University of Antwerp

Rethinking science in a knowledge society

Prof. Gert Verschraegen (Department of Sociology)

Doctoral Day Antwerp Doctoral School - March 16th 2023

Overview

Intro : research in a knowledge society

A short history of science and research

Current developments

Overview

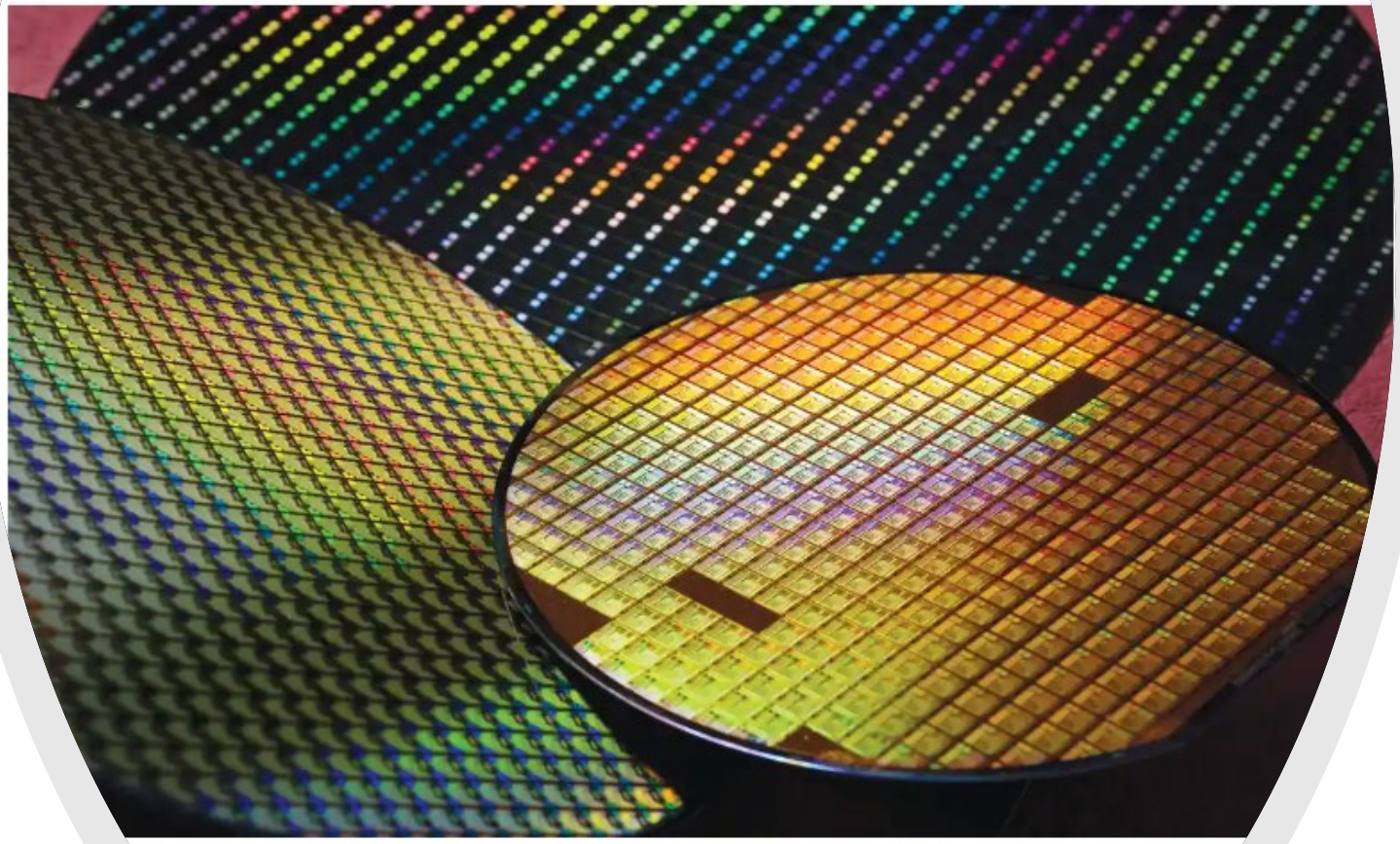
Intro : research in a knowledge society

A short history of science and research

Current developments

war: Japan and Netherlands pected to join US in ban on tech xports to China

Washington officials appear to confirm deal to restrict export of semiconductor manufacturing technology to China



afers from TSMC, the Taiwanese semiconductor manufacturer. Photograph: Ta
tor Manufacturing Company

mate emergency: world 'may have ssed tipping points'

ing of 'existential threat to civilisation' as impacts lead to de of unstoppable events

of the west Antarctic ice sheet may be in irreversible retreat,' said one of the researchers. Photograph: /AFP/Getty Images

world may already have crossed a series of climate tipping points, ding to a stark warning from scientists. This risk is "an existential threat ilisation", they say, meaning "we are in a state of planetary gency".

ng points are reached when particular impacts of global heating become ppable, such as the runaway loss of ice sheets or forests. In the past, me heating of 5C was thought necessary to pass tipping points, but the evidence suggests this could happen between 1C and 2C.

iew

miracles needed': Prof Mark obson on how wind, sun and water power the world

n Carrington Environment editor

rbines in California. 'We have wind, solar, geothermal, hydro, electric cars ... We have 95% of the tech says Jacobson. Photograph: Robert Alexander/Getty Images

uential academic says renewables alone can halt climate ith technologies such as carbon capture expensive wastes

,ene editing hold the key to oving mental health?

tion: Getty Images.

suggests traumatic childhood experiences embed s in our brains and put us at risk of mental illness, but diting may offer us hope of removing them

