



Artificial Intelligence and a Politically Sustainable Economy

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How do we govern the use of AI?
What is AI?

Intelligence is the capacity to do the right thing at the right time – to perceive and to act.

Artificial Intelligence is a trait of artefacts, deliberately built to facilitate our intentions.

Nothing about intelligence changes responsibility for that deliberate act.

Intelligence is computation—a transformation of information. Not math.

Computation is a physical process, taking time, energy, & space.

Finding the right thing to do at the right time requires search.

Cost of search = # of options^{# of acts} (serial computing).

Examples:

- Any 2 of 100 possible actions = $100^2 = 10,000$ possible plans.
- # of 35-move games of chess > # of atoms in the universe.

Concurrency can save real time, but not energy, and requires more space.

Quantum saves on space (sometimes) but not energy(?)

Omniscience (“AGI”) is not a real threat. No one algorithm can solve all of AI.

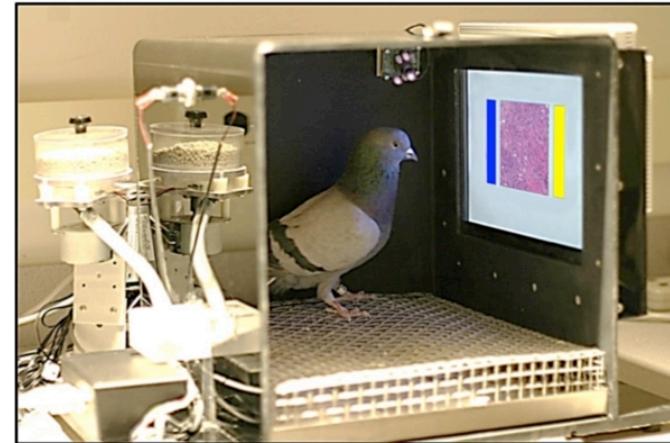
Viv Kendon, Durham



Artificial General Intelligence is a
myth. (well, several myths).

Natural Intelligence Is Not General

- Early theory of psychology (**Behaviorism, Skinner 1913**): Any stimulus could provoke any response.
- Scientists proved their own theory wrong.
- This is how & why science works.



Pigeons learn to peck for food, flap wings to avoid shock.
Pigeons **cannot** learn to peck to avoid shock, or to flap wings for food. (**Gallistel et al 1991**)

Humanity's winning (ecological)
strategy exploits concurrency –
we share what we know, mining
others' prior search.

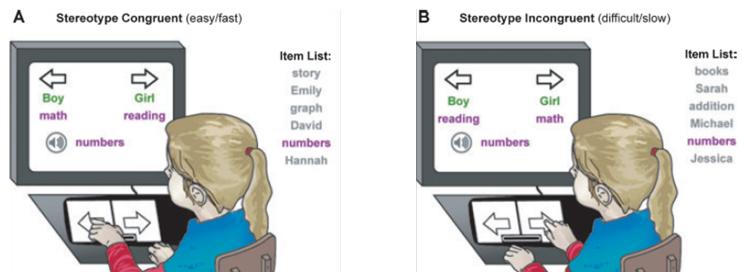
Now we do this with machine
learning.



AI is already “super-human” at chess, go, speech transcription, lip reading, deception detection from posture, forging voices, handwriting, & video, general knowledge and memory.

This spectacular recent growth derives from using ML to exploit the discoveries (previous computation) both biological and cultural.

AI Trained on Human Language Replicates Implicit Biases, Reality



Gender bias [stereotype]

Female names: Amy, Joan, Lisa, Sarah...

Male names: John, Paul, Mike, Kevin...

Family words: home, parents, children, family...

Career words: corporation, salary, office, business, ...

