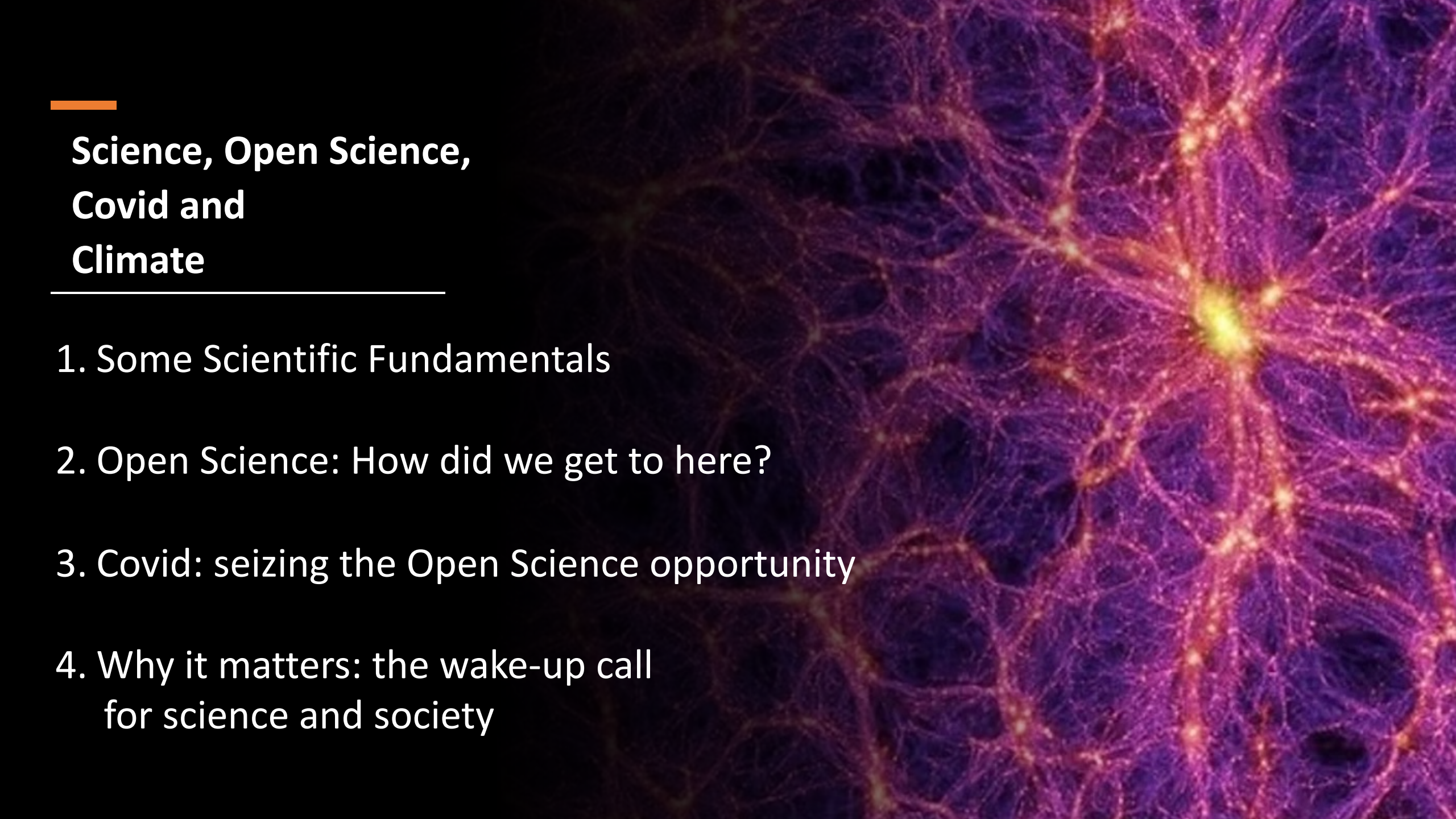
Science, Open Science, Covid and Climate

Geoffrey Boulton
International Science Council
& University of Edinburgh

"From Tackling the Pandemic to Addressing Climate Change"

United Nations Dag Hammarskjöld Library
Open Science Conference 2021



Science, Open Science, Covid and Climate

1. Some Scientific Fundamentals

2. Open Science: How did we get to here?

3. Covid: seizing the Open Science opportunity

4. Why it matters: the wake-up call for science and society

Scientific Fundamentals and Practices

The fundamentals do not change as we enter a new era of open science:

- maintaining rigour by sceptical scrutiny of accessible concepts and evidence
- communicating and disseminating understanding

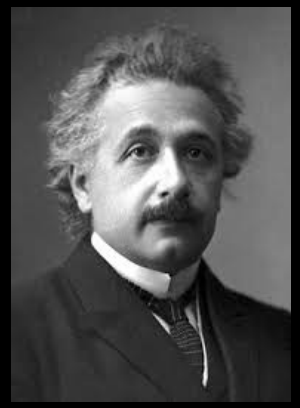
But:

the way science is done and its contribution to the public good are changing because:

- digital technologies have enlarged opportunities for discovery, communication and dissemination
- social and political expectations of science and of the global public good have evolved

Consequence:

The Open Science Movement

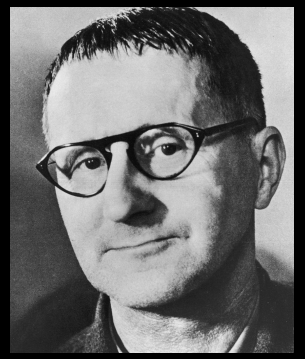


No amount of experimentation can prove me right.
A single experiment can prove me wrong.

Albert Einstein

The progress of science is strewn, like an ancient desert trail, with the bleached skeletons of discarded theories that once seemed to possess eternal life.

