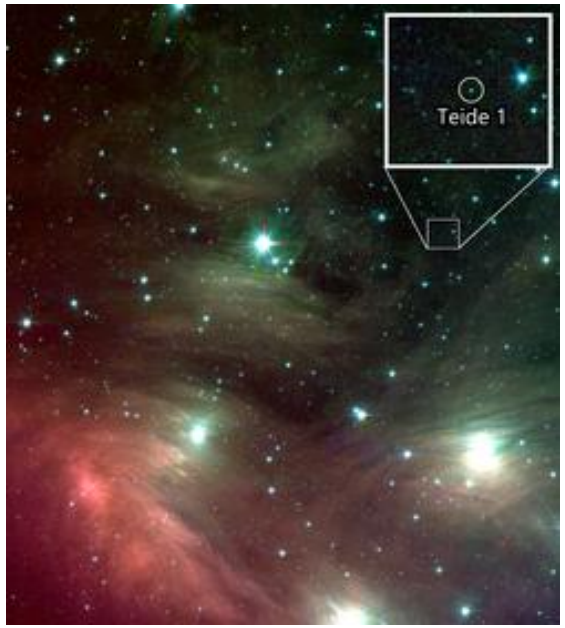
ARTIFICIAL INTELLIGENCE AND SCIENTIFIC ENDEAVOUR

