



ADVISOR 2019 SYMPOSIUM

**Fashion Island Hotel
Newport Beach, California**

March 11-13 2019

At the Nexus of Financial and Technological Innovation

Cam Harvey, PhD

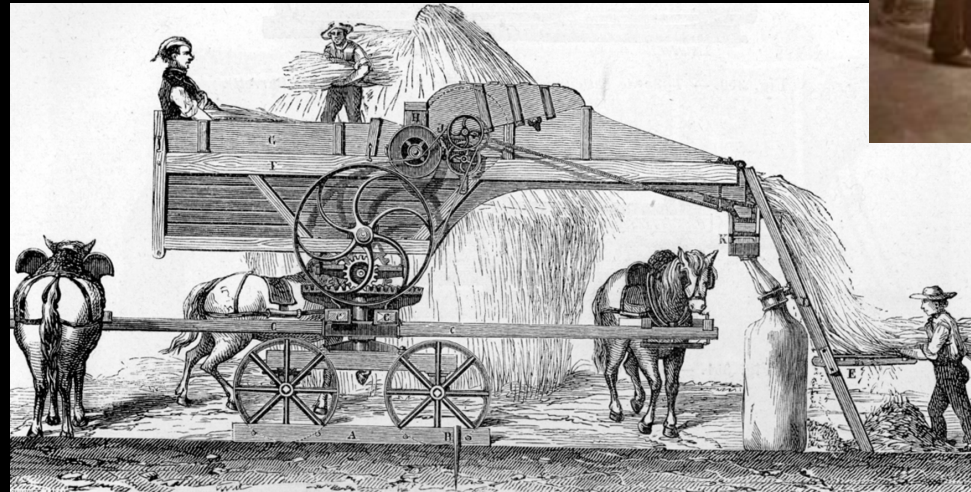
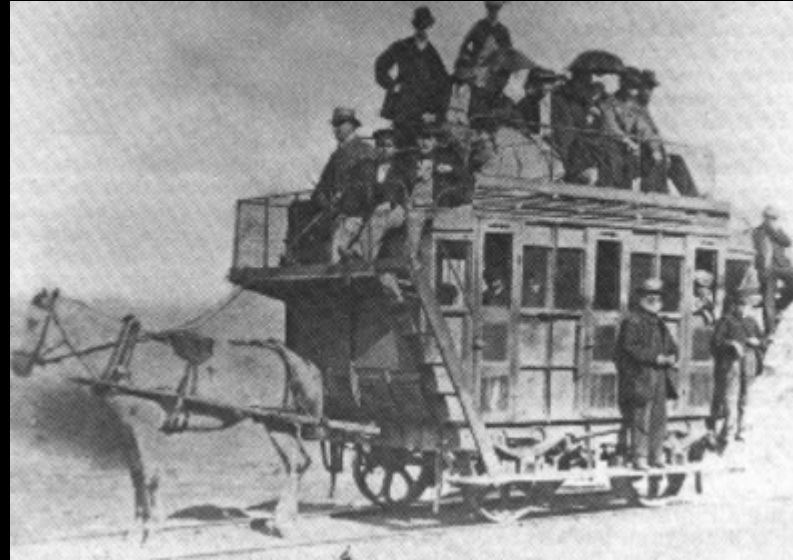
Partner and Senior Advisor, Research Affiliates
Professor, Duke University



THE GREAT HORSE MANURE CRISIS OF 1894

Horses

- Late Victorian England, 3.3 million working horses
- 1893 there were 300,000 working horses in London



Horses

- Each horse producing 15-35 lbs of manure every day
- About 4,000 tons left on the streets every day
- Not just the manure, the average life of a working horse was 2-3 years – so many carcasses abandoned on the streets

Horses

- 1894 Times of London:

“In 50 years, every street in London will be buried under nine feet of manure.”



Horses

1915 London:

- No horses used for trams or cabs
- The motor carriage is the technological disruption

DISPENSE WITH A HORSE



and save the expense, care and anxiety of keeping it. To run a motor carriage costs about $\frac{1}{2}$ cent a mile.

THE WINTON MOTOR CARRIAGE

is the best vehicle of its kind that is made. It is handsomely, strongly and yet lightly constructed and elegantly finished. Easily managed. Speed from 3 to 20 miles an hour. The hydrocarbon motor is simple and powerful. No odor, no vibration. Suspension Wire Wheels. Pneumatic Tires. Ball Bearings.