Arthur Koestler

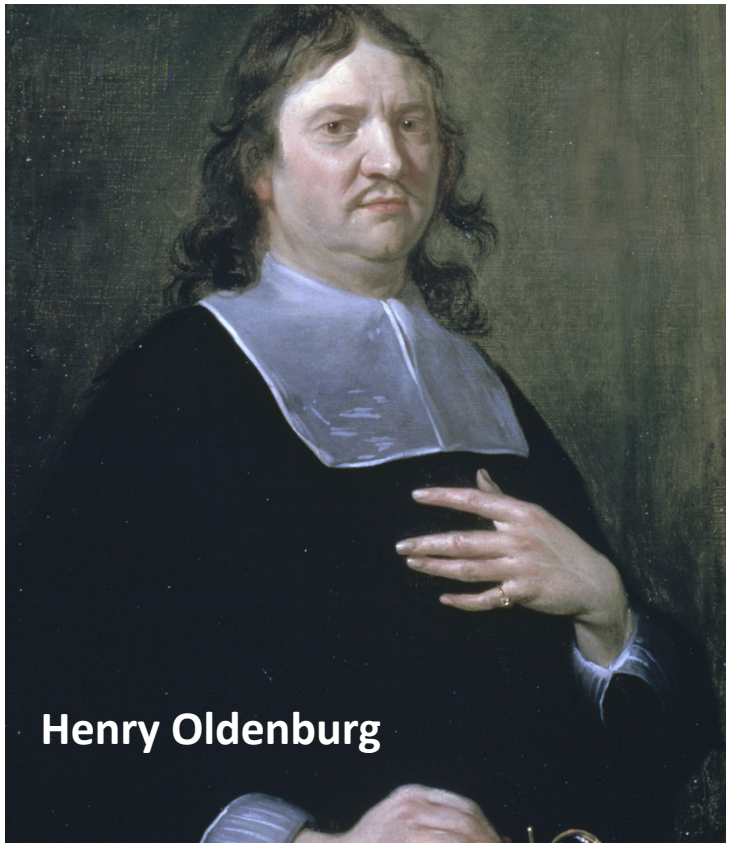


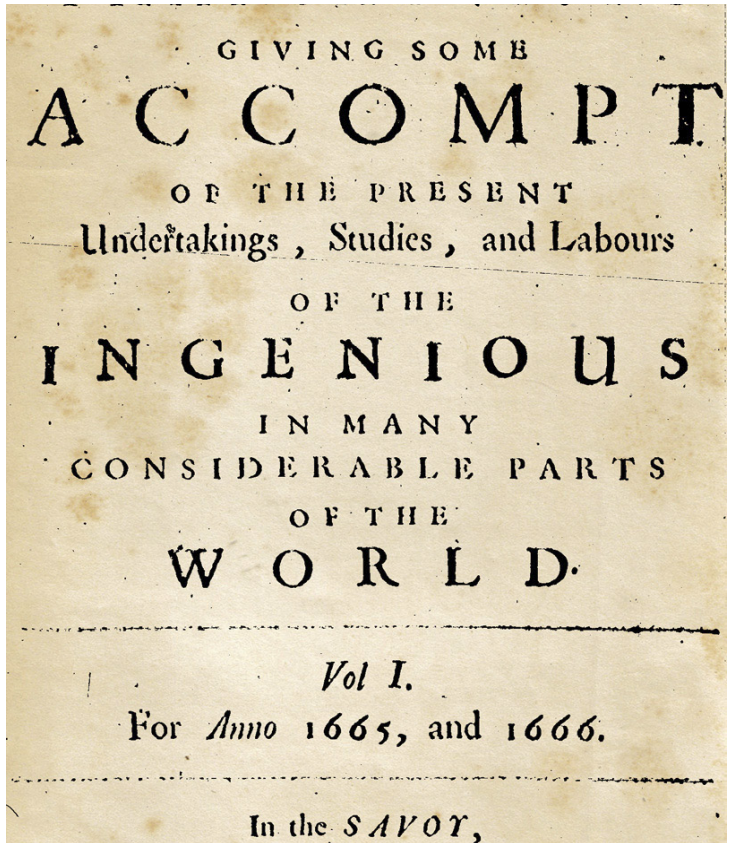
The purpose of science is not to open a door to infinite wisdom, but to set a limit to infinite error.

Bertholt Brecht

2. Open Science: How did we get here?

Open Science - Act 0
1665




GIVING SOME
ACCOMPT
OF THE PRESENT
Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

Vol I.
For *Anno* 1665, and 1666.

In the *SAVOY*,

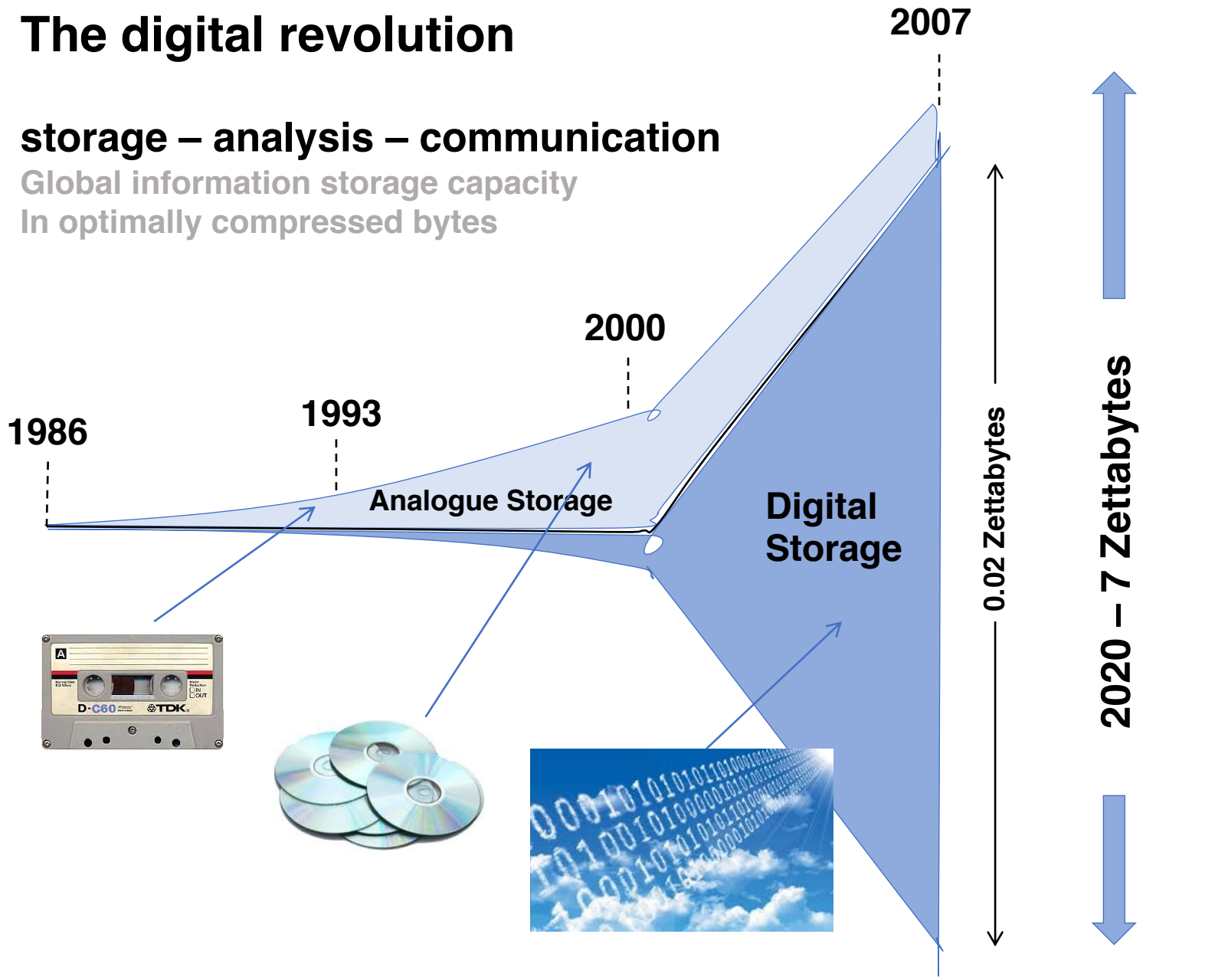
Innovations

- Publicly available (at a price)
- concepts must be supported by evidence (data)
- in the vernacular, not Latin
- peer review by Society's Council members

The digital revolution

storage – analysis – communication

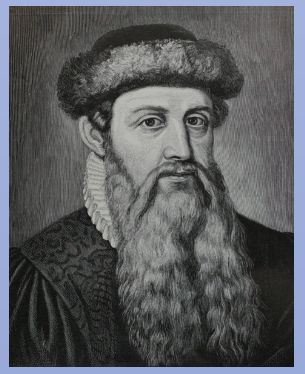
Global information storage capacity
In optimally compressed bytes



A World Historical Event

The technologies by which knowledge is acquired, stored and communicated have always been essential drivers of human material and social progress

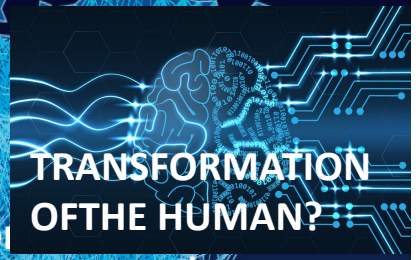
Johannes Gutenberg
1400-1468



The Digital Revolution – 1990 - ?