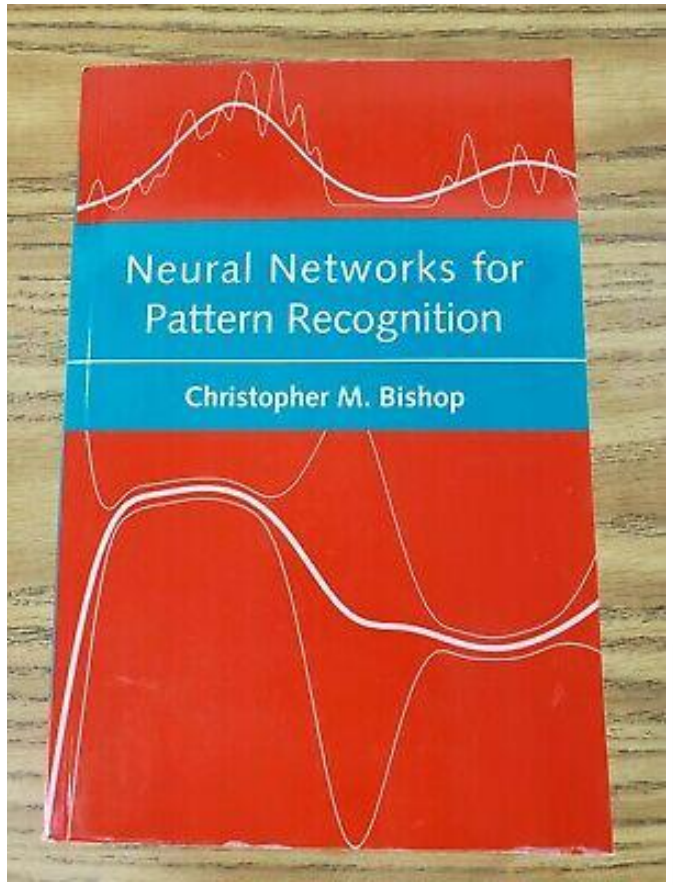
BENEFITS AND CHALLENGES

AMOS STORKEY
SCHOOL OF INFORMATICS
UNIVERSITY OF EDINBURGH

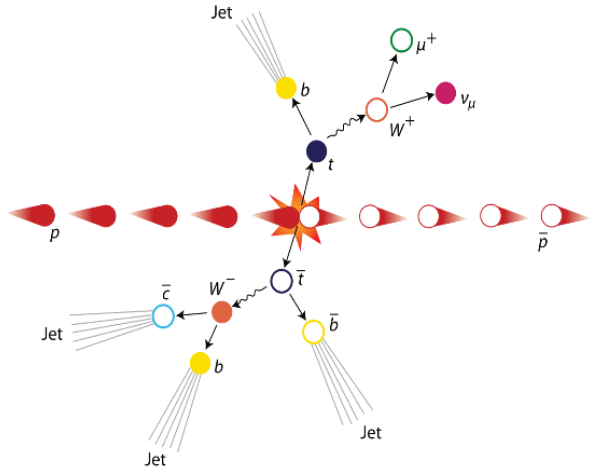
1995


Welcome
Welcome to Windows 95
Did you know...
To open a program, you just click the Start button, and then click the program's icon.
What's New
Online Registration
Close
Microsoft
Microsoft
Windows 95


Teide 1


Neural Networks for
Pattern Recognition
Christopher M. Bishop


New
Cool
Headlines
Popular
Yahoo!
Write Us
Add URL
Random
Info


Jet
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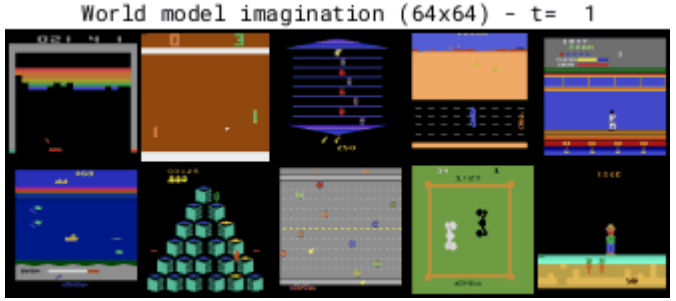
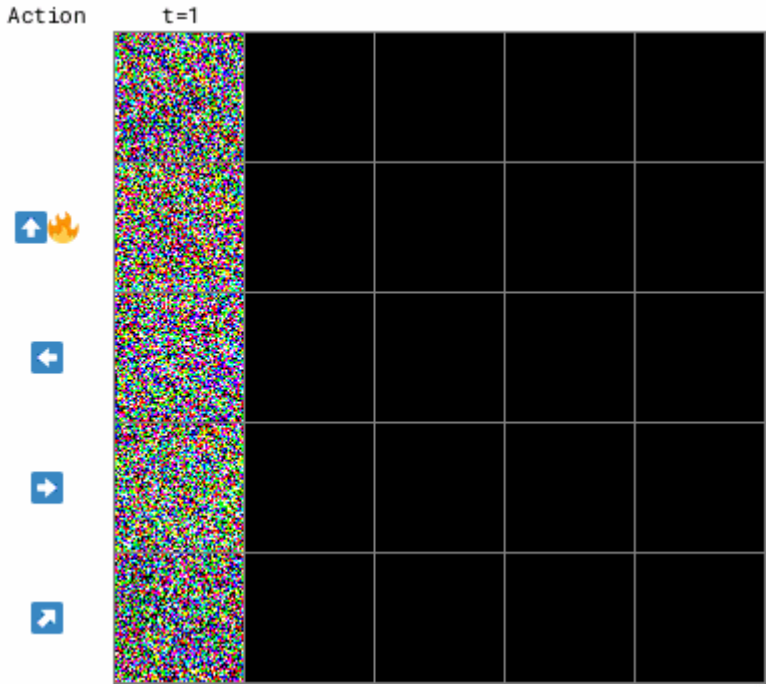
AI TODAY?

- DIAMOND: https://diamond-wm.github.io/





- Counterstrike Global Offensive. But does it understand geometry?
- Well yes... and no

Eloi Alonso, Adam Jelley, Vincent Micheli, Anssi Kanervisto, Amos Storkey, Tim Pearce, François Fleuret (2024) Diffusion for World Modeling: Visual Details Matter in Atari. Neurips 2024.