Price \$1,000. No Agents.

Send for Catalogue.



<http://www.industrialoutpost.com/understanding-the-great-horse-manure-crisis-of-1894/>

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Horses were disrupted by technology

- Minimal impact on labor
- Drivers switched to taxis - motorized carriages
- Stable hands pumped gas at service stations
- The main losers were the horses: UK working horse population plummets to 25,000

Two views of technology

The Dark View

Karl Marx (Das Kapital, ch. 15
“Machinery and Modern Industry”)

- Technology is an instrument of the capitalist to increase profit at the expense of labor
- Technological advances will lead to mass unemployment

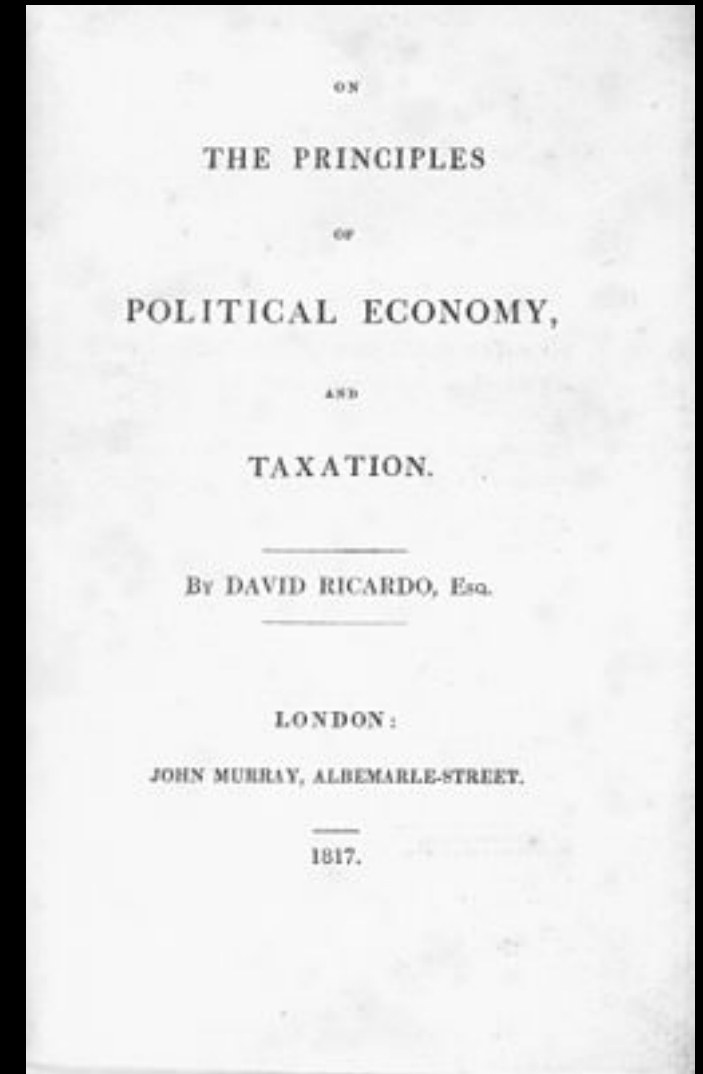


Two views of technology

The Dark View

This was not just Marx's view

- David Ricardo expresses a similar view in chapter 31 “On Machinery” in his famous *The Principles of Political Economy and Taxation*
- Also, John Stuart Mill and Thomas Robert Malthus!



Two views of technology

The Bright View

Empirical evidence began to shape a more nuanced view

- Technological change can lead to short-term disruptions but there is no evidence of long term effects on employment
- For example, 100 years ago over 50% of the U.S. population worked on farms; today it is less than 2% (yet much more food is produced and it is cheaper)

Two views of technology

The Bright View

Empirical evidence began to shape a more nuanced view

Three basic ideas:

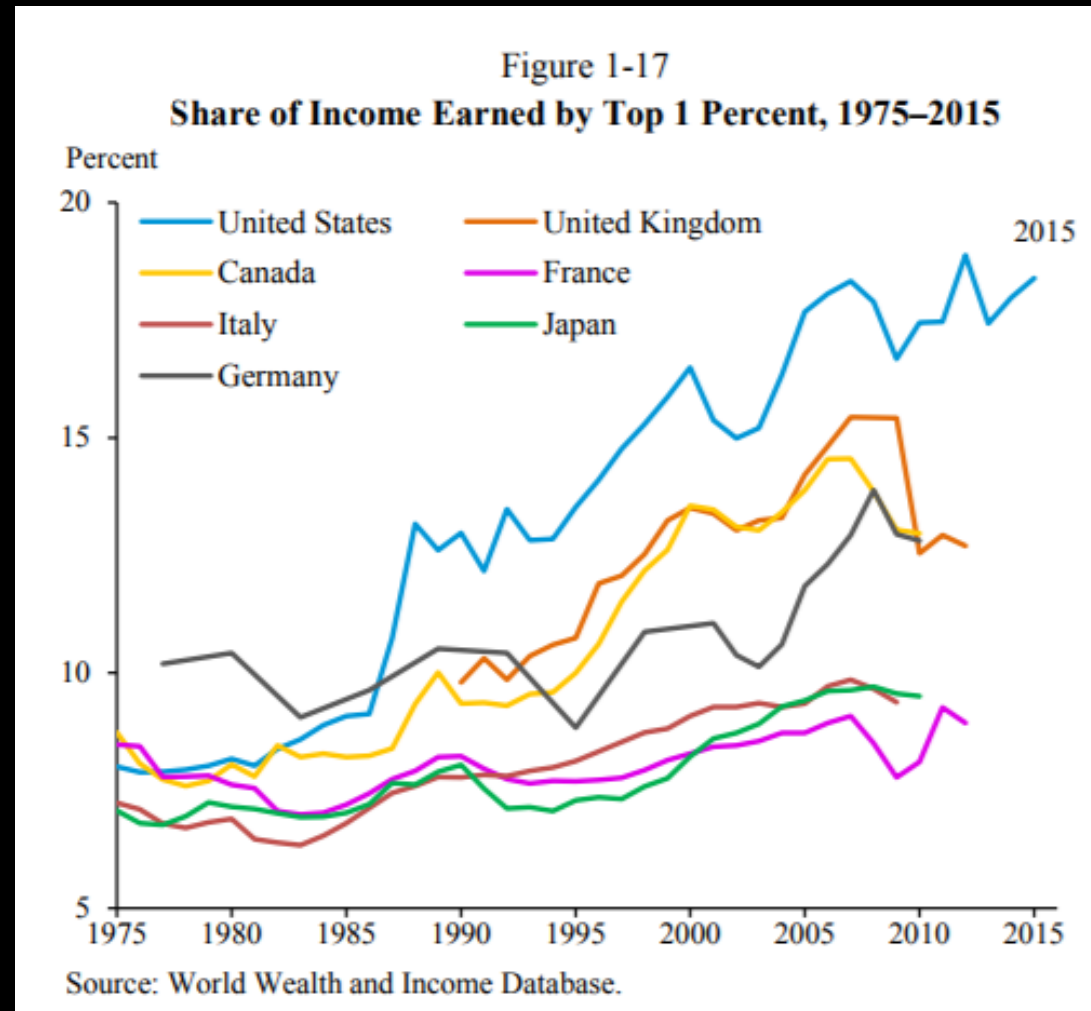
- It is crucial to take the benefits of technology into account when predicting the impact on the economy and labor specifically
- Labor is mobile and will eventually find new jobs
- Different technologies have different demographic impacts, e.g., the tractor displaced relatively unskilled labor while the computer displaced skilled labor

Globalization and technology

Historically, technology has made goods and services more portable leading to increased trade

- Increased trade generally associated with increased growth

Unequal Benefits of Globalization



Unequal Benefits of Globalization

Jeff Bezos' wealth is now equal to 2.3 million Americans'

David Carrig, USA TODAY Published 3:29 p.m. ET March 6, 2018 | Updated 7:53 a.m. ET March 7, 2018



But this metric looks at
2.3 million “median”
Americans

<https://www.inc.com/bill-murphy-jr/this-forgotten-jeff-bezos-interview-explains-why-amazon-is-so-successful-today.html>

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Unequal Benefits of Globalization

The three richest people in the U.S. – Bill Gates, Jeff Bezos and Warren Buffett own as much wealth as the bottom half of the US population, or 160 million people.

