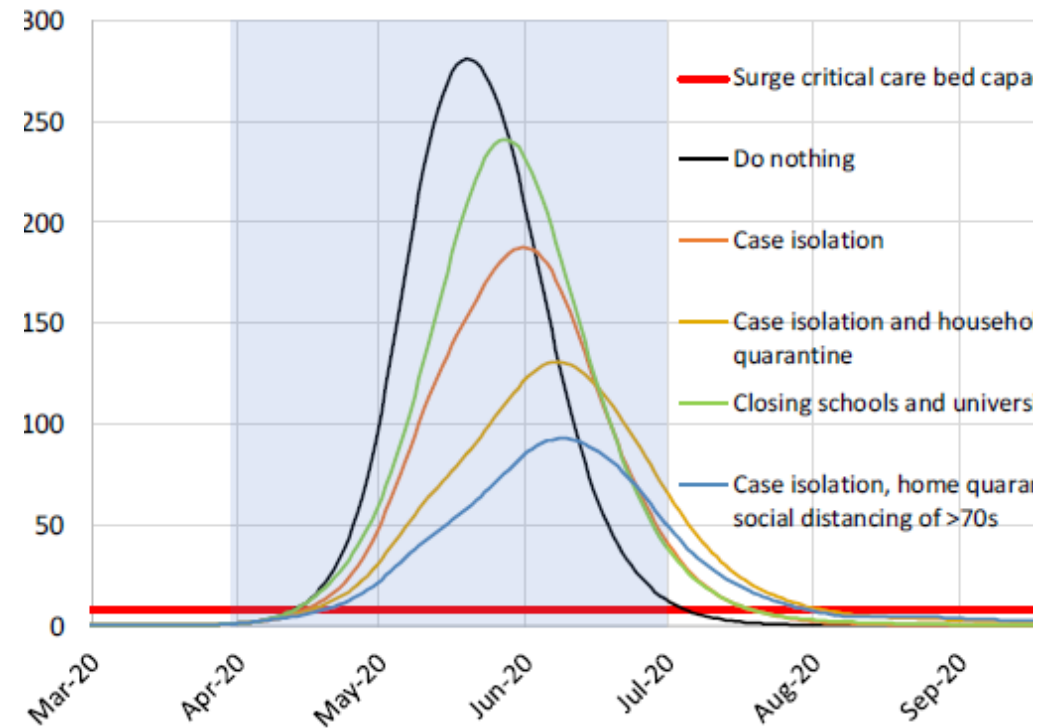
12 to 20 March 2020

Implications of Exeter Model (Early march)

- Peak from 74 to 241 days.
- 'Best-guess' was 133 days from of person to person transmission within the UK 1-March – takes us to July.
- They estimate an attack rate of 82%.
- The peak number of new cases over 1 million people per day .
- Fortunately, seasonality to the transmission
- A 50% due to summer would reduce the attack rate to 70%, and the peak incidence would fall to 330, 000 new cases per day.

Mitigation

- Figure 2: Mitigation strategy scenarios for GB showing critical care (ICU) bed requirements. The black line shows the unmitigated epidemic. The green line shows a mitigation strategy incorporating closure of schools and universities; orange line shows case isolation; yellow line shows case isolation and household quarantine; and the blue line shows case isolation, home quarantine and social distancing of those aged over 70. The blue shading shows the 3-month period in which these interventions are assumed to remain in place.



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COVID -19 and Judgement



- How can we best behave?
- What is truth?
- What is rational ?
- The limits of models and logic
- The usefulness of emotion
- Self Awareness
- Navigating across Paradigms
- Top down and bottom up approaches

How do we extract signal from the noise?

PERSONAL QUALITIES

A word cloud of personal qualities. The word 'Judgement' is the largest and is written in red, slanted text, positioned in the center. Surrounding it are various other qualities in blue text, including 'Intelligence', 'Common sense', 'Character', 'Insight/Self-awareness', 'Emotional Intelligence', 'Experience', 'Risk assessment', 'Discernment', 'Wisdom', 'Perceptiveness', 'Gut feel', 'Reason', 'Acumen', and 'Intuition'. The words are arranged in a circular pattern around the central 'Judgement' word.