GENERALISATION AND GEOMETRY

THE PLAN

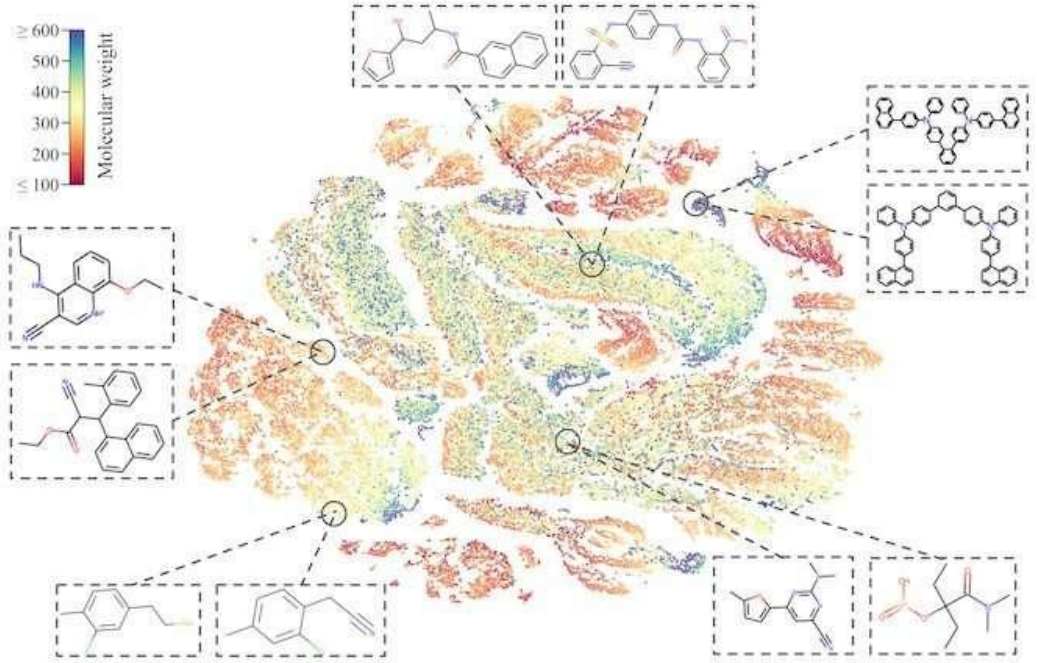
- AI and SCIENCE
- AI and SCIENTIFIC SOCIETY
- AI and the FUTURE