Unequal Benefits of Globalization

Unintended consequences



WORLD

'BREXIT' CAMP SEIZES ON HIGH U.K. MIGRATION FIGURES

<https://www.newsweek.com/brexit-camp-seizes-high-uk-migration-463669>

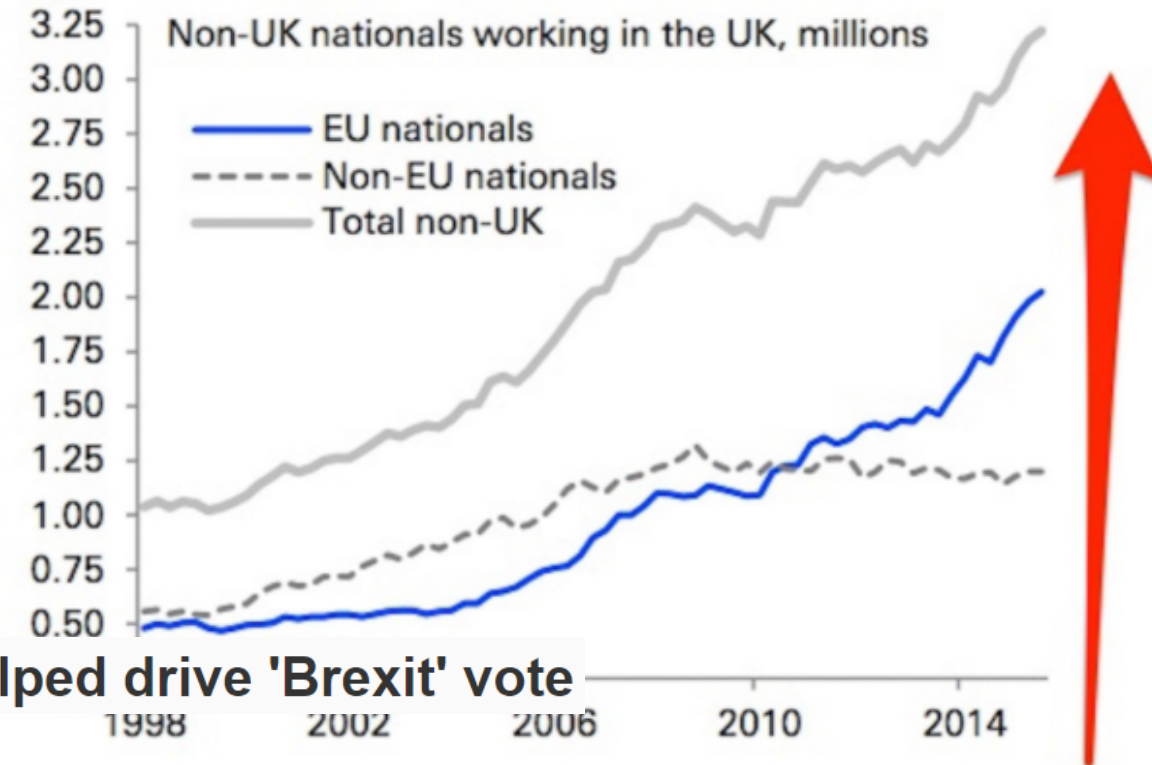
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Unequal Benefits of Globalization



Exploding UK immigration helped drive 'Brexit' vote

Figure 1.9: Rise in non-UK nationals largely due to EU



Source: Deutsche Bank, ONS

TURKEY
(population 76 million)
IS JOINING THE EU

voteleave.uk

Vote Leave, take back control

<https://www.theguardian.com/politics/2016/jun/16/nigel-farage-defends-ukip-breaking-point-poster-queue-of-migrants>

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Unequal Benefits of Globalization

Outsourced labor and immigration are but a side-show in a much more important force: Technology



<https://www.dailymotion.com/video/x2sa3yl>

<https://www.autoevolution.com/news/gm-opens-st-petersburg-plant-2100.html>

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Unequal Benefits of Globalization

In contrast to outsourced labor and immigration, there is nothing policy makers can do to stop or slow the impact – you can't prevent a company from buying a machine



Rise of the Machines

Cray 2 is the world's fastest supercomputer: 1985-1990

- CPU: 1.9 GFLOPs*
- Weight: 5,500 pounds
- Cost: \$32 million (current \$)