Intuition

Common sense

Reason

Intelligence

Character

Gut feel

Judgement

Insight/Self-awareness

Perceptiveness

Emotional Intelligence

Acumen

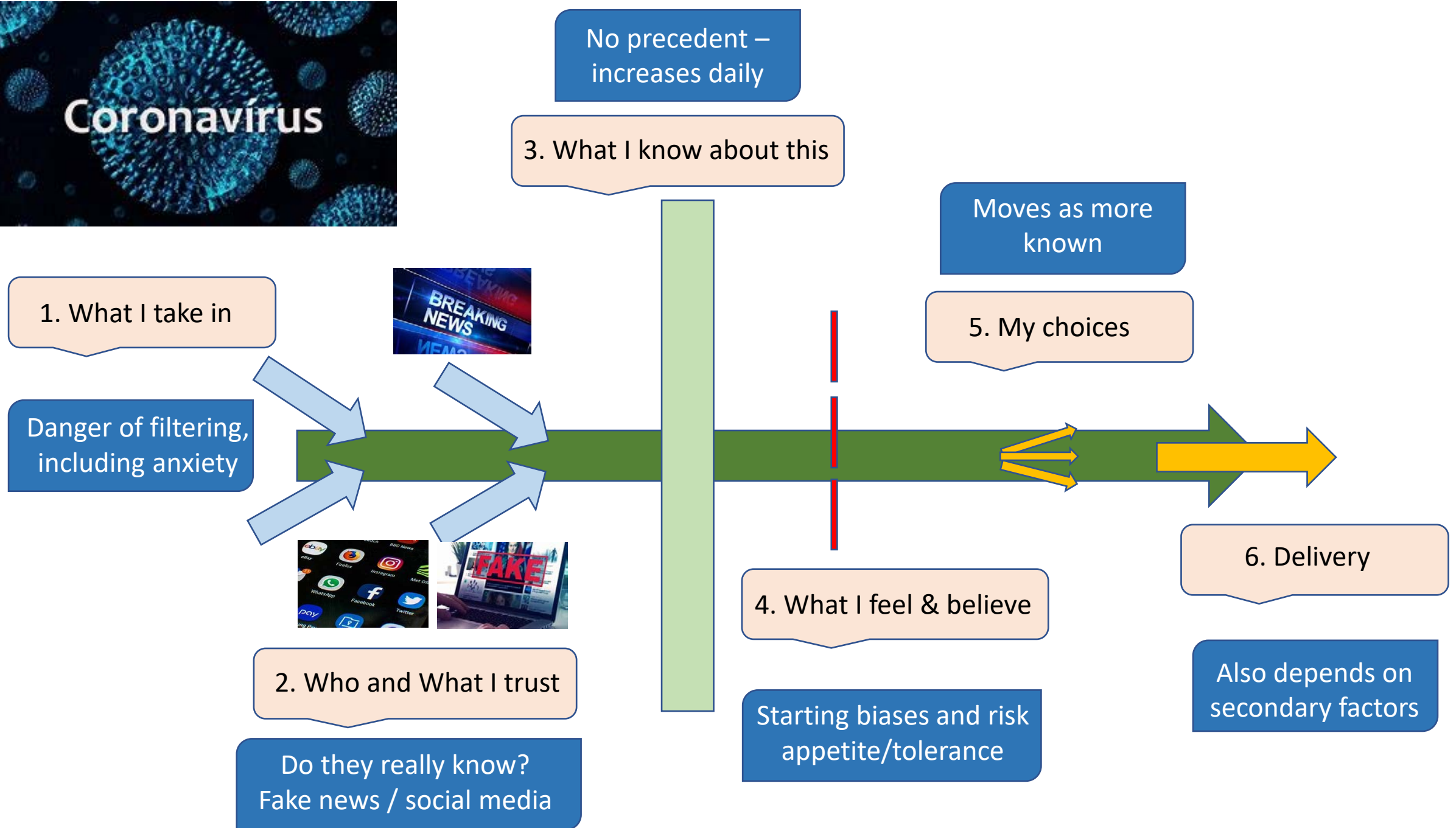
Experience

Wisdom

Discernment

Risk assessment

Coronavirus



SOME BIASES*

Recency

Loss aversion

Small numbers

Analogy

Sunflower

Status quo

Endowment