- vast data streams
- vast source diversity
- vast computational capacity
- learning algorithms
- instantaneous communicatio
- access anywhere anytime
- low cost

A NETWORKED EARTH



Open Science Act 1: Open Access

The Budapest Open Access Declaration – 2002

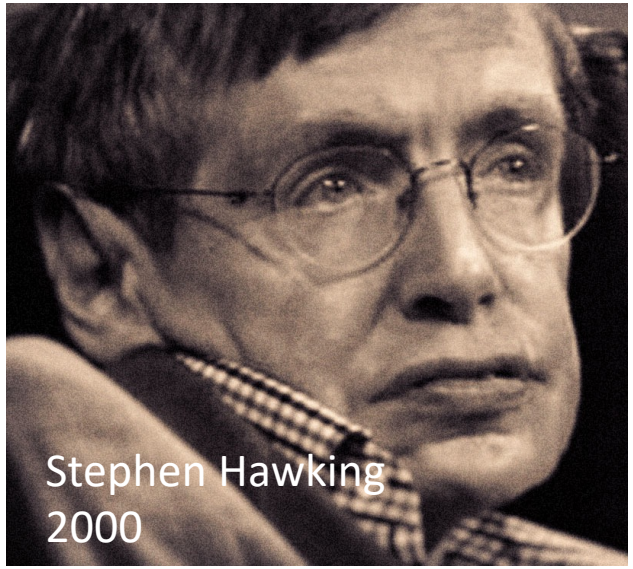
"An old tradition and a new technology have converged to make possible an unprecedented public good.

The old tradition is the willingness of scientists and scholars to publish the fruits of their research in scholarly journals without payment, for the sake of inquiry and knowledge.

The new technology is the internet.

The public good they make possible is the worldwide electronic distribution of the peer- reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students and other curious minds."

Act 2 - Open Data (2002/2012)



"….the next [21st] century will be the century of complexity"

general availability of findable, accessible, interoperable re-useable (FAIR) data

scientific rigour demands:

data, meta-data and code that provides the evidence for a published claim to be concurrently available for scrutiny.

science & technology
Department: Science and Technology
REPUBLIC OF SOUTH AFRICA

ASSAf

International Science Council
Regional Office for Africa

CODATA

NRF National Research Foundation

Act 3 - Open to Society Democratisation of science (2018)

Science in Africa must becomes a more public enterprise that engages actively with business, policymakers, governments, communities and citizens as knowledge partners in jointly framing questions and jointly seeking solutions rather than one conducted behind closed laboratory and library doors.

The Platform will work to:

- enable scientists and communities to create actionable knowledge;
- enhance the credibility, practical relevance and socio-political legitimacy of science in and for Africa;
- strengthen the pan-African voice in global science.

Act 4: Defining Open Science (2020/21)

PURPOSE

UNESCO

PROCESS

- Open Access
- Open Infrastructure
- Open Data
- Open Source
- Open Evaluation
- Citizen Science
- Open Notebook
- Open Labs
- Open Educational Resources
- Open Innovation
- Open Hardware

International Science Council

PURPOSE

- scrutinise and challenge truth claims (**rigour**)
- serve the knowledge needs and interests of wider publics (**democratisation**)
- maintain the record of science, its evolving stock of knowledge, ideas and possibilities accessible and free to all, irrespective of geography, gender, ethnicity or financial circumstance (**efficiency**)
- open the data and evidence of science to be accessible and re-usable by all, subject to constraints of safety, security and privacy (**complexity**)
- engage with other societal actors in the common pursuit of new knowledge, and in supporting humanity in achieving sustainable and equitable life on planet Earth (**sustainability**)

A Barrier to Open Science
how not to Assess Science – use proxy metrics

Proxy measures

- citation indices
- journal impact factors
- university rankings

A dysfunctional market

- paper productivity not science productivity
- drive predatory journal market
- drive price inflation
- fragment the science community
- undermine education
- places record of science behind paywall
- strategic data about science in private hands

Richard Goodhart

Goodhart's Law

"When a measure becomes a target, it ceases to be a good measure".

3. Covid: seizing the Open Science Opportunity

The Open Science in Action

Communicating to diverse audiences

- Clarity – Credibility
- Communicate uncertainty and risk – a basis for trust
- Context and relevance to varied audiences

Delivering access to knowledge

- Websites & data platforms
- Sharing and rapid release of results

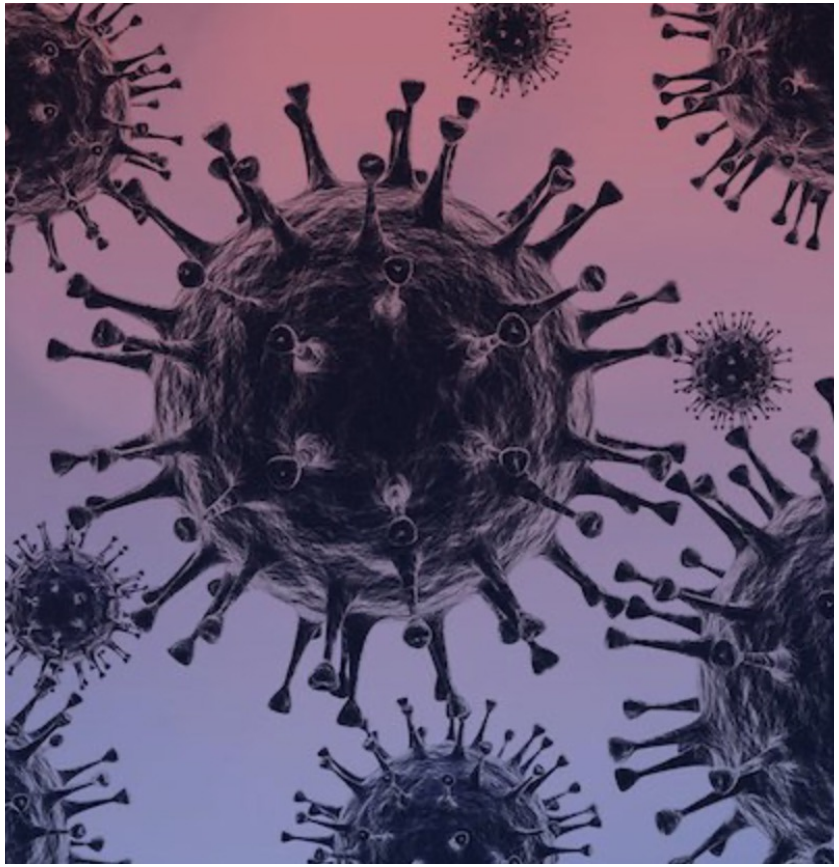
Co-production of knowledge

- Science & civil society
- Supporting community action

The big lesson for science from Covid

A stress test for Open Science. The utility of broad-spectrum Open Science has largely been a matter of conjecture - no longer:

- Spontaneous response from a great diversity of sciences
- Unrivalled sharing, and across the public/private interface
- Agile release of emergent science
- New open data resources
- Rapid publication and pre-prints
- Effective communication of science in the public domain
- Revelation of the richness and relevance of scientific knowledge over a wide spectrum



The Director of the US National Institute of Health: “we have never seen anything like this”

“the phenomenal effort will change science – and scientists – for ever’”

The opportunity for this be the new normal for science?

What would make it so?

The Challenge for Science

“Never waste a Good Crisis!”

Priorities for change

OPENING THE RECORD OF SCIENCE

I. Affordable, universal open access
II. Open licensing
III. Rigorous, efficient, timely peer review
IV. Data publication
V. Maintaining the record of science
VI. Inter-operation between disciplines
VII. Digitally enabled publication & dissemination
VIII. Governance in scientific hands

Urgent reforms

Normalise:

- Pre-prints, servers, overlay review
- Open Licenses
- Citable data publication

Implement:

- Novel peer review
- Platform-agnostic discovery services
- Global curation infrastructures for the Record of Science