Original finding [N=28k participants]: $d = 1.17, p < 10^{-2}$
Our finding [N=8x2 words]: $d = 0.82, p < 10^{-2}$

Caliskan, Bryson & Narayanan
(*Science*, April 2017)

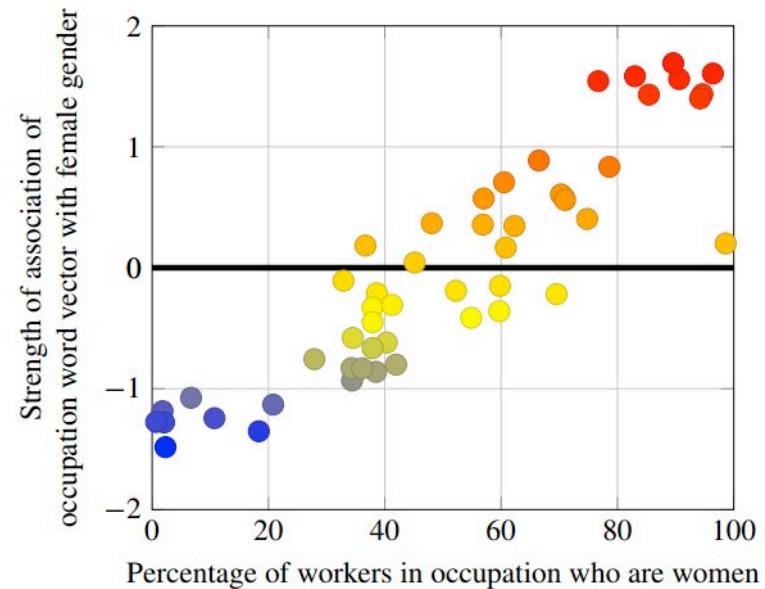
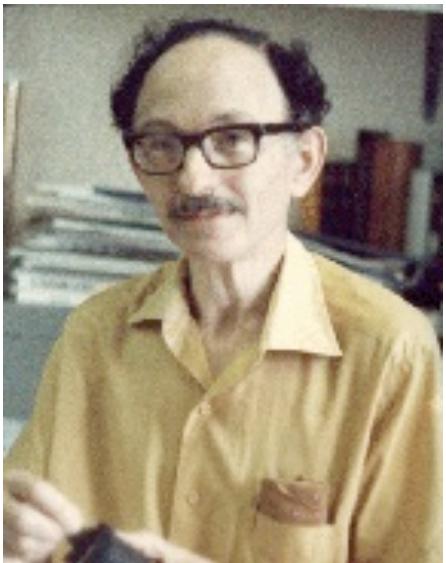


Figure 1. Occupation-gender association
Pearson's correlation coefficient $\rho = 0.90$ with $p\text{-value} < 10^{-18}$.

2015 US labor statistics
 $\rho = 0.90$

The Intelligence Explosion aka Superintelligence



I J Good (1965)



Nick Bostrom (2014)

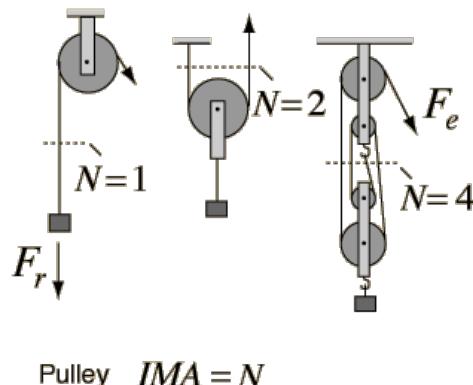
Self improving (machine) intelligence.

Exponential growth.

Unintended consequences derived in pursuit of designed priorities.