Systematic optimism or pessimism

Anchoring

Randomness

Confirmation

Overconfidence

Representative

Compromise

Availability

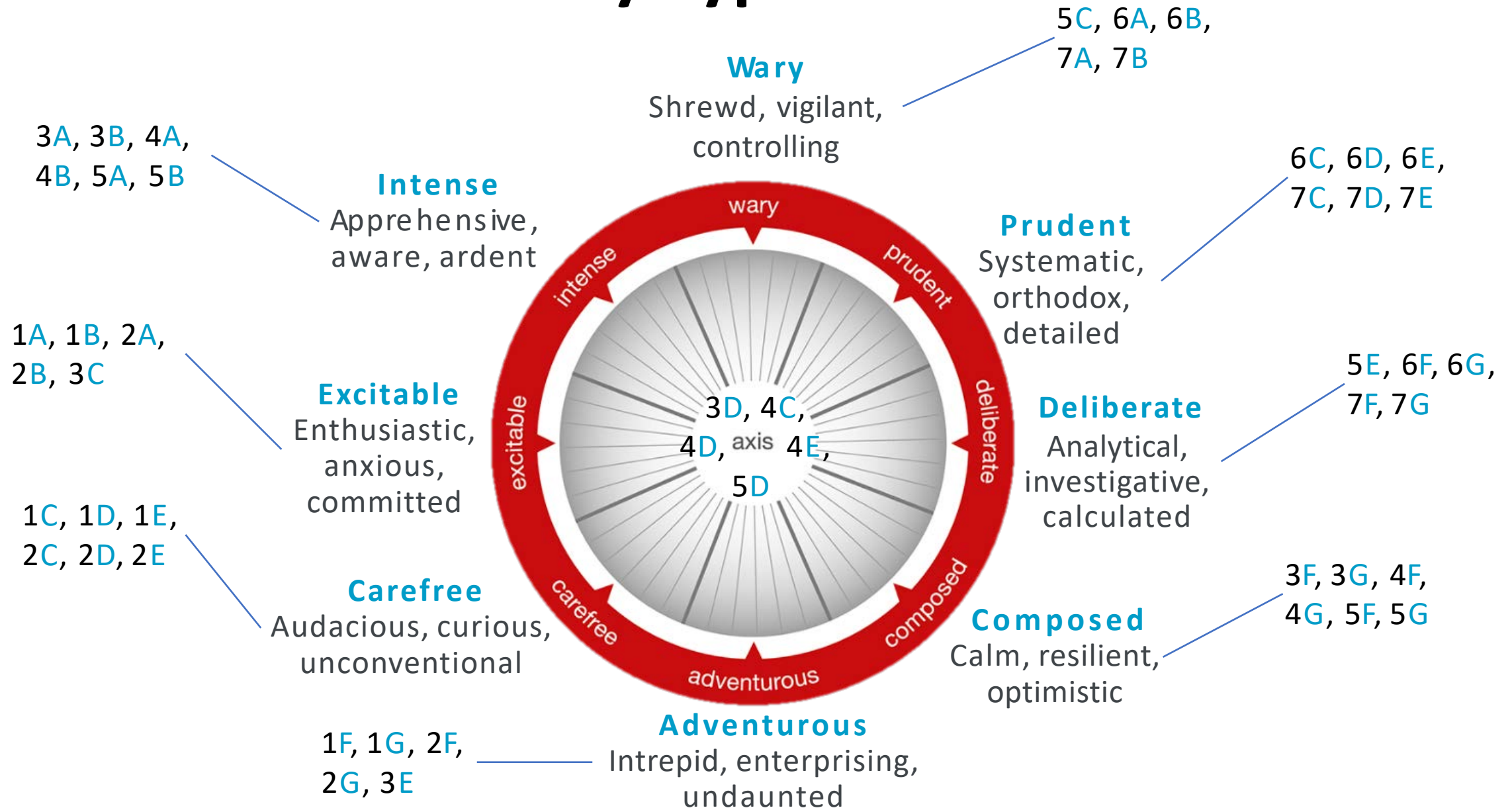
Groupthink

Hindsight

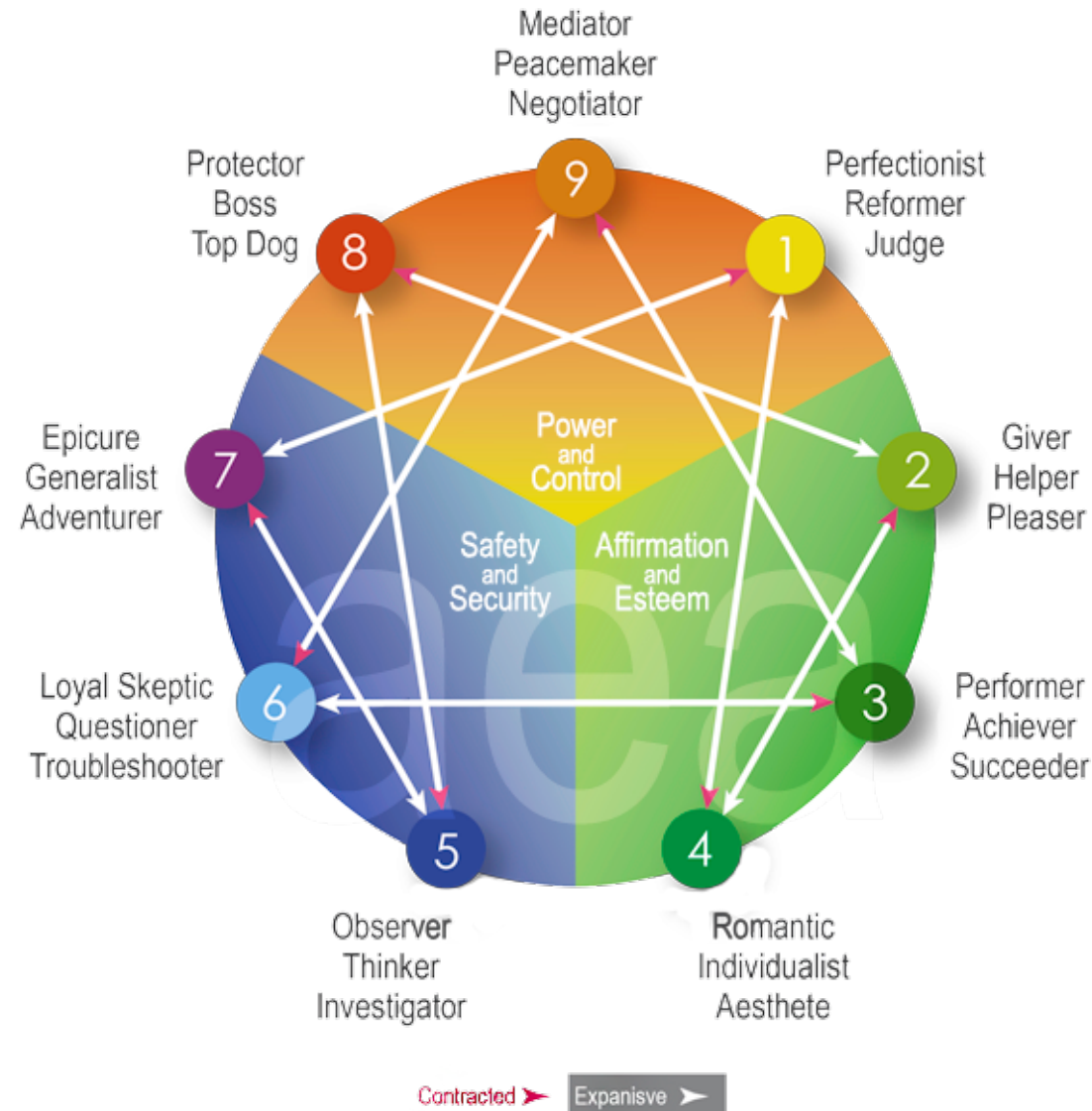
Escalation

Sunk cost

Risk and Personality Types



Enneagram – Personality Types





Judgement

JUDGEMENT – 6 QUESTIONS TO ASK YOURSELF

- **Listening and reading – Have I understood?**
- **Can I trust the information and the people?**
- **Do I have the relevant experience and knowledge?**
- **How do my beliefs and feelings (including about risk) affect my choice?**
- **Are these the right options for my choice?**
- **Delivery (including timing) – Is this practical?**