Governance

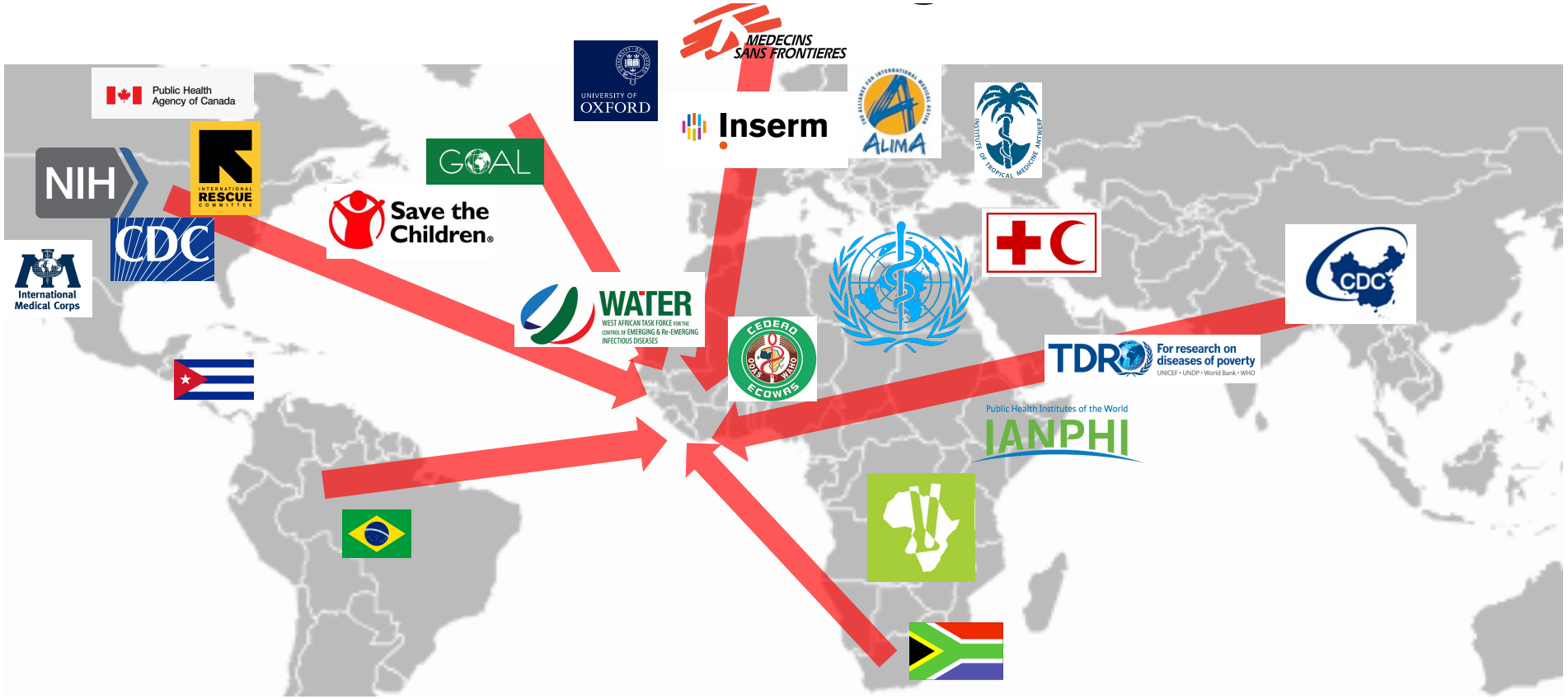
- Within the science community
- Incentives **f**rom bibliometric to open science
- Globally inclusive/nationally efficient
- Distributed functions/common standards

Exploit the Digital

"The Journal is dead, but if its not, it should be. Journals are unnecessary with online publishing. Using a journal to restrict access is outrageous."

Governance and inclusivity are vital: common standards, distributed functions

e.g. International response to the 2014-2016 Ebola Crisis

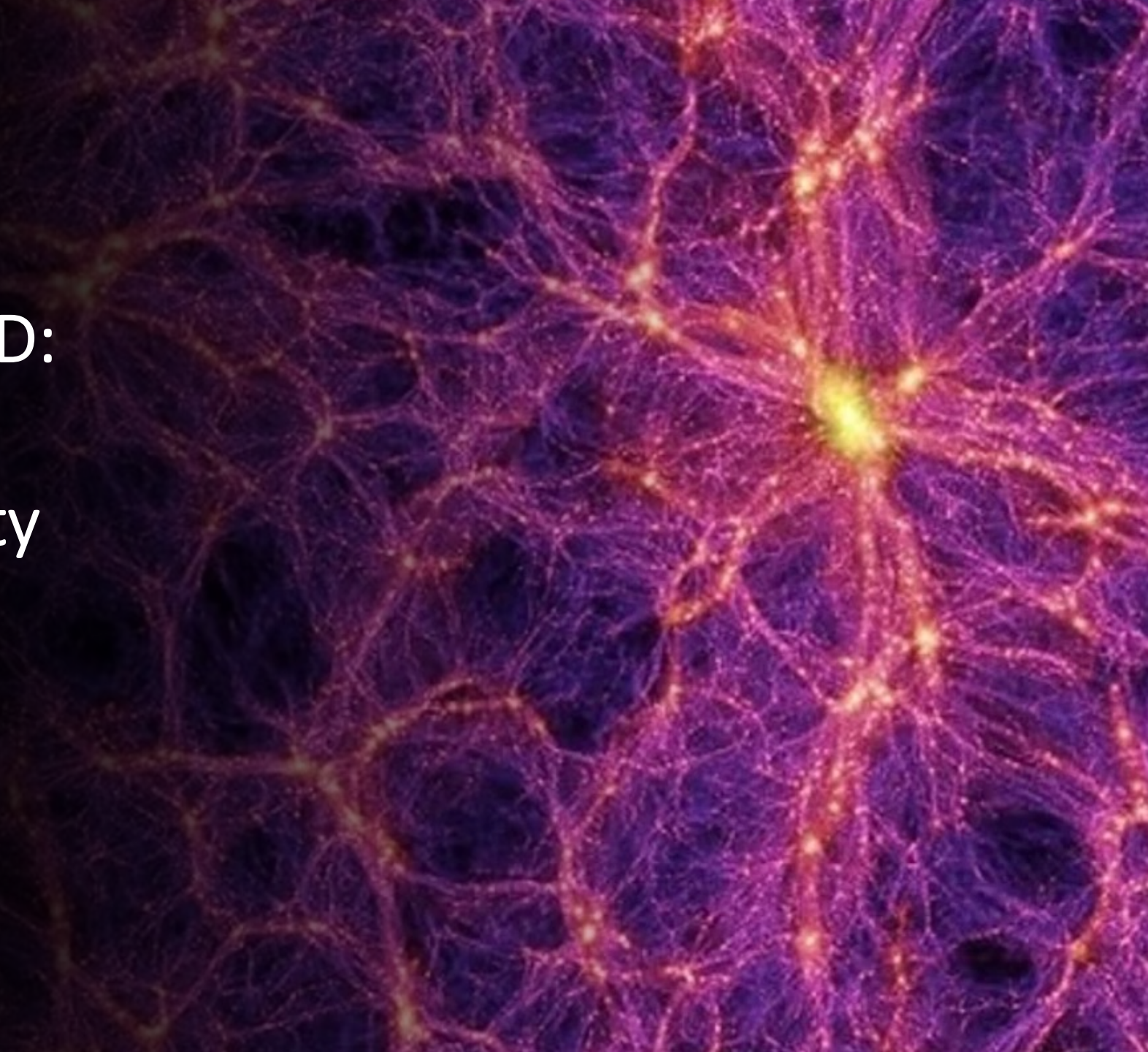


Only a selection of international responders is shown. There were many more.