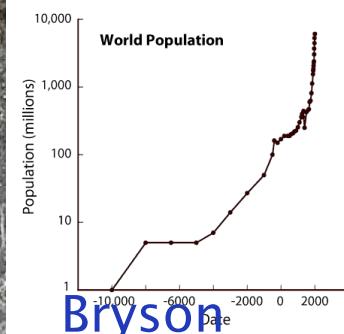
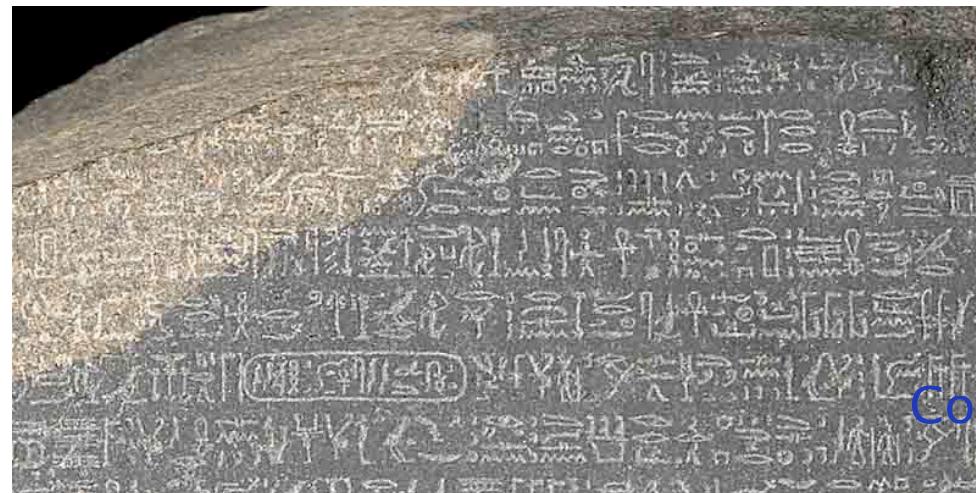
Superintelligence
is not a myth.

12,000 years of AI



If we accept that **intelligence** can be decomposed (e.g. action, perception, motivation, **memory**, learning, reasoning)...
Then every machine and especially writing have been examples of **AI**.

The “intelligence explosion” is us—
AI-boom!
AI-enhanced humans.



Bryson
Collective Agency
2015

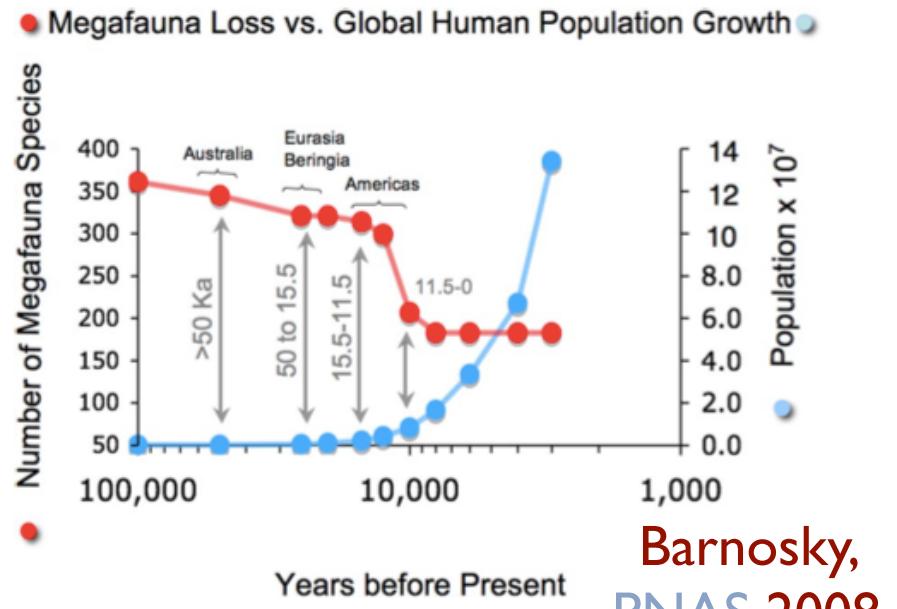
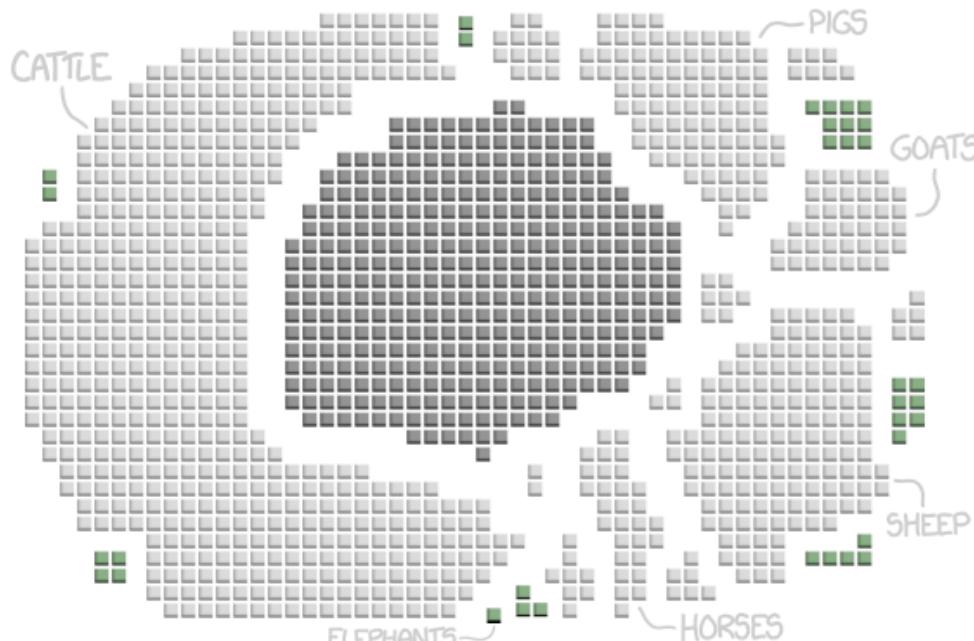
Sustainability