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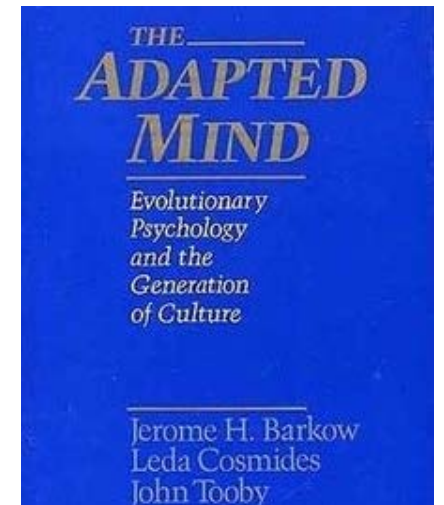
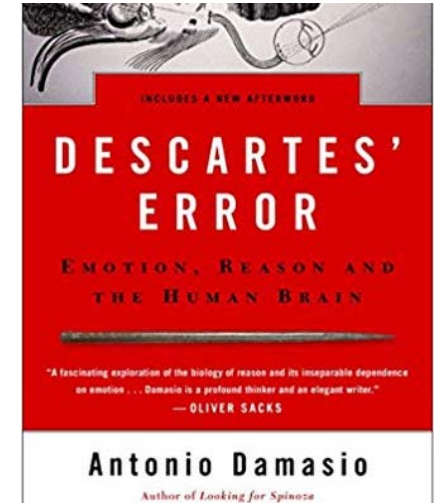
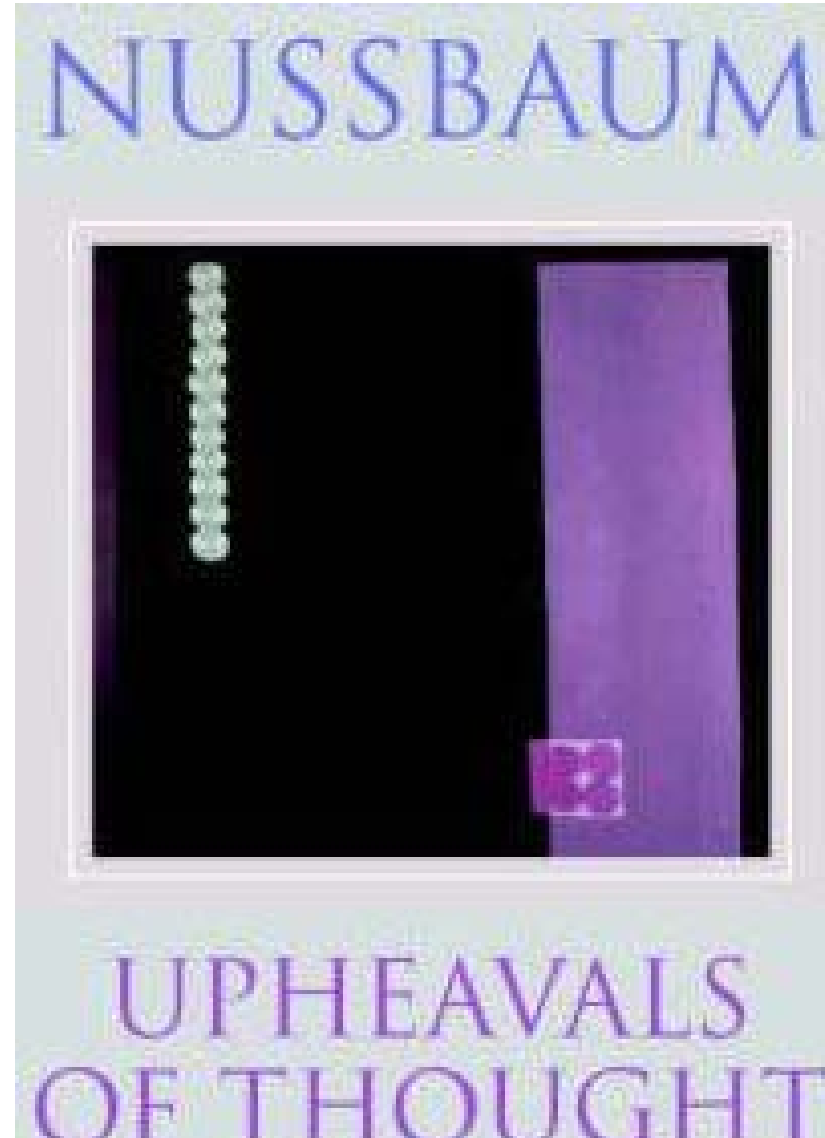
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Knowledge and its Limits