*1.9 billion operations per second

http://farm2.staticflickr.com/1100/774443499_c13cf1fca7.jpg

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Rise of the Machines

iPhone Xs:*

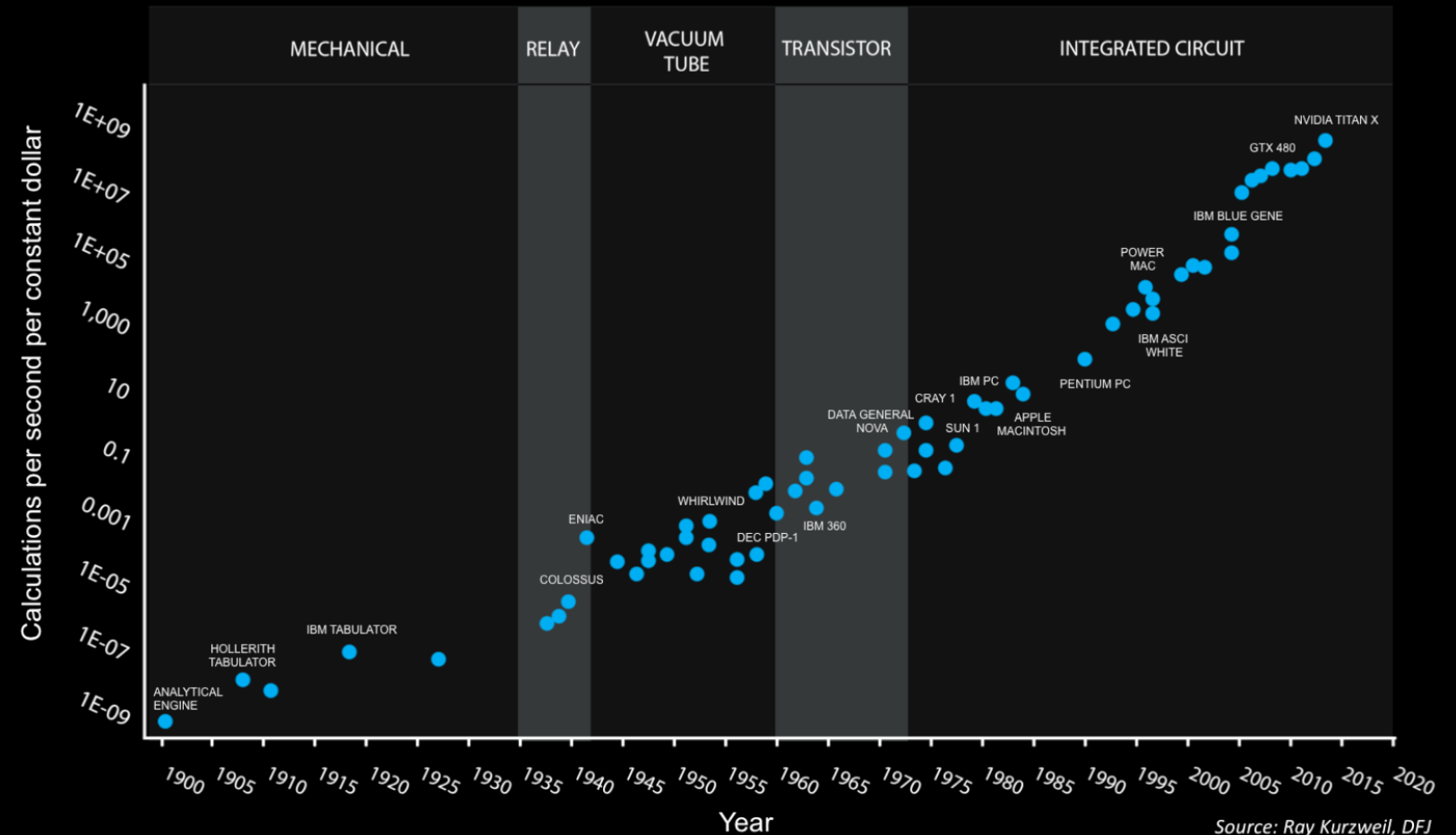
- 5,000 GFLOPs (9x faster than 2017)
- 512 GB storage
- 6.24 oz
- \$1,000



*A12 Bionic. <https://www.apple.com/iphone-xs/a12-bionic/>
Also note the Apollo guidance system had only 4K of RAM.