University of Antwerp

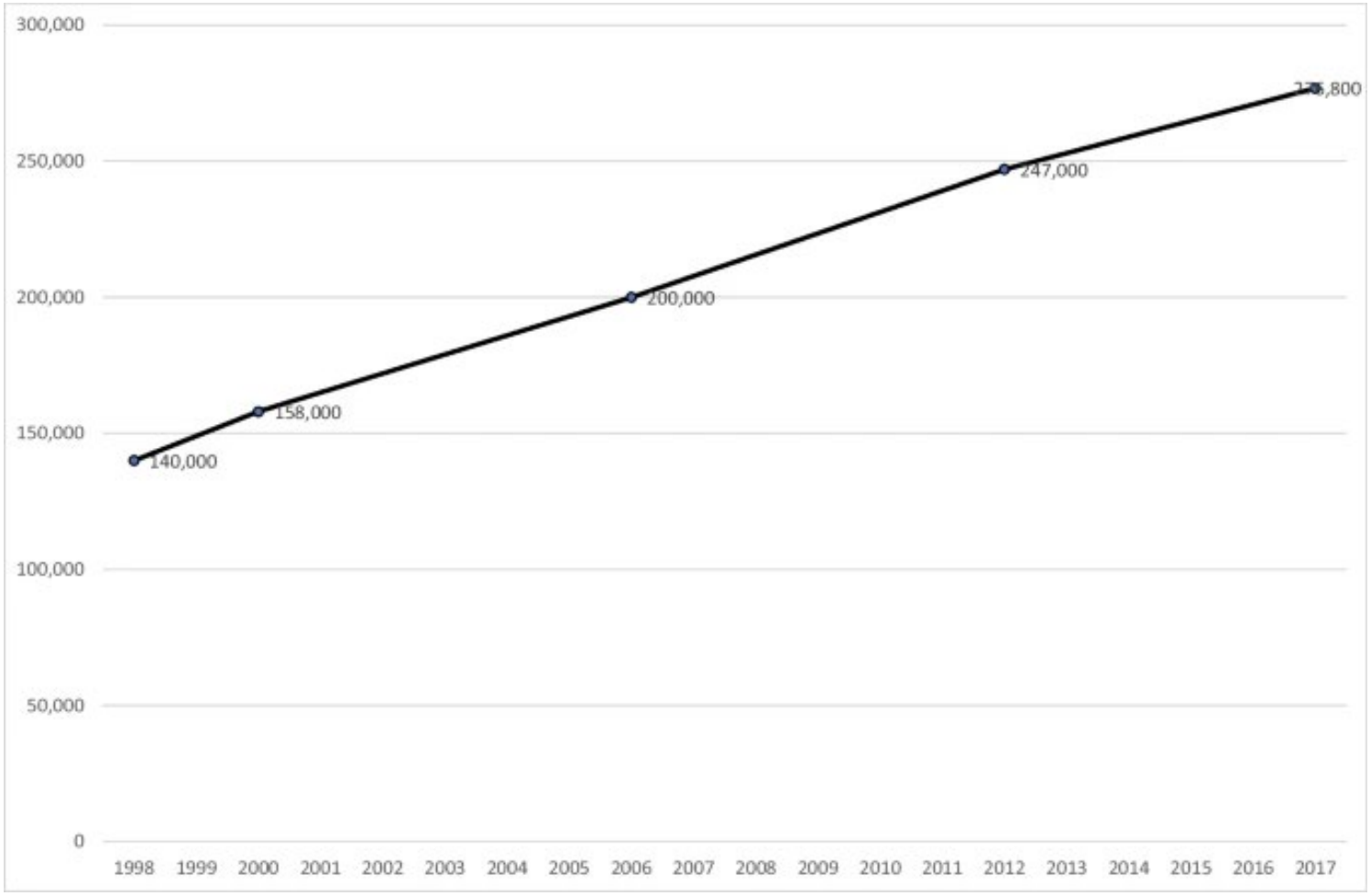
Socioeconomic status in the US harder to change than any time in past 150 years

by Michele W. Berger, University of Pennsylvania

Credit: CC0 Public Domain

For a certain population subset, socioeconomic status in the United States is harder to change now than at any point in recent history, according to research from the University of Pennsylvania, Princeton University, and elsewhere.

The expansion of doctoral education, OECD countries (Sarrico, 2022)