- Nussbaum
- Damasio
- Evolutionary Psychology

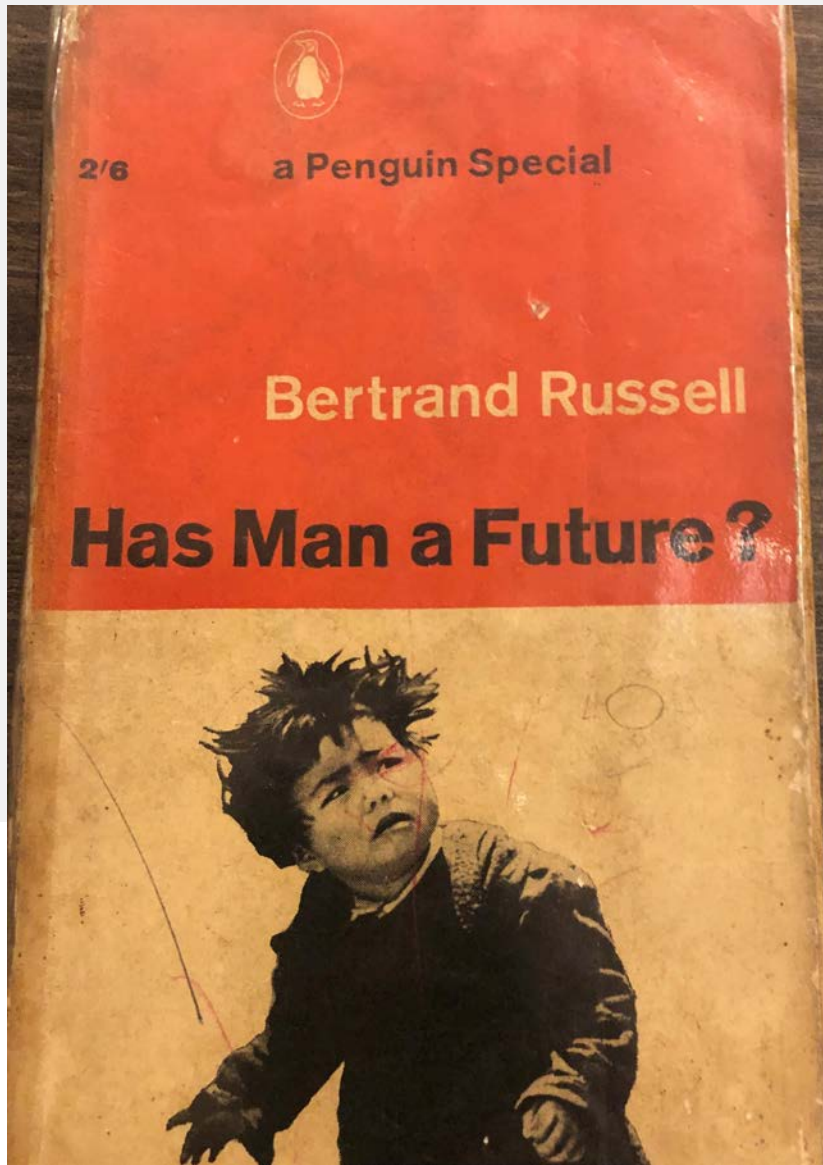


Integrating Various Disciplines



- Actuarial Science and Risk Theory
- Contagion and Networks
- Framing and Cognitive Behaviour Therapy
- Risk Appetite and Personality Theories
- Fear, Panic and Anxiety – evolutionary psychology
- Governance and Cultures
- History, Politics & Philosophy
- Bias, Heuristics and Judgement
- Radical Uncertainty
- Self Awareness, Reflexivity and Navigation

How do we extract the signal from the noise?



Has Man a
Future?



Navigating Across Paradigms

27 March 2020

Tan Suee Chieh