xkcd

EARTH'S LAND MAMMALS BY WEIGHT

■ = 1,000,000 TONS

HUMANS OUR PETS AND LIVESTOCK WILD ANIMALS



Unanticipated Consequences

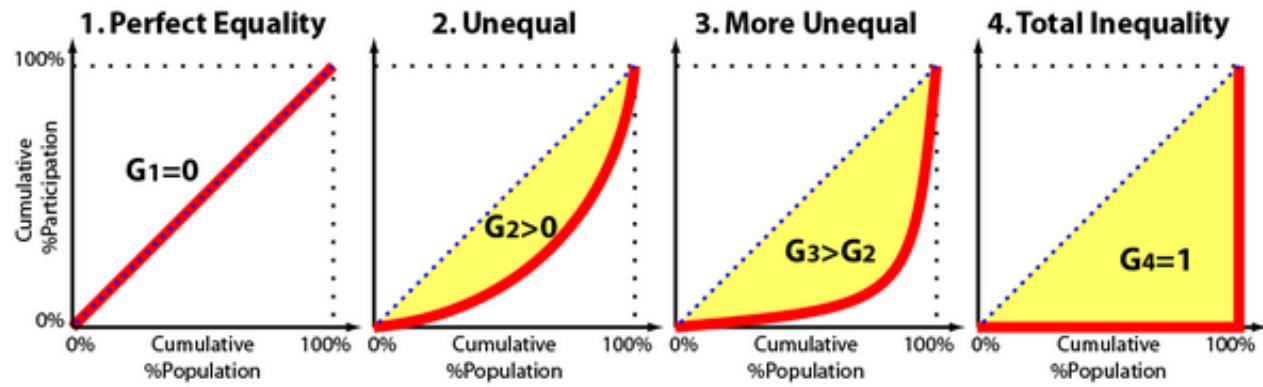
Challenges of AI / ICT

- Massive Investments in China and the USA
- Social Disruption
 - Empowerment of individuals.
 - Rapid formation of new social identities.
 - Dissipation of distance leading to:
 - communication of wealth and power across national borders.
 - concentration of wealth / business ⇒ inequality

The Gini Coefficient is half of the relative mean absolute difference in wealth.