AI AND SCIENCE

AI, SCIENCE, AND MEDICINE

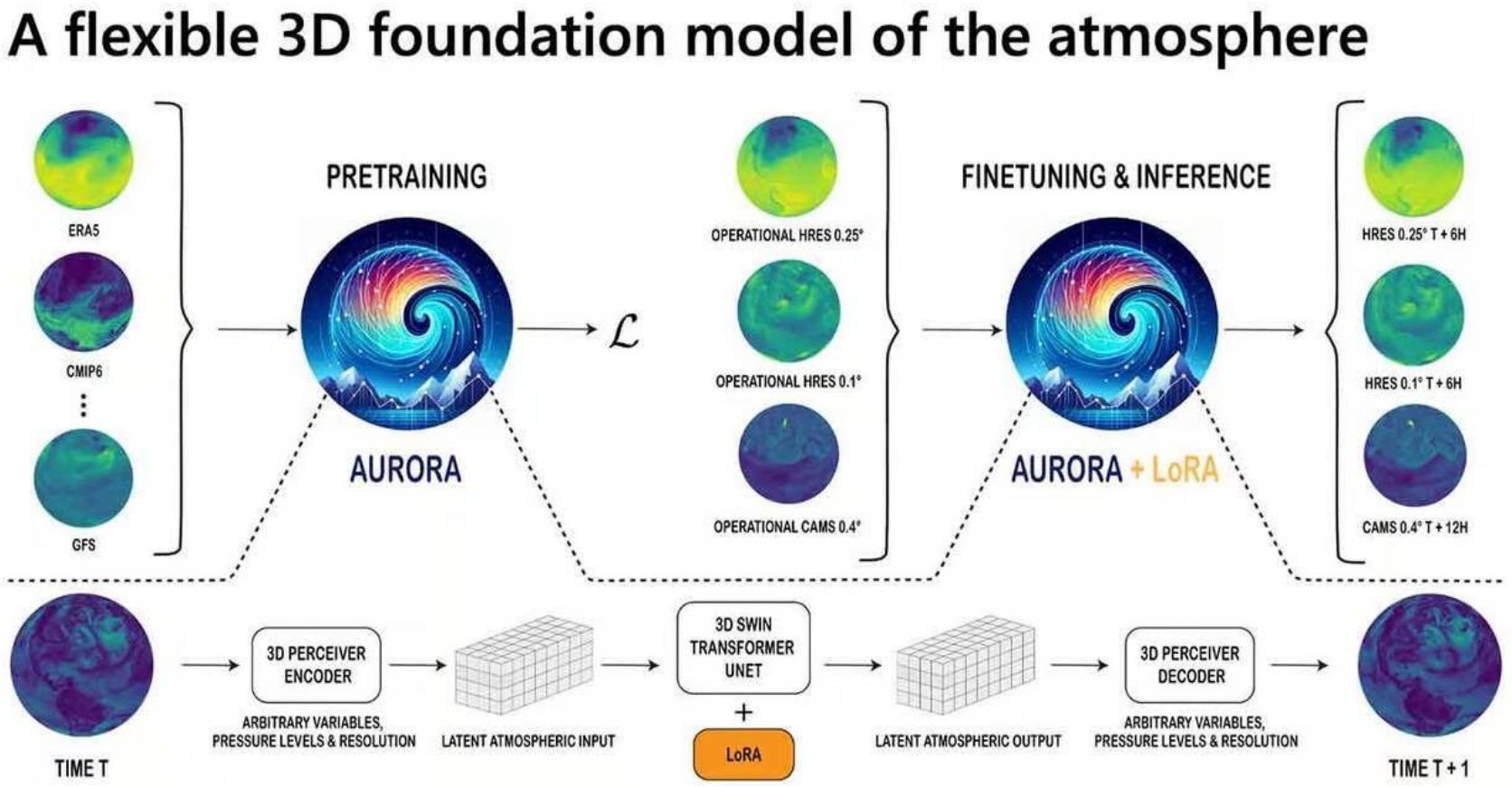
- Physics:
  - Emulators, Learning symmetries, finding Hamiltonian embeddings, detectors and analysers.
- Chemistry:
  - Molecular dynamics, molecular discovery, property prediction.
- Biology:
  - Systems biology, protein folding, modelling cellular growth and regeneration, computational neuroscience
- Informatics:
  - ML4Sys, language generation, programme discovery.
- Geosciences:
  - Weather systems, remote sensing, ice dynamics, ocean dynamics, digital twins.
- Medicine:
  - Drug discovery, predictive precision medicine, epidemiology, screening programmes.

Search, emulators, representation, generative models, risk, assimilation



From Wang et Al (2022) Molecular Contrastive Learning of Representations via Graph Neural Networks

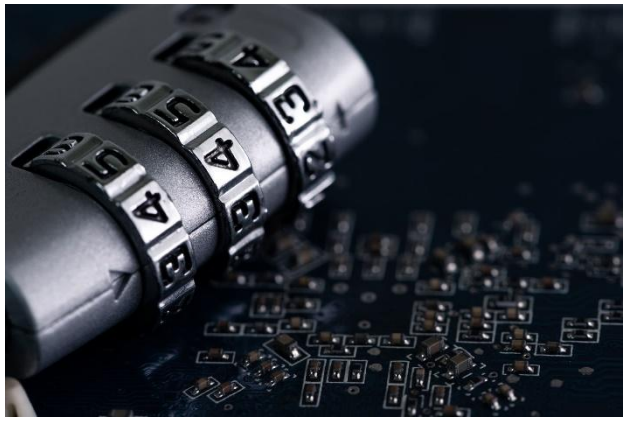
EXAMPLE: AURORA



From Bodnar et Al (2024) [Aurora: A Foundation Model of the Atmosphere]