At the end of the outbreak, international institutions left, and took the data with them

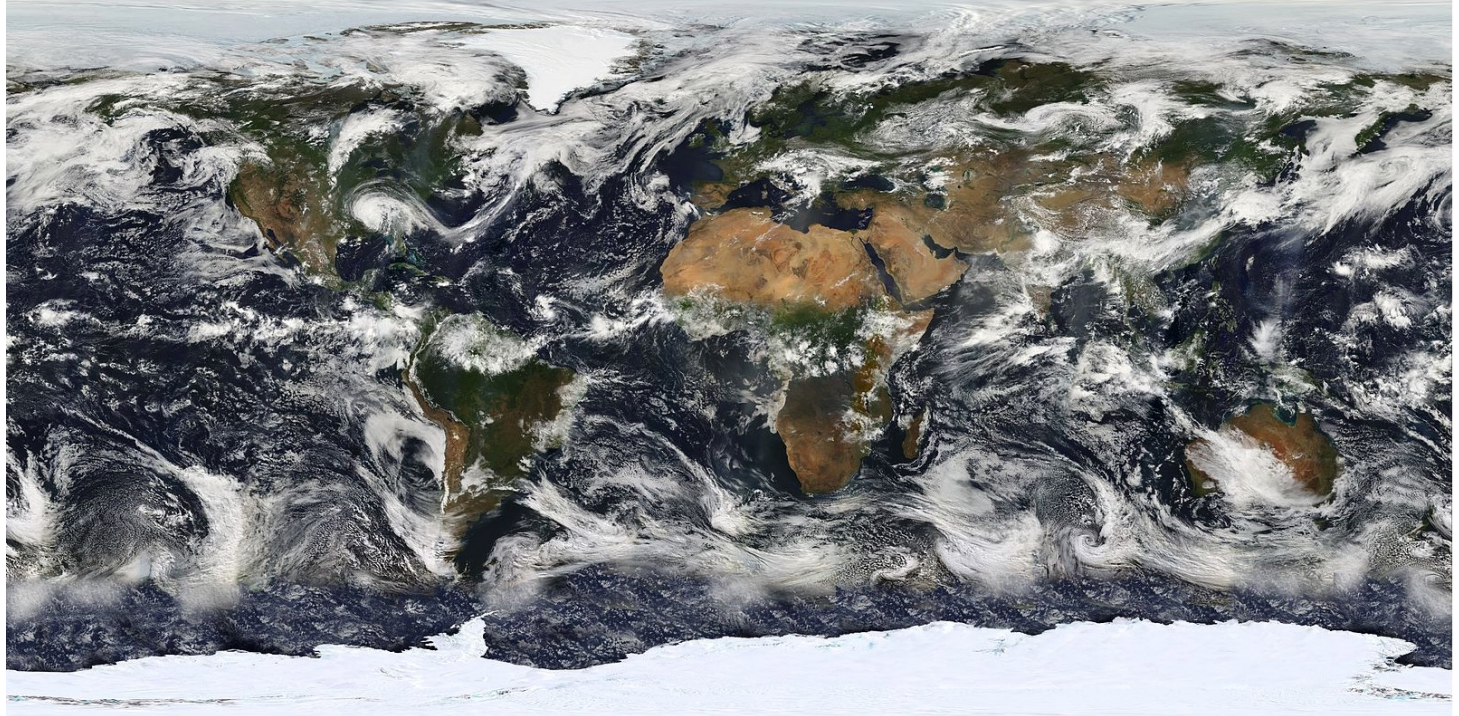
Only a selection of international responders is shown

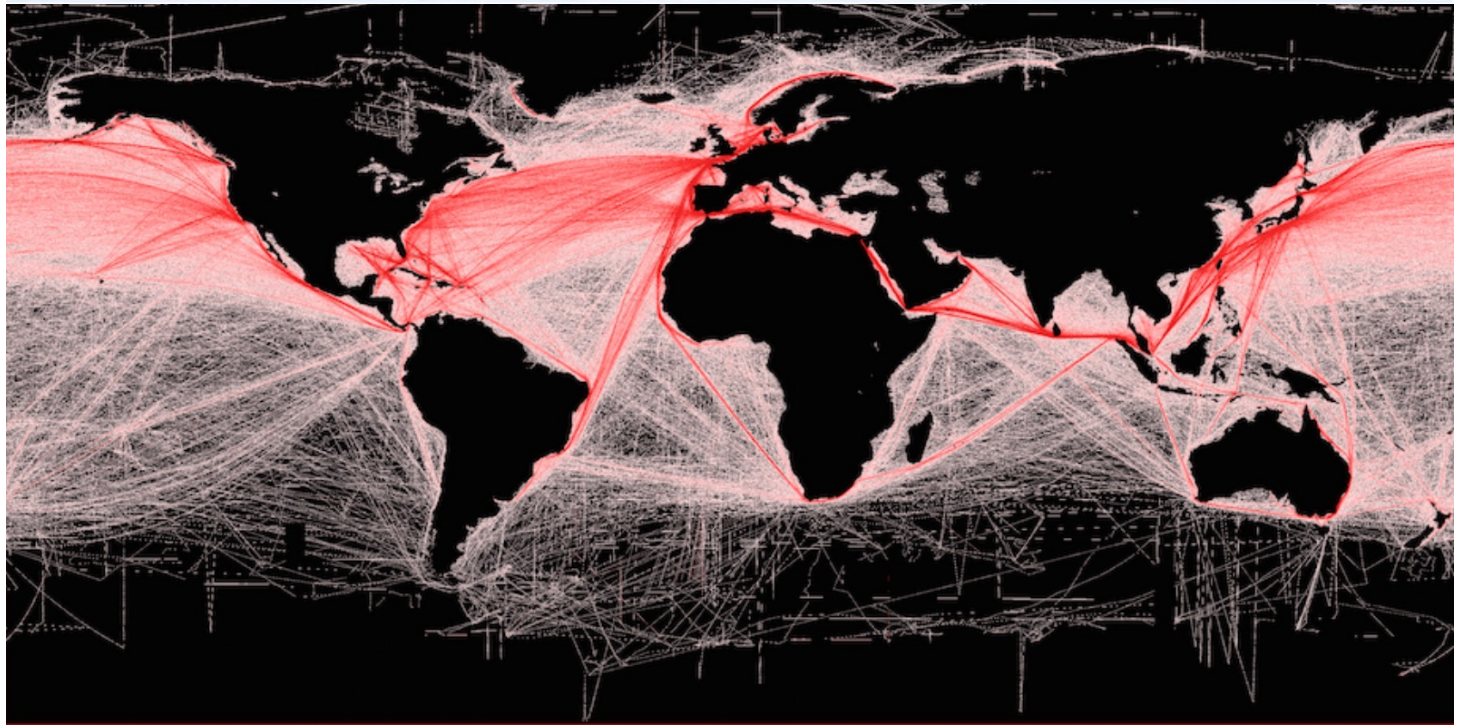
4. Lessons from COVID: the wake-up call for science and society



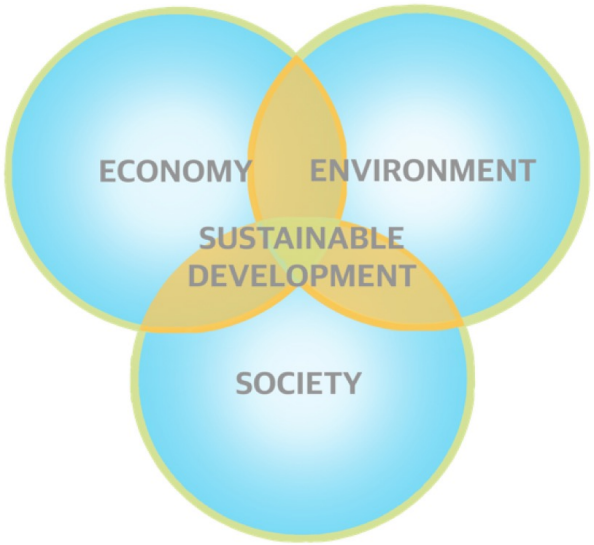
Lesson 1:

We’re all in this together

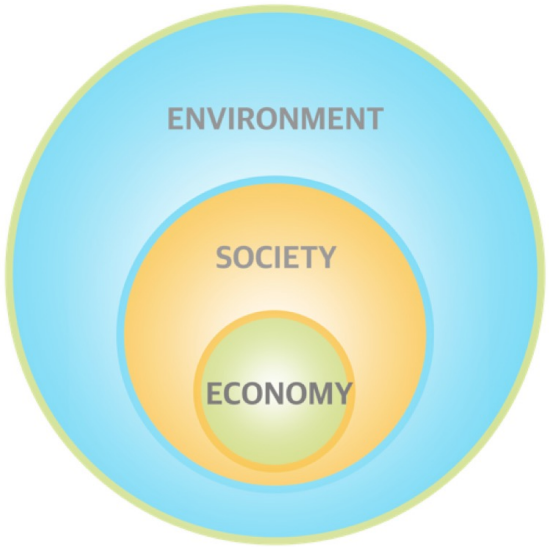




Perception



Reality



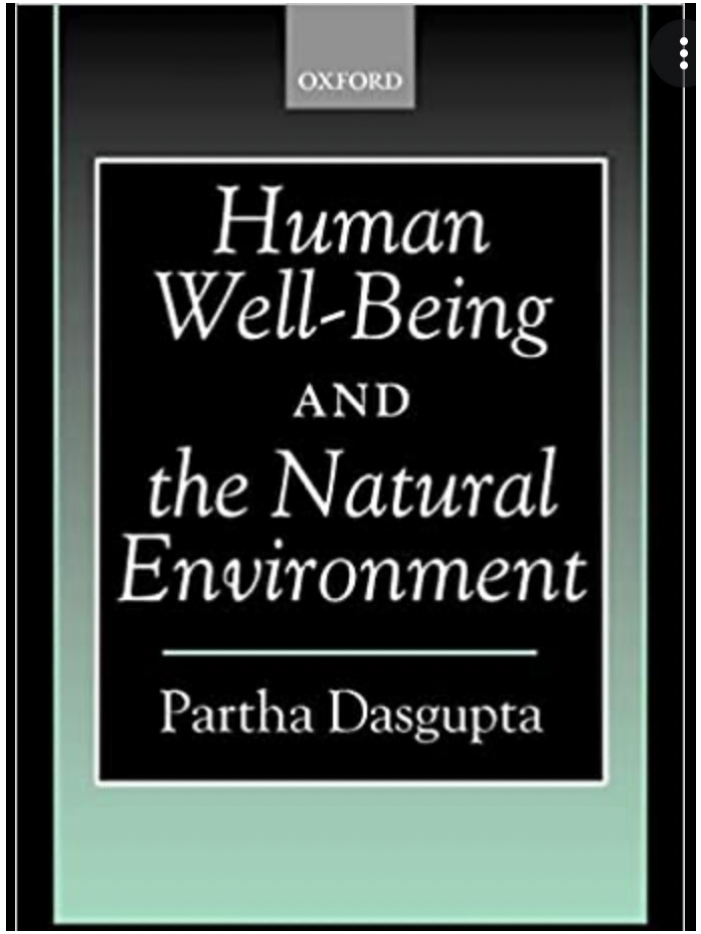
Lesson 2: Nature isn't a random economic externality

COVID and CLIMATE are predictable parts of the planetary economy.

They are not, in any rational meaning of the term, "externalities".

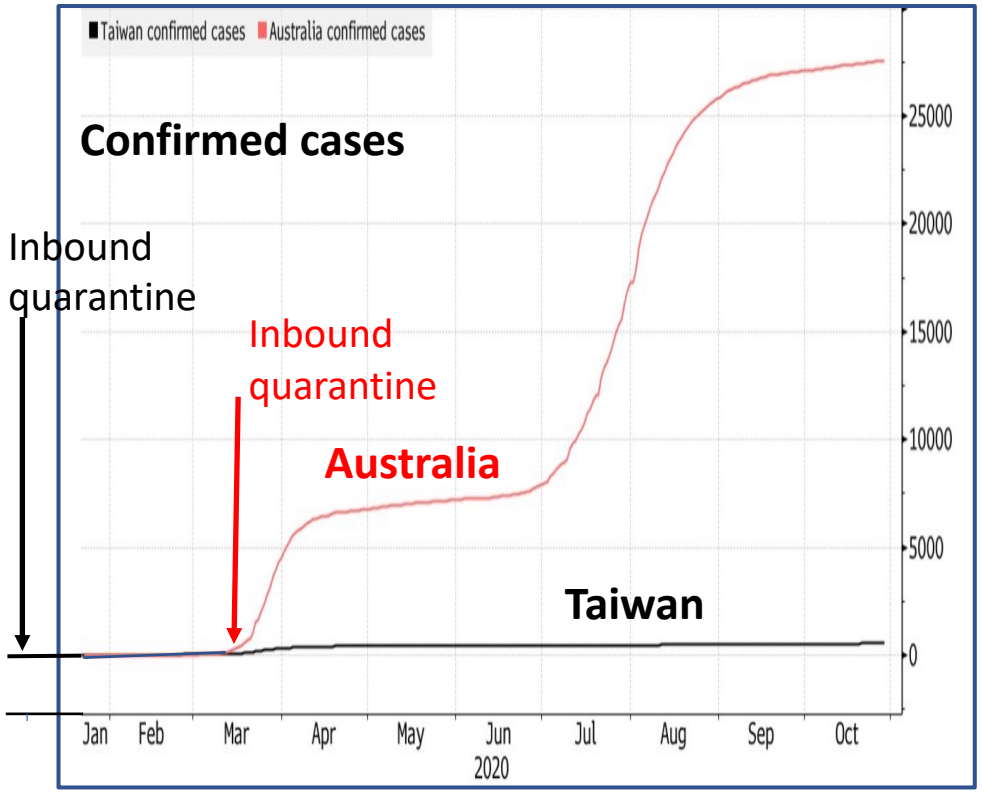
The human economy is also part of the planetary economy, but not, in the short term, so predictable.

Do we have to monetise the environment In order to deal rationally with it?