$$\frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2n \sum_{i=1}^n x_i}$$

Inequality Matters

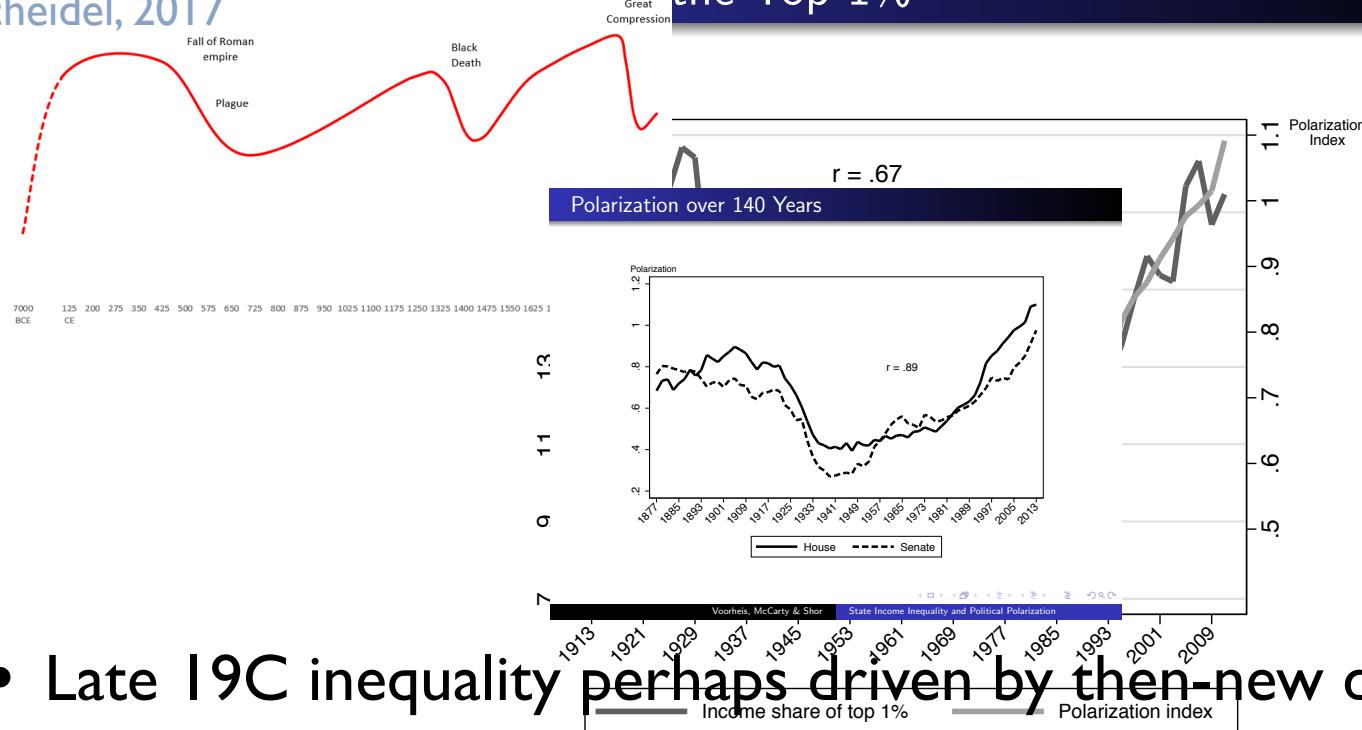


Empirically,
Gini = .27 ~ ideal.

0 is too low, (need to reward excellence);
.3-.4 social disruption;
> .4 economies decline.

We've Been Here Before

Scheidel, 2017



- Late 19C inequality perhaps driven by then-new distance-reducing technologies: news, oil, rail, telegraph; now bootstrapped by ICT?
- Great coupling – period of low inequality where wages track productivity – probably due to policy. **We can fix this.**

Governing AI isn't that different
from just governing.

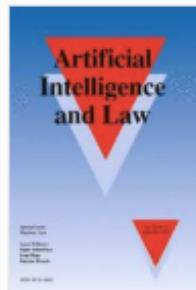
Regulating AI is very like
regulating software in general.

Transparency and Accountability

- In the **worst** case AI is as inscrutable as humans.
 - We audit **accounts**, not accountant's synapses.
 - AI facilitates mandating **transparently-honest accounts**.
 - Fully document the **software engineering process**, **data** and **training**; log the system's performance.