AI AND SCIENCE: THE CHALLENGES

Speed of change



Data ownership

Perceived value of computation expertise

Privatization of science

Public AI engines?

Foundational AI v. AI applications?

Pay and value discrepancy

AI AND SCIENCE: SCIENTIFIC ACTIVITY

AI impacts science activity communication:

- Move beyond the paper model of scientific activity
- AI tools for planning, execution and evaluation: AI Assistants.
- Expansive models. But explainability? On human terms? Does that limit science?

Problems of the AI technology landscape

- Faking, cheating, deceptive use
- Variability collapse – lack of diverse thinking
- Control of small number of companies over thought
- Efficient tooling may reduce variance but increase bias
- Evaluation, understanding, interpretation

AI AND SCIENCE: SCIENTIFIC PROGRESS

- Lu et Al (2024) The AI Scientist: Towards Fully Automated Open-Ended Scientific Discovery. (Sakana AI – Nvidia backed)

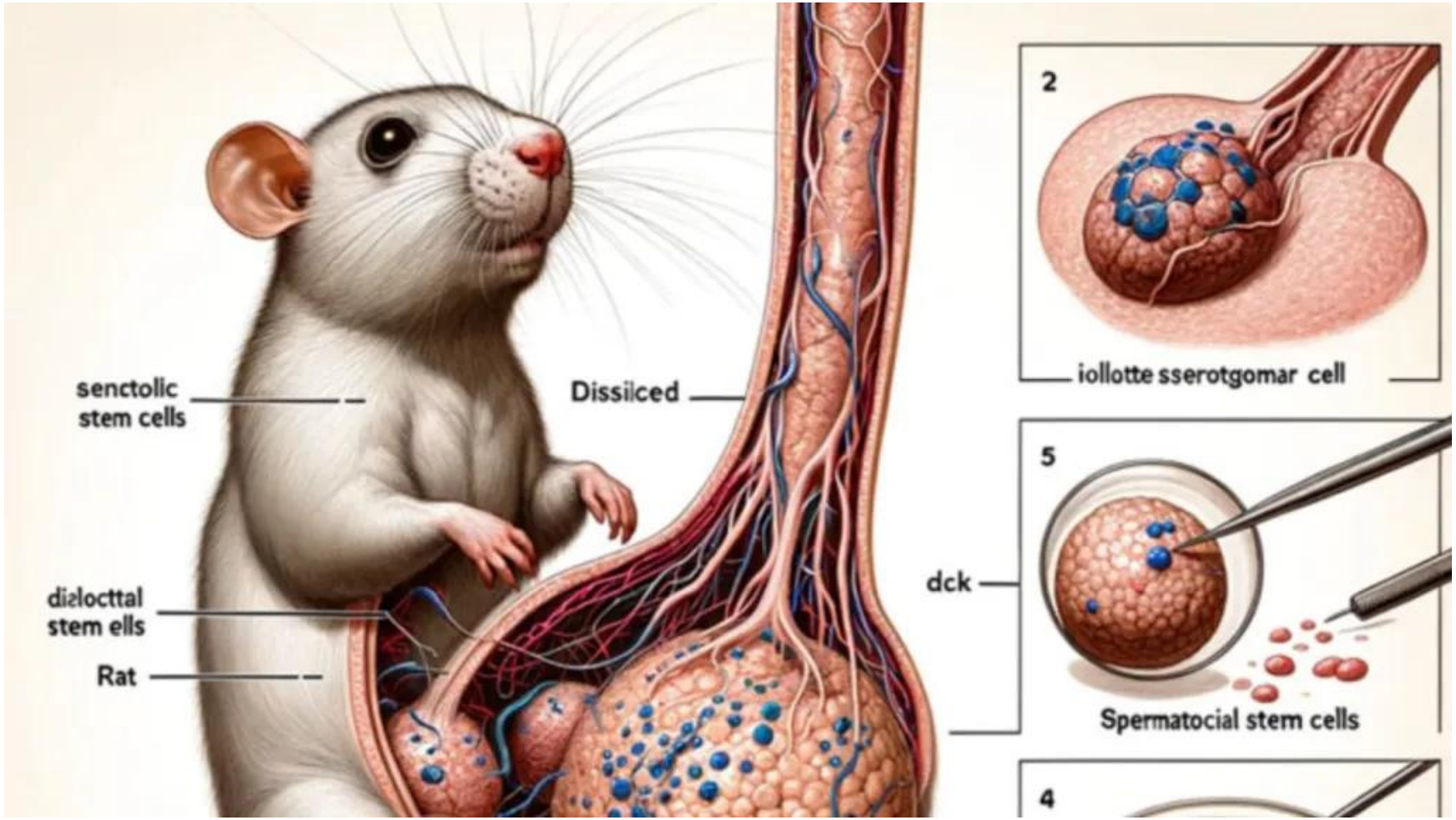
- Future science will need AI tooling – like current science needs computation.
- **But** will there be a shift in what it means to "understand"? What is scientific knowledge? Whose knowledge?
- Human knowledge versus AI agent knowledge? Keeping the human in science?