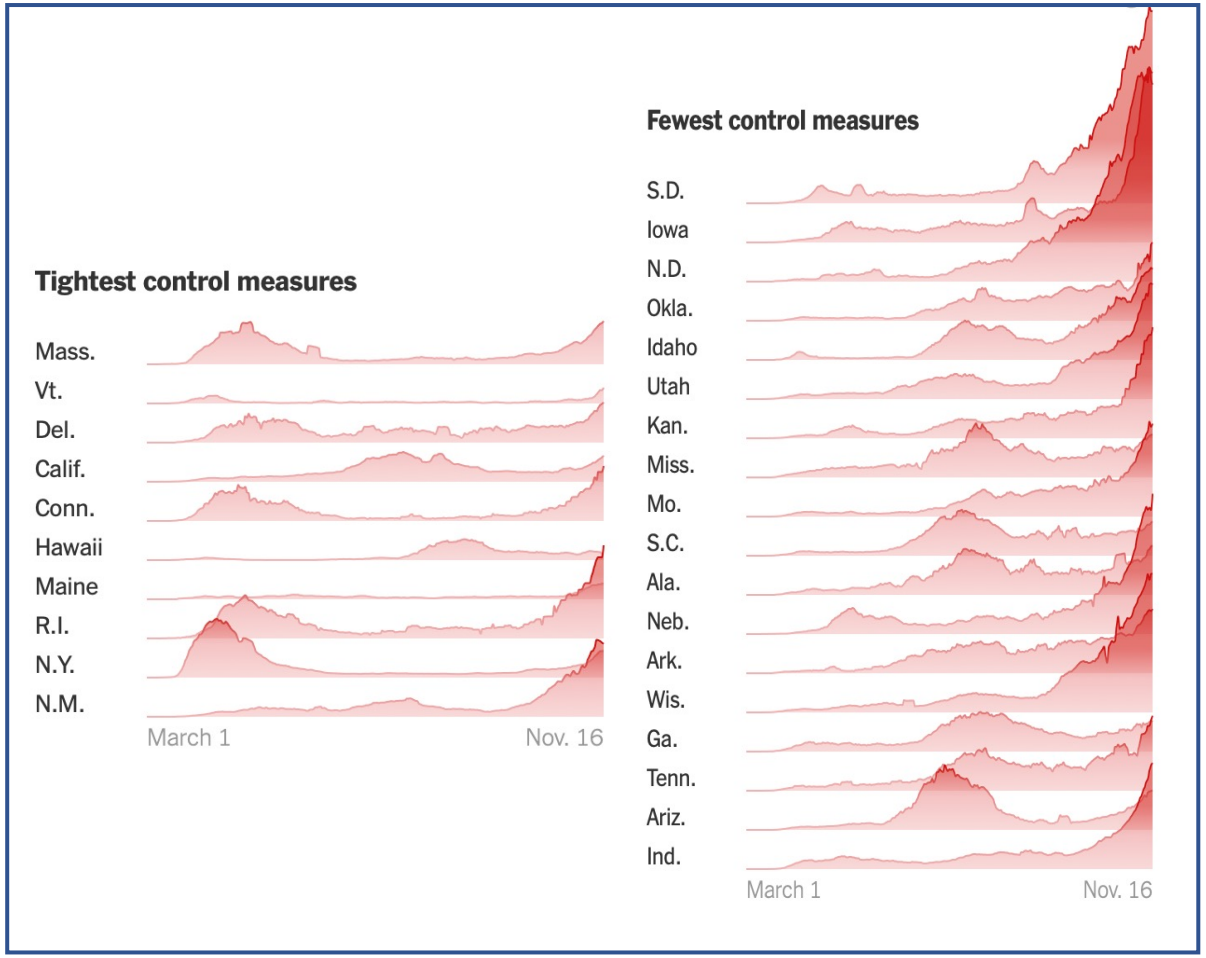
Lesson 3: Act early, act Hard

Early

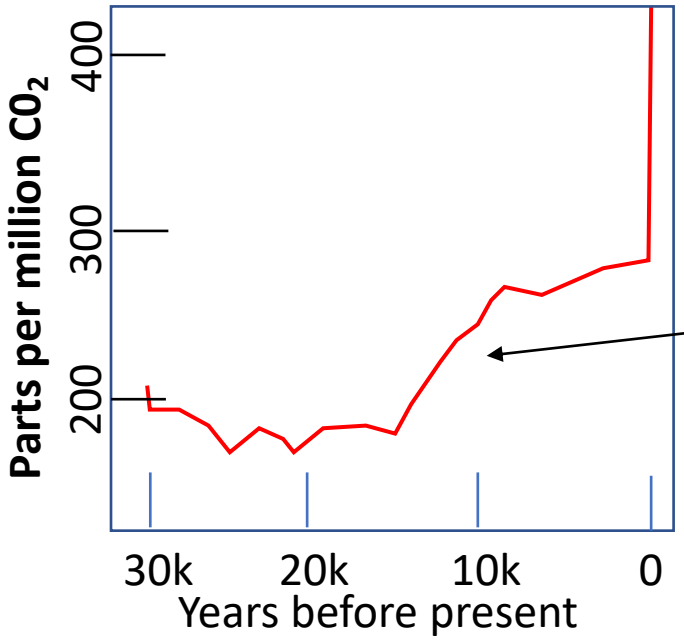


A tale of two islands

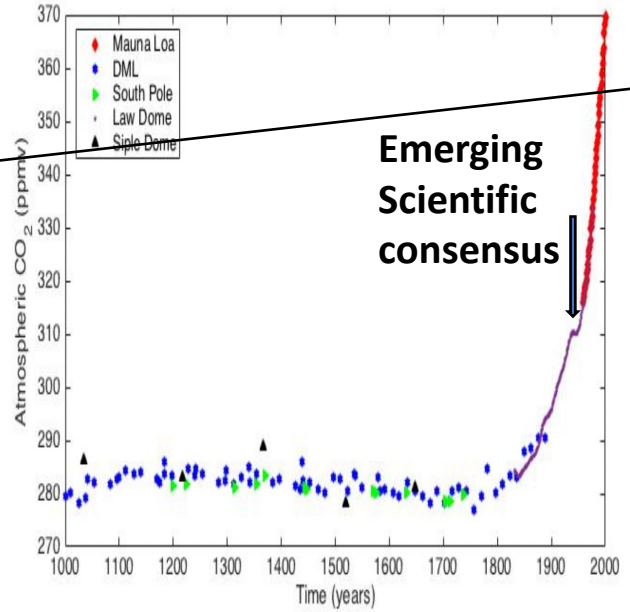
Hard



Carbon Dioxide: the global thermostat
It's getting late

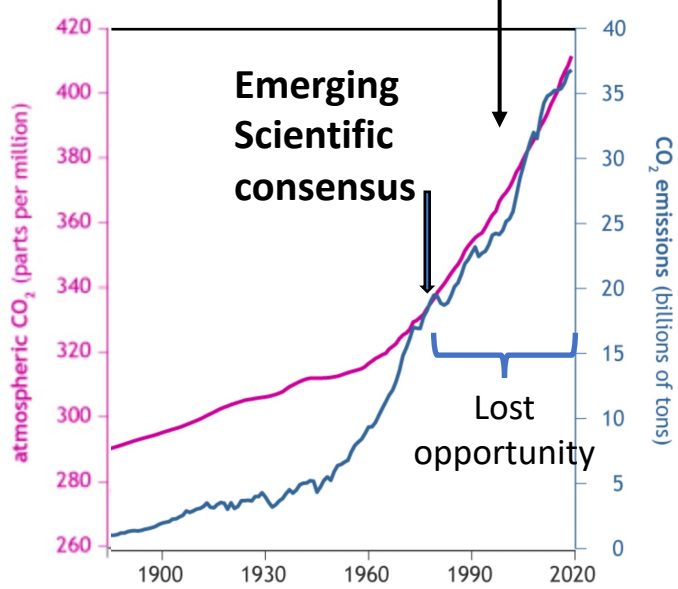


30,000 years



1,000 years

Warming & CO_2
100x faster
than the end of
Ice Age warming



130 years

Why do we fail to act?

- Populist politics – don’t be a bringer of bad news?
- Credibility – it’s only a theory?
- Hard wired for the immediate?
- Lack of imagination?
- Cheating?

We need to understand these psychologies in an age of pandemics, of climate change and looming planetary boundaries

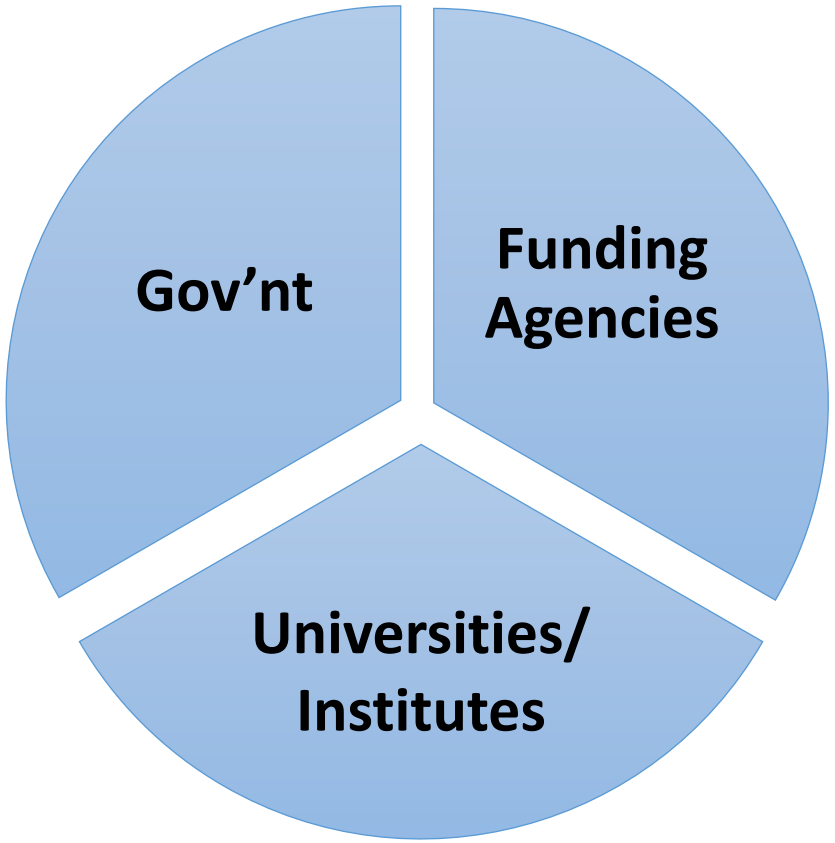
Lesson 4: Where does all this science come from?