What Matters Is Human Accountability

- Law and Justice are more about dissuasion than recompense.
- Safe, secure, accountable software systems are modular – suffering from isolation or loss in such is incoherent.
- No penalty of law against any artefact (including a shell company) can have efficacy.



[Artificial Intelligence and Law](#)

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Of, for, and by the people: the legal lacuna of synthetic persons

Authors

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Joanna J. Bryson , Mihailis E. Diamantis , Thomas D. Grant

Bryson, Diamantis & Grant
(*AI & Law*, September 2017)

AI, Employment, and Wages

- We have more AI than ever, & more jobs than ever (Autor, 2015, “Why are there still so many jobs.”)
- AI **may be increasing inequality**, by making it easier to acquire skills. This reduces an aspect of **wage differentiation** – a factor believed to benefit redistribution.
- Example 1: There are more human bank tellers since ATMs, because each branch has fewer, so branches are cheaper, so more branches.
 - Tellers are now better paid, but **fewer branch managers**, who used to be really well paid.
- Example 2: There aren’t enough truck drivers, because it’s no longer a well-paid job.
 - GPS + power steering = **anyone can do it**.

Public Goods Investment

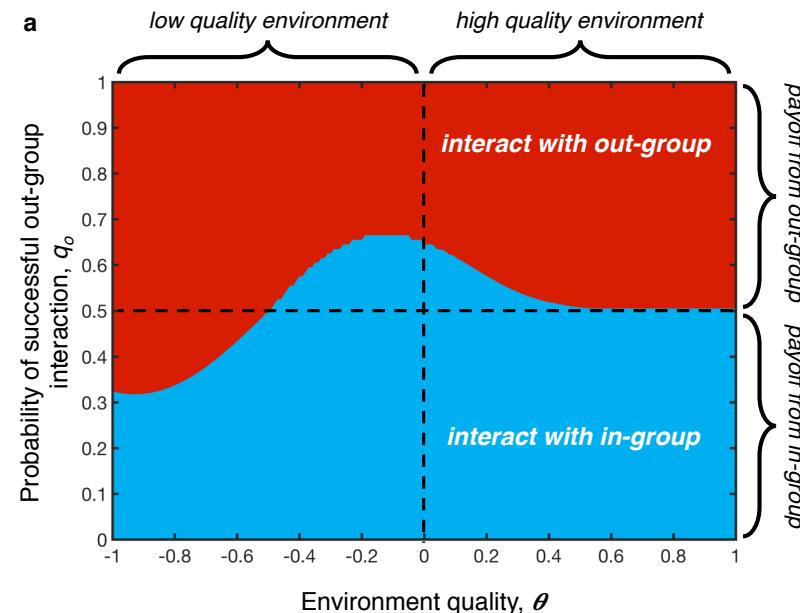
- Public Goods are those with no one clear owner. Examples: bridges, clean air, public health, grazing commons.
- None are really entirely public, just different levels of control / access compared to conventionally private goods.
- Therefore it makes sense to invest, provided those who invest are at least slightly more likely to benefit (or others who behave like them because of them).
- Hamilton's Law: cooperation is feasible where:

$$cost_i < \sum_{j=0}^N (benefit_j \times relatedness_{ij})$$

When should you invest in the public good?

- Trick question: no single solution.
- Tradeoffs determined by costs and benefits, and other investment options.
- Heuristic: in a **good economy**, may want to focus on growing the pie, in a **weak economy**, may feel safer focussing on yourself (fighting for a bigger slice / wedge of pie, cf. Stewart, McCarty & Bryson in prep; Bryson, Mitchell, Powers & Sylwester 2014).

$$cost_i < \sum_{j=0}^N (benefit_j \times relatedness_{ij})$$



Conclusions

Should we regulate AI?

- Yes – we already do. All commerce is regulated.
- We just need to do it **better** – accommodate AI.
- Expect those who build and use AI to be **accountable**, to be able to prove **due diligence**.
- Work with and innovate **governments** to ensure adequate **redistribution** (investment in infrastructure).

Thanks to my collaborators, and to you for your attention.



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