- Making AI work for human scientific endeavour

AI AND SCIENTIFIC SOCIETY

THE RAT

RETRACTION: THE OVER-ENDOWED RAT



AI AND SOCIETY: AUTOMATION

- AI, automation, deception, control.
- Large language models etc. are cheap and effective. Likely they:
  - Will further find their way into the writing of papers and proposals
  - Will further find their way into reviewing of papers and proposals
  - Will further direct the scientific enterprise towards AI-easy activity
  - Will replace humans at various points of the science process
- But they also are / will be:
  - Used to spam journals and conferences with fake papers
  - Used to create review and editor rings, fake reviewers etc.
  - Be easily leveraged or gamed to favour more powerful manipulative players
  - Reduce human-to-human interaction in scientific endeavour

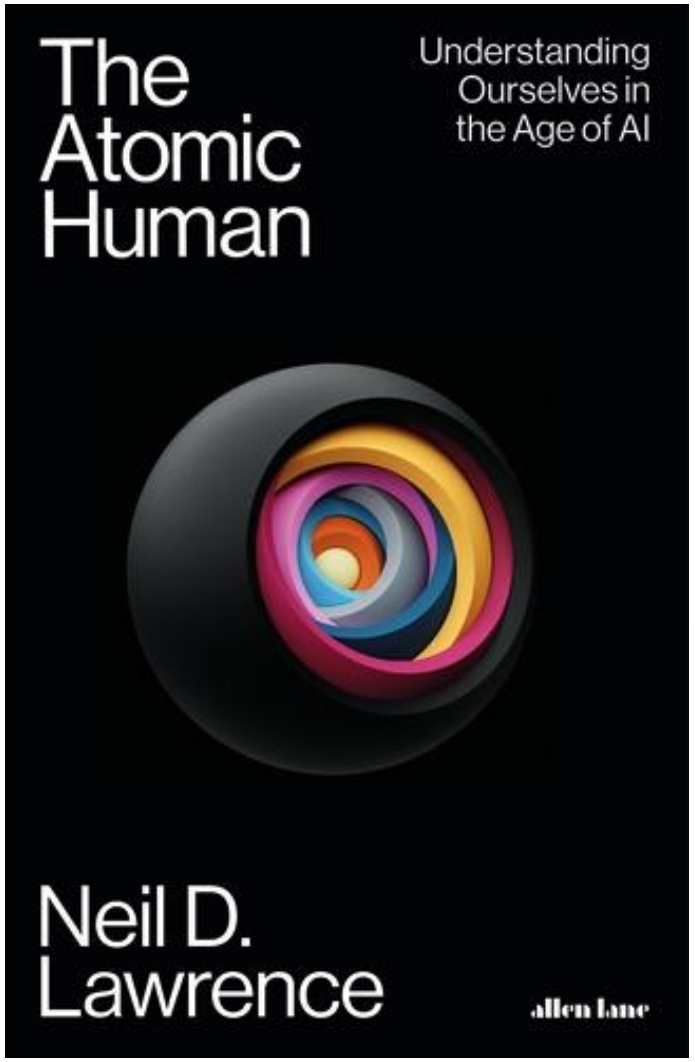
AI AND SOCIETY: FIRMS AND LARGE MULTINATIONALS