"because of capitalism, because of greed"

"I'M MAINLY MOTIVATED BY GREED"

It comes from efficient national science systems

Self-organizing Triad



Priorities

Governments
Jobs/growth/innovation
Knowledge exchange

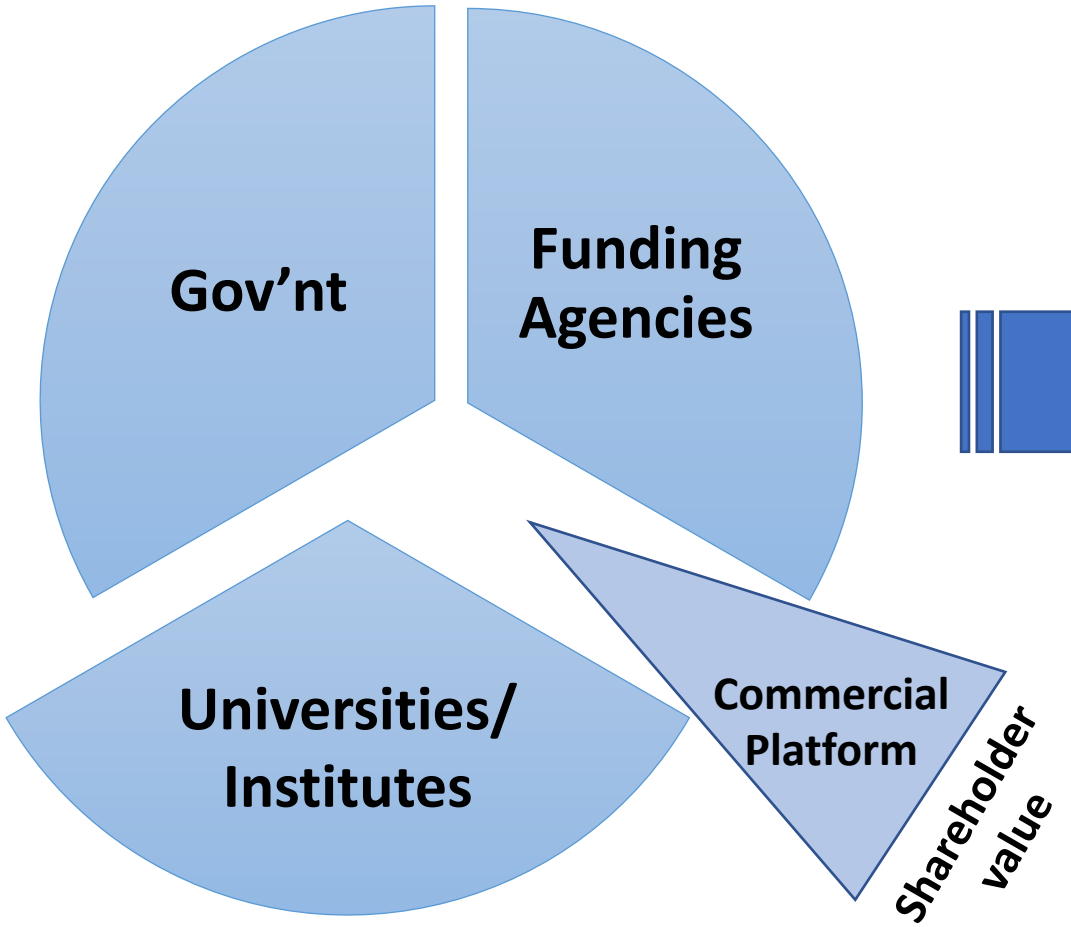
Funding agencies
Strategic
Excellence

Universities
Highly competitive
Strategic research
Academic freedom as enabler of broad-spectrum research

Public Good Motivation

System disruption?

A quartet?



Priorities

Governments
Jobs/growth/innovation
Knowledge exchange

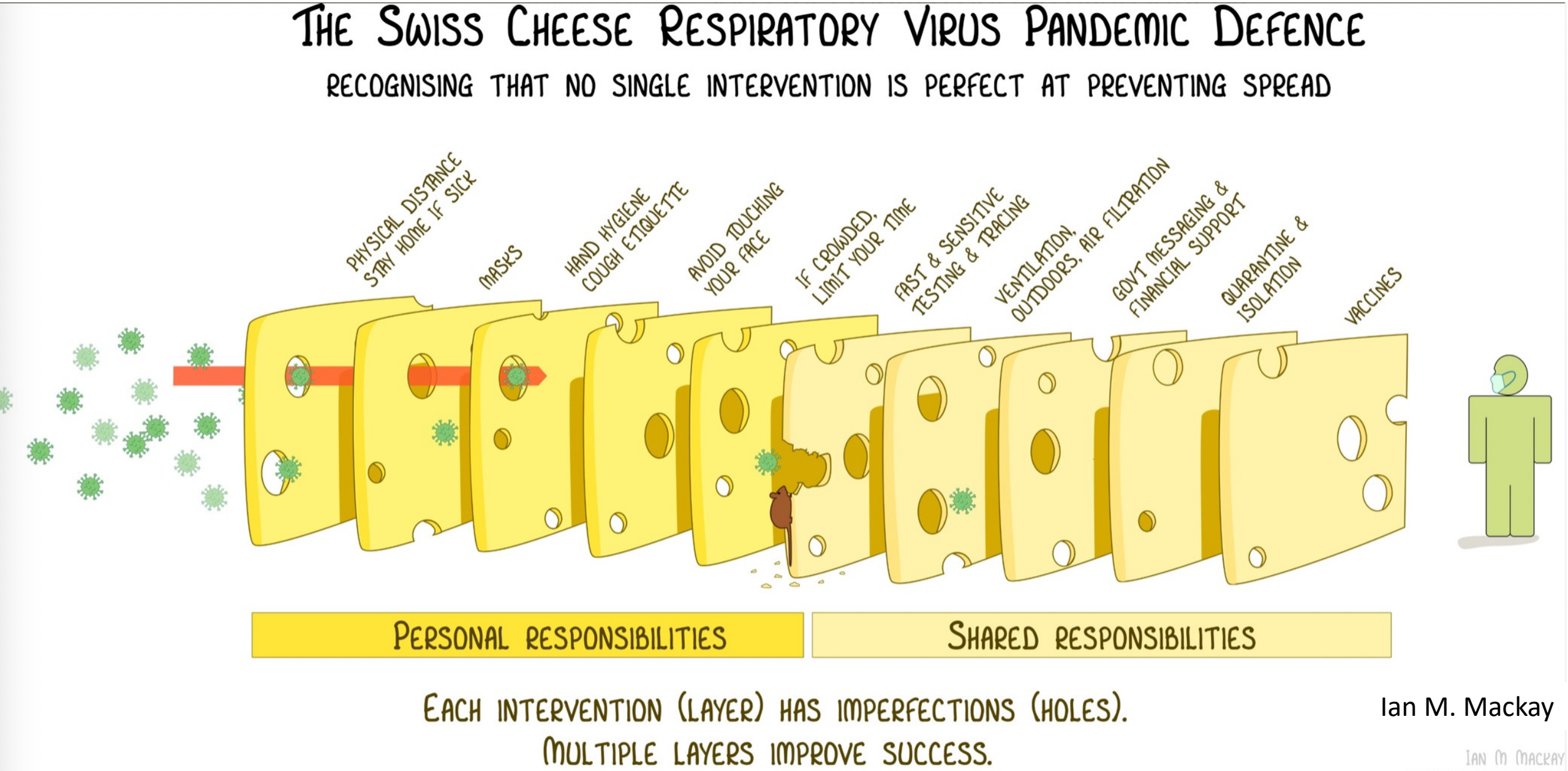
Funding agencies
Strategic priorities
Excellent research

Universities
Highly competitive
Strategic research
Curiosity-driven research

Institutes
Strategic Research

Public Good Motivation

Lesson 5: There is no silver bullet



Ian M. Mackay

Final Lesson: no vaccine for climate change