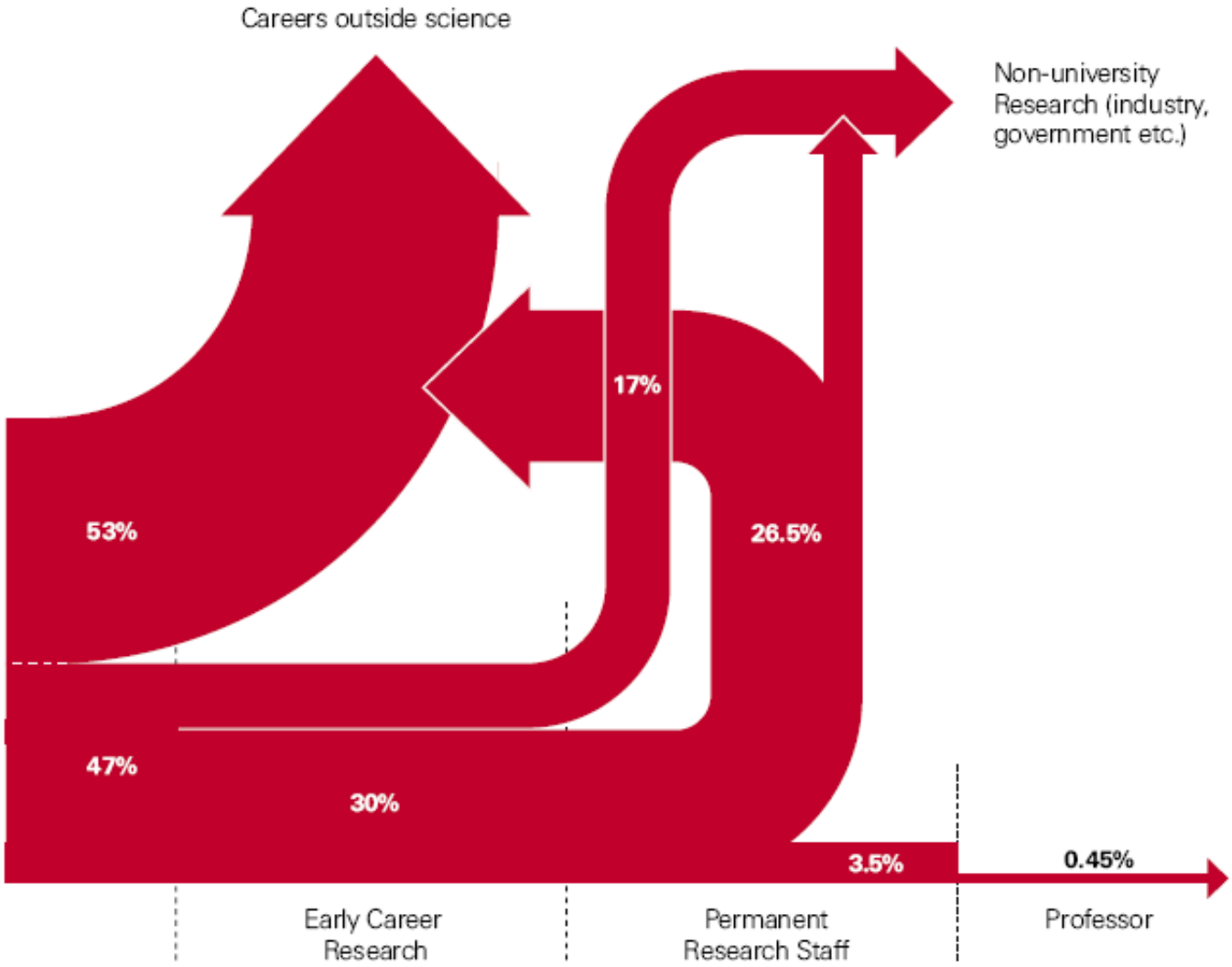


Figure 1.6. Careers in and outside science

Research in the knowledge society

source: Royal Society, 2010, The Scientific Century

Overview

Intro : research in a knowledge society

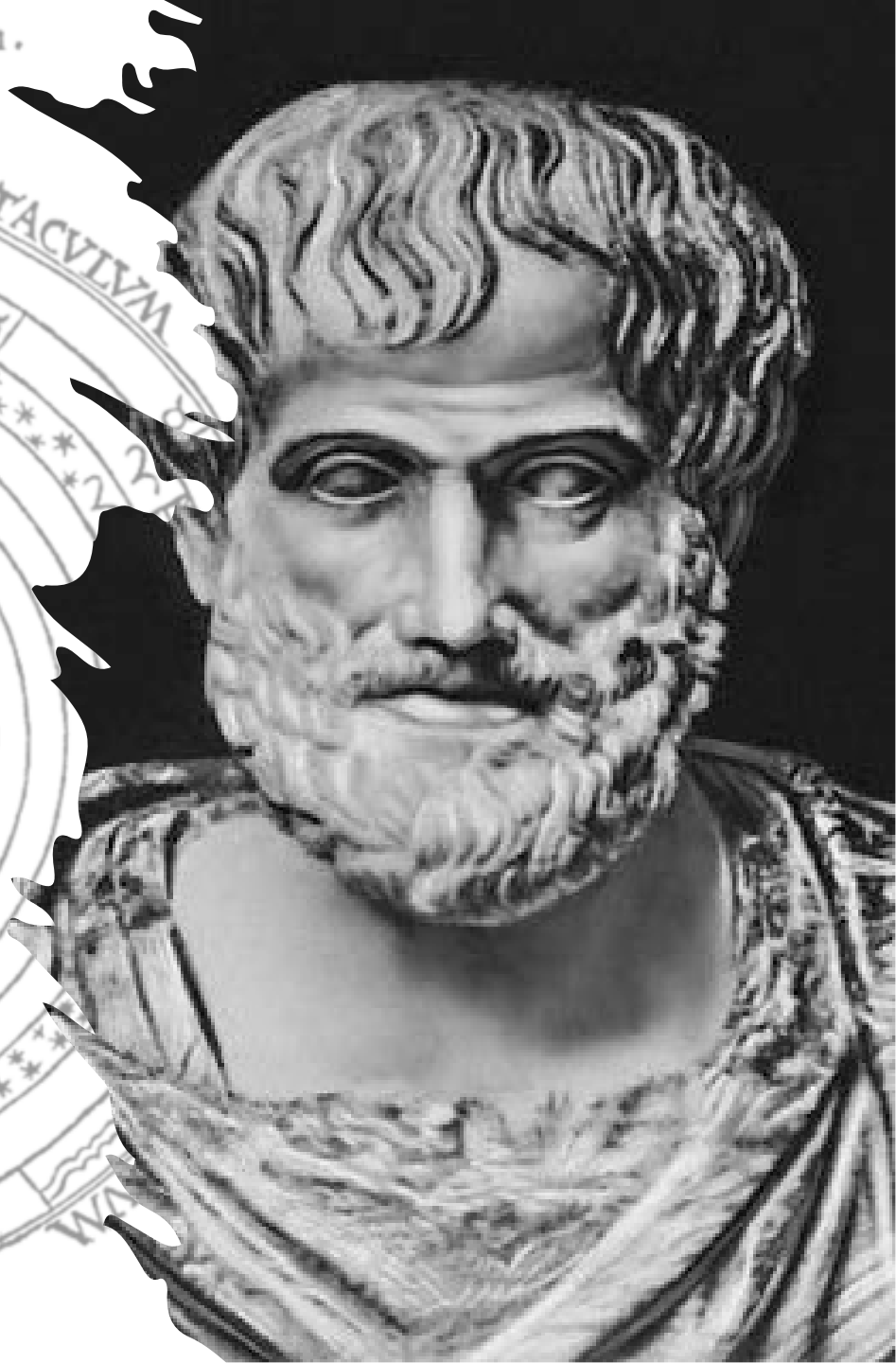
A short history of science and research

Current developments

The professional scientist or researcher

In 1834, Cambridge University historian and philosopher of science William Whewell coined the term "scientist" to replace such terms as "cultivators of science“ or "natural philosophers".

Schema huius præmissæ diuisionis Sphærarum.



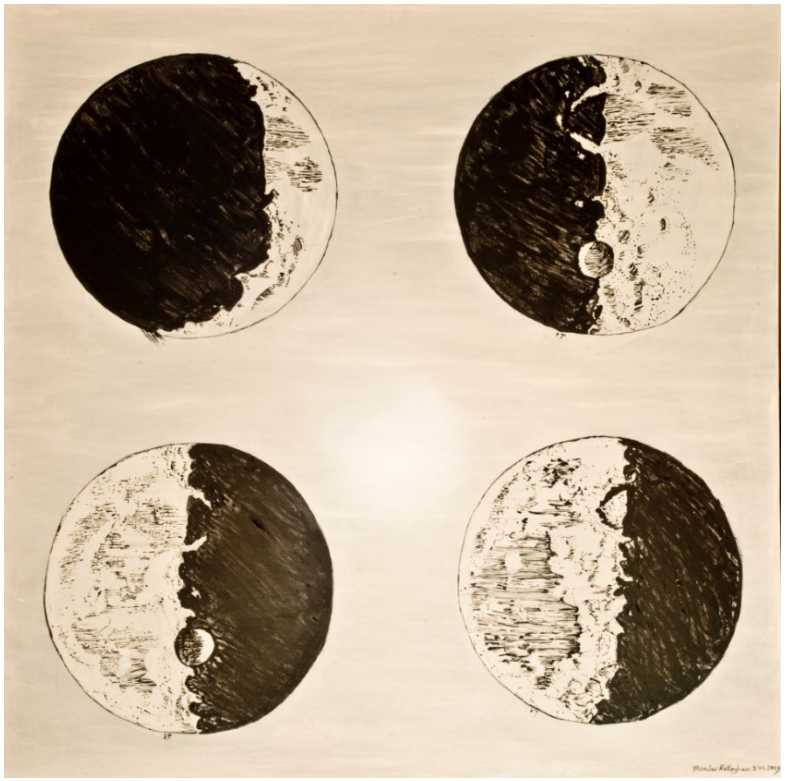
The scientific revolution (16th – 17th century)

- Non-hierarchical character of knowledge: to be valid knowledge was no longer assessed against (religious) doctrines

- Dissapearance of a religious, teleological worldview; focus shifted to observation and empiricism

- Introduction of new detection methods (e.g. a telescope) and procedures (e.g. the experimental method)

The scientific revolution



The steady spread of science (18th cen

- Until ca. 1800 scientists often stood in a personal patronage relationship to a sovereign.
- Throughout Europe ‘learned societies’ are founded (« Royal Society of London for the improvement of natural knowledge » (1662)) and ‘Academieën voor Wetenschap’ (« Académie des Sciences » (1666)).
- Closed nature of science <--------> authority of science
- => science slowly opens for extra-scientific audiences (-> slowly -> upper class)

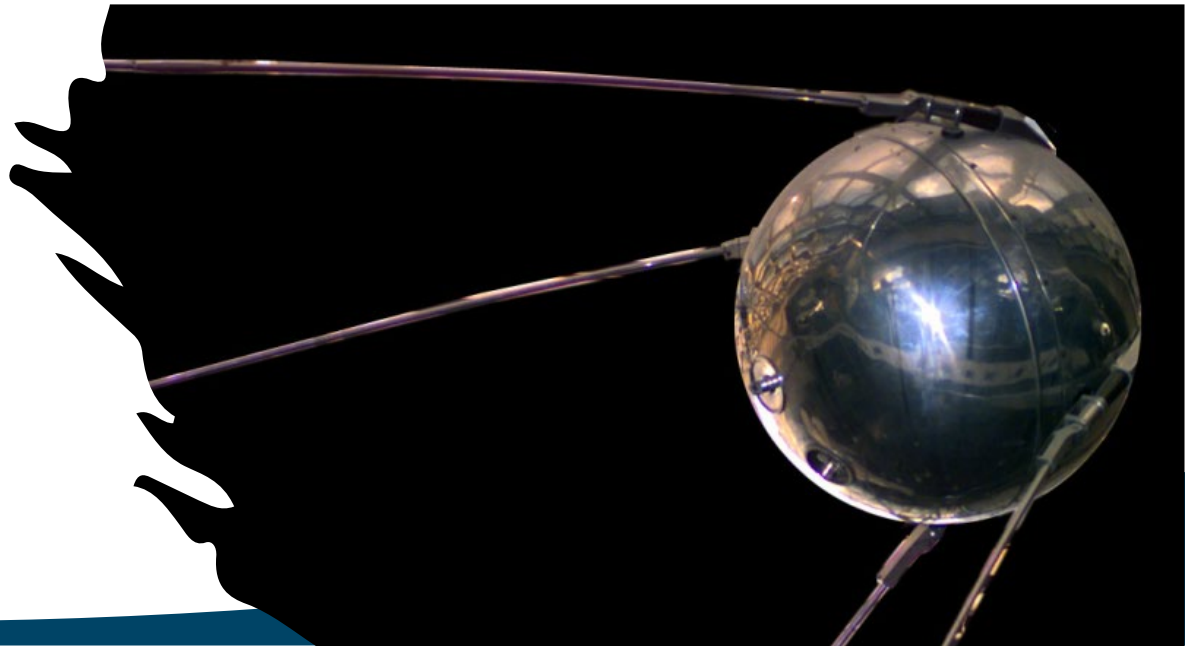
The rise of the research university

- Before 1800: universities were focused on education, not on research -> primary purpose of universities: the preservation of existing knowledge.
- However, from 1800 onwards education was increasingly coupled to research (German universities as precursors)
- Universities developed as the major 'home base' of the scientist. => This strengthened the professional autonomy of science.
- The German model of the research university and the so-called unity of teaching and education was diffused accross Europe and the US.

WWII and the Cold War: 'B

- The relation between science and the state changed substantially during the second world war and after (the cold war).

- Competition with the USSR as regards armament and space research led to a drastic increase in public funding for scientific research, particularly in the US (1950: founding National Science Foundation, 1958: establishment of NASA)



Big Science

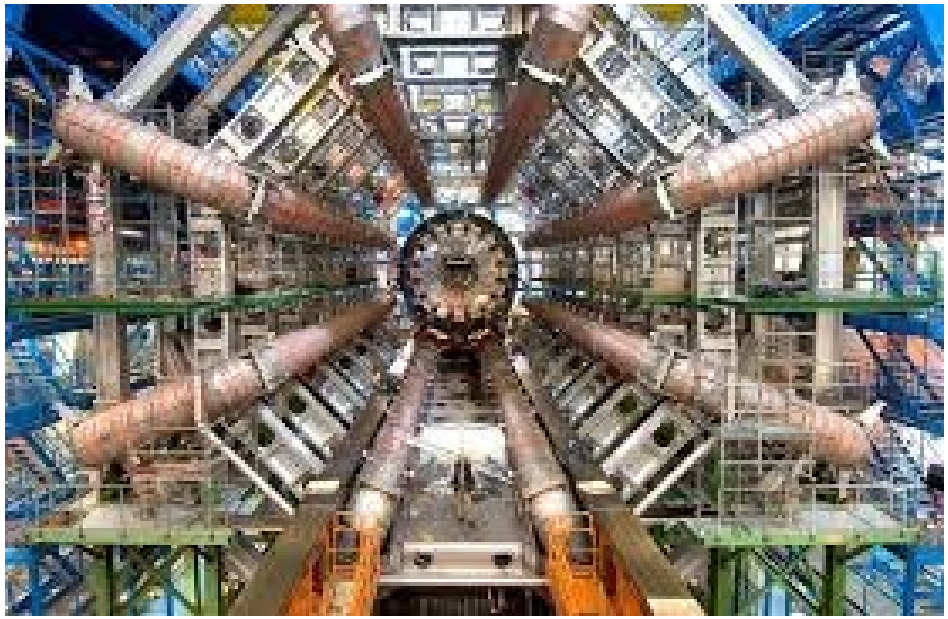
- Artisanal, individual (so-called 'little') science was curtailed in favor of large-scale organized interdisciplinary, project-oriented research, which often focused on national defense and industry.

- In the US, for instance, 70% of industrial research in electronics was funded by the federal government, often for the purpose of military applications (e.g. radar and laser technologies).

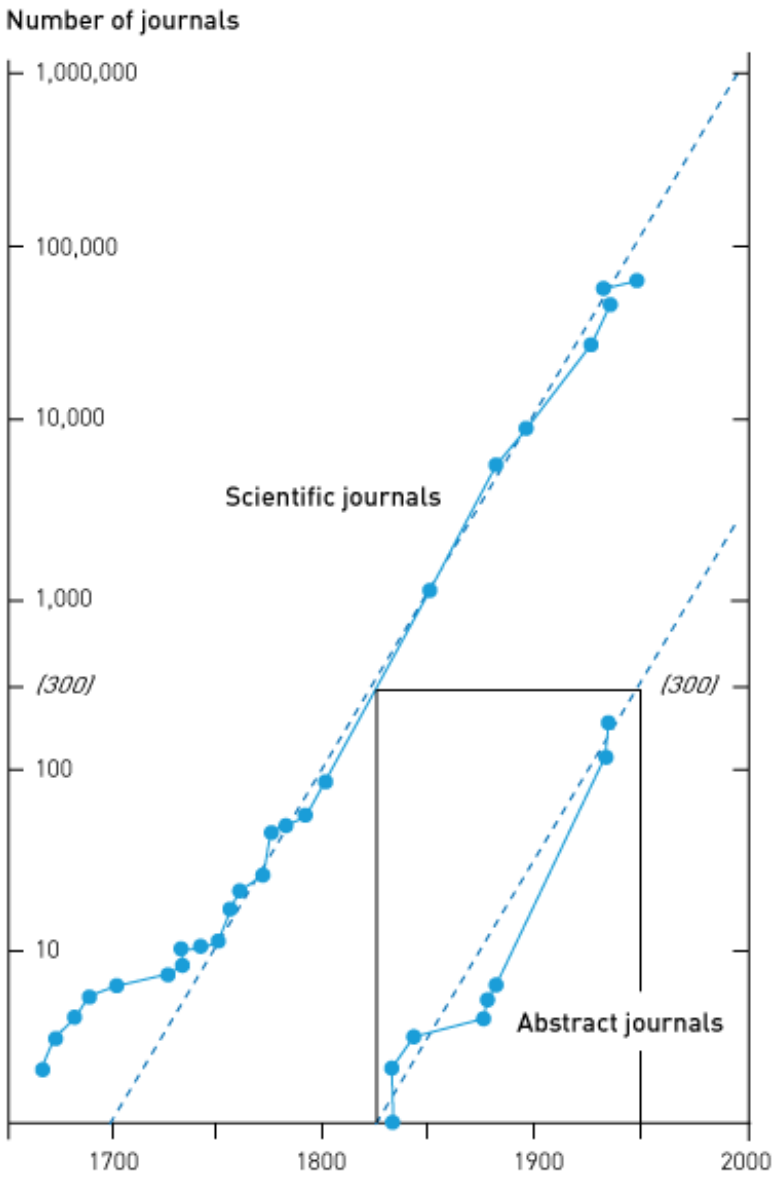
- Strong belief in the potential of 'pure science'.

- Also in Europe: 'big science' arose in the 1950s

  - See e.g. CERN, the institute for higher physics in Genève



Little Science, Big Science (D. de Solla Price, 1963)



About

Academia.edu is a platform for academics to share research papers. The company's mission is to accelerate the world's research.

Academics use Academia.edu to share their research, monitor deep analytics around the impact of their research, and track the research of academics they follow. Over 105 million academics have signed up to Academia.edu, adding 24

Science as a huge, global system of communication

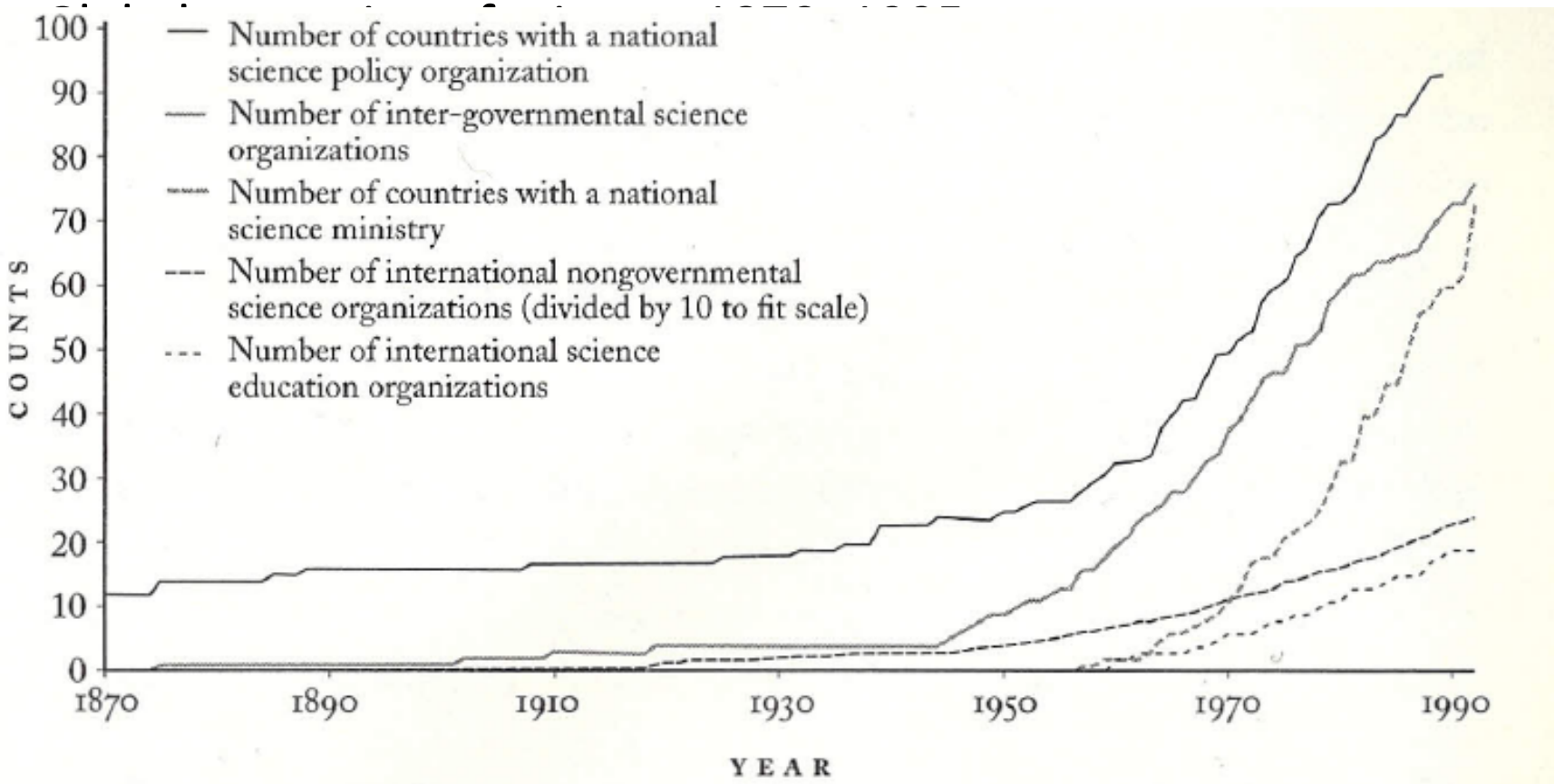


Figure I.1. Worldwide Expansion of Science: Increasing Organization and State Structure, 1870–1995

Overview

Intro : research in a knowledge society

A short history of science and research

Current developments

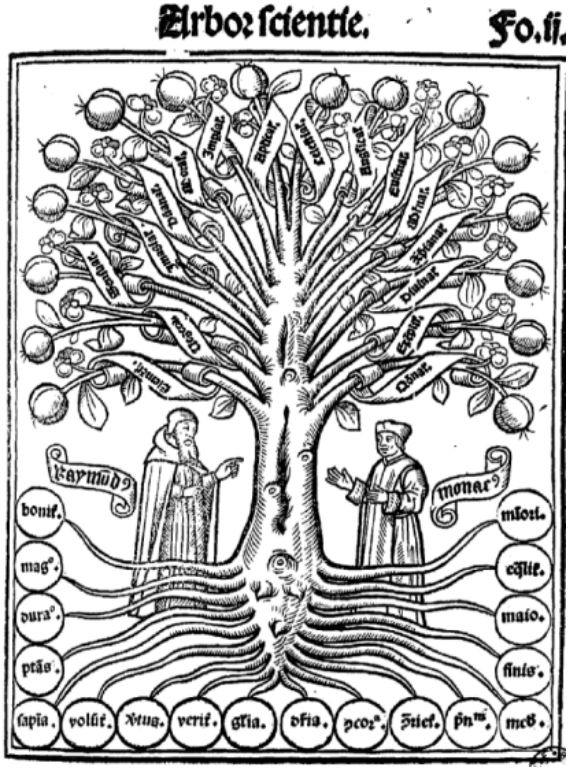
1. Transformations in the organisation of science

2. Transformations in the relation between science and society

1. Transformations in the organisation of science

- Traditional representation of science was derived from the so-called “tree of knowledge,” according to which metaphor knowledge is split into branches, then into major disciplines, and further differentiated into subdisciplines and specialties.

- Modern universities mainly organized their social structure along this model



Disciplines as primary form of organization in modern science (1750-1960)

- 1) at the cognitive level
  - Each discipline is oriented to a central (set of) problem(s)
  - Theories, explanations relevant to these problems
  - Sometimes disciplines have specific methods, although more overlap here
- 2) at the social level
  - Community of specialists, sharing a similar background
  - Social structures (conferences, societies…)
- 3) At the communicative level
  - Publications referring via citations to earlier publications
  - Communities around publication outlets
- 4) At the professional level
  - University system and 'professional organizations' couples research - education (disciplining training and rules) – labour markets (disciplinary careers)

Post WWII : emergence of interdisciplinarity

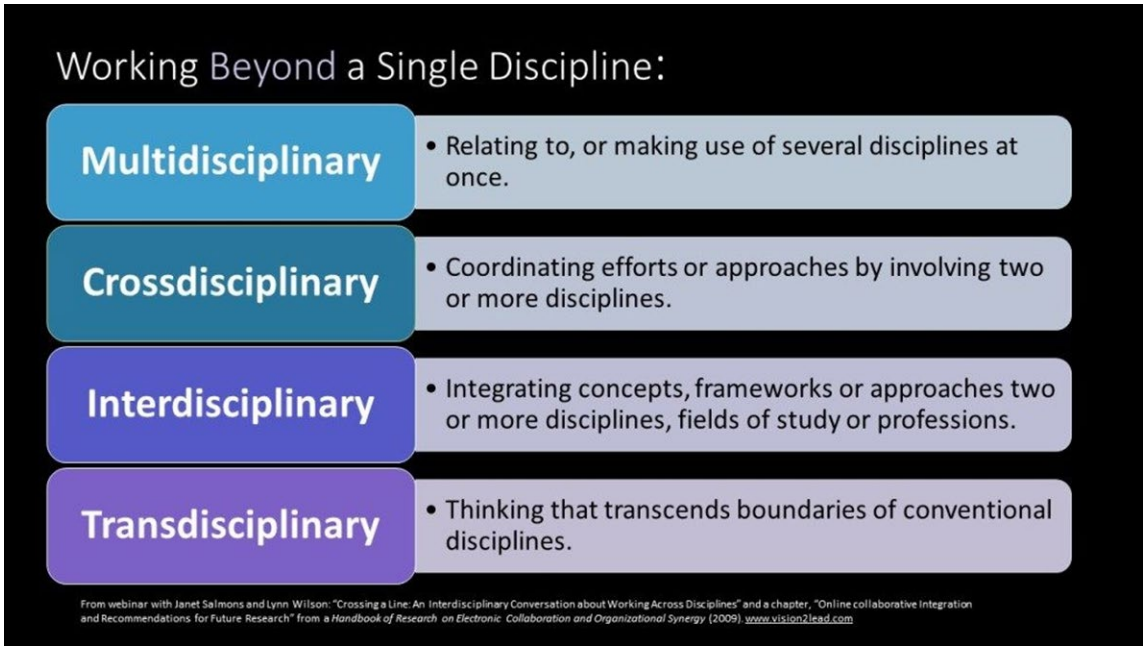
- Incessant proliferation of ever new disciplines / subdisciplines

- Different processes
  - interdisciplinary combinations create novelties
  - Increasing specialization (thematic, methodological, theoretical, etc.)
  - Strategies of disciplines trying to encroach on the domain of other disciplines
  - Globalization of science enables growing specialization (‘small worlds’ at global scale)

- Collaboration structures as the structural form of interdisciplinarity and importance of ‘coauthorship’ (building interdisciplinarity into the individual scientific paper)

Terminology

- The terms multidisciplinary, cross-disciplinary, interdisciplinary and transdisciplinary are used to imply, in increasing order, different degrees of academic disciplinary synthesis and interaction



Dissonance Between the Epistemic and Social Structures of Science

- By now, many scientific activities no longer align with traditional disciplinary boundaries

- Problems that attract scientists' attention are increasingly ill defined, technically complex, and interdisciplinary, requiring expertise in diverse disciplinary traditions

A fragmented field of science

- Universities remain important, but are joined by many other organisations (public and private) doing research
- Social structures of science (e.g. universities) remain predominantly oriented towards disciplines (departments, faculties, etc.)
- Yet, increasing specialization leads to fragmentation : even experts in a particular scientific field (e.g. a sub-discipline) can be considered as ‘well-educated lay people’ at most when it comes down to research findings in other scientific domains
- New interdisciplinary fields such as nanotechnology, environmental or cognitive sciences evolve into “disciplines” themselves
- Yet, most of these new 'disciplines' are more interdisciplinary by nature and science organizations still struggle to fit them into existing structures

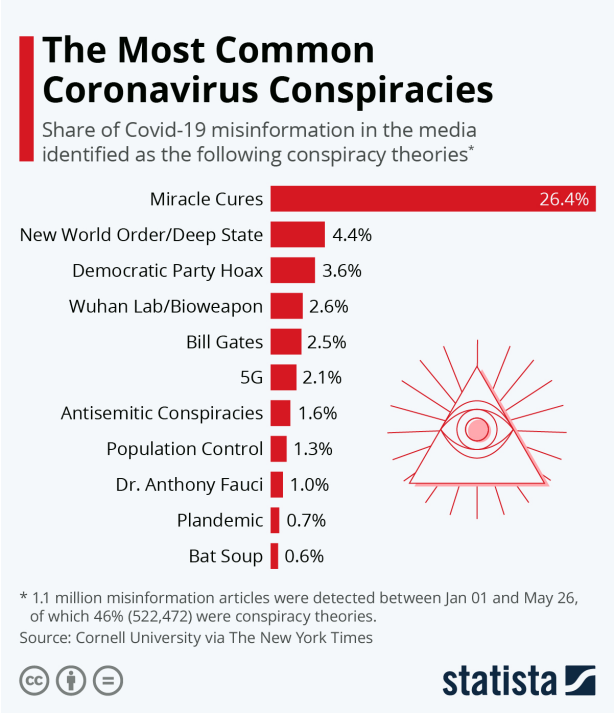
Doing interdisciplinary research?

- Cost and benefits for individual researchers?
  - some research finds that individuals conduct collaborative interdisciplinary work at a cost (i.e., having to mastermultiple areas of scholarship and be reviewed across fields),
  - other research (e.g. on networks, diversity, and recombinant innovation) shows high levels of productivity, originality, and growth associated with cross-disciplinary expert interactions

- Anyhow, forming interdisciplinary collaborations requires time, common investments and many iterations
  - Bottom-up collaborations tend to be more successful than formally assigned interdisciplinary research teams
  - Build in 'time' and 'space' to teach/learn intellectual practices in neighboring domains (e.g., analysis styles and disciplinary languages)
  - Need for a 'common space' in which researchers practically engage one another to work on a common problem and as a basis that organizes their behaviors and activities

2. Transformations in the relation between science and society

Declining trust in science?



Why should we trust scientists?

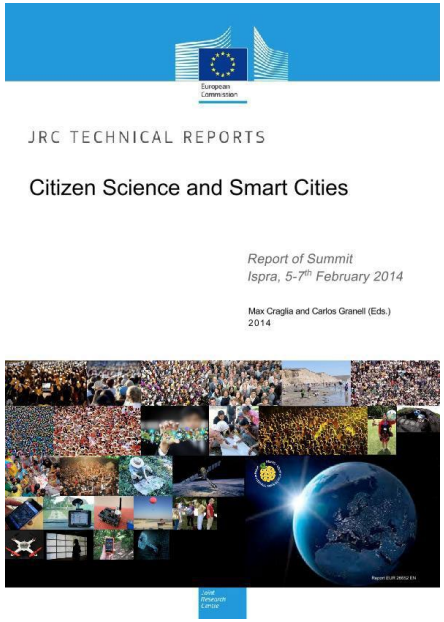
Why should we trust scientists?

- The scientific method?... There any many

- The reliability of science is rather to be found in the ways scientific claims are rigorously tested, vetted or adjudicated. This is a collective and institutional process that is subject to constant adjustment and revision:
    - E.g. peer review
    - E.g. Robert Merton CUDOS-norms (1)'Communism', (2) 'Universalism' (3) 'Disinterestedness' (4) 'Organized scepticism'

- It's not a perfect system, but this collective process differentiates science from hearsay, rumor and opinion

Attempts to reinforce the relations between science and society



www.iedereenwetenschapper.be

Open Science

- European Commission (2015) defined it as “a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools”

- Potential of Open Science (OS) to enhance research and societal impact has been widely discussed within academic and policy circles over the last two decades, and has been underscored by the rapid development of COVID-19 treatments and vaccines— only possible through the immediate sharing of results globally (‘open data’).

- Thank you for your attention
- Success in your future research career!
- For questions, remarks:

Gert.verschraegen@uantwerpen.be