- The firm: an organism more powerful and more capable than individual humans

- Current: humans symbiotic in companies. Human workers, human owners, human customers
- Direction of travel: large internet companies built around automation.
  - Business scaling not about employees
  - High level of control of human capital
  - High economic control – "reinvest" rather than dividend
  - Finger in every pie. Including science.
- Future: B2B market growing massively compared with B2C market
- Potential for human-out-of-the-loop corporate environments dictating economy

ARTIFICIAL GENERAL INTELLIGENCE?

- Careful:
  - Concept of AGI is dubious. Concept of intelligence is dubious. Not one thing
  - Neil Lawrence: the idea of AGI is a re-emergence of eugenic thinking. Need to know what it means to be human.
  - But impact from AI and automation doesn't require "intelligence". It simply requires acquiescence.
  - We have given power to automation, process, organisations for centuries.
  - We, the people, choose to.



AI AND THE FUTURE

- Making AI work for people; making science work for people
- Making AI work for human scientific endeavour

- Companies are not necessarily on our side...

- Centralised data-assimilating AI?

- Or a distributed human-centric AI in Science? Human-aiding tooling, locally controlled, with use informed by knowledgeable users.

AI AND EUROPE

- What should European AI look like?
- Not competing at the large-internet-company monolithic-AI game.
- Something else – a distributed AI infrastructure at the edge.
- An AI economy of small lean communicating but distributed AI agents.
- In science – we want people to adapt and mould AI to aid their scientific curiosity. The way they see it. Not the way they are told to see it.

AI AND US: GOING FORWARD REALISTICALLY

- What should we embrace, what should we guard against, what should we change? And how?
- How do we harness the good? Resourcing, emphasis, engagement, collaboration
- The power and futility of regulation.
- Technological defences.
- The power of education?
- Emphasis on science as human endeavour not disembodied knowledge?
- Distributed collaborative edge AI: AI in the control of people not companies?
- Data ownership, data sharing.

BREAKOUT

- REPORTS:
  - International Science Council
    https://council.science/news/ai-in-science/
  - Royal Society
    https://royalsociety.org/news-resources/projects/science-in-the-age-of-ai/
- QUESTIONS and ACTIONS:
  - How do we protect the scientific endeavour from the more dubious AI scams?
  - How do we change the funding, collaboration and reviewing landscape to enable the right kind of AI advances?
  - How to we ensure that automation and AI enhances human inquisitiveness and drive for understanding?
  - How do we avoid a dominance of a few large agents (e.g. large multinationals) in determining our Scientific directions?
  - What sort of AI research helps to empower people rather than reduce them?
  - How do we build better collaborations between Scientists and AI researchers?
  - How should we view large companies trying to dominate in control over AI?
  - How do we enable a European AI strength and agenda?
  - What is our vision and hope for what Science should look like in 15 years time? And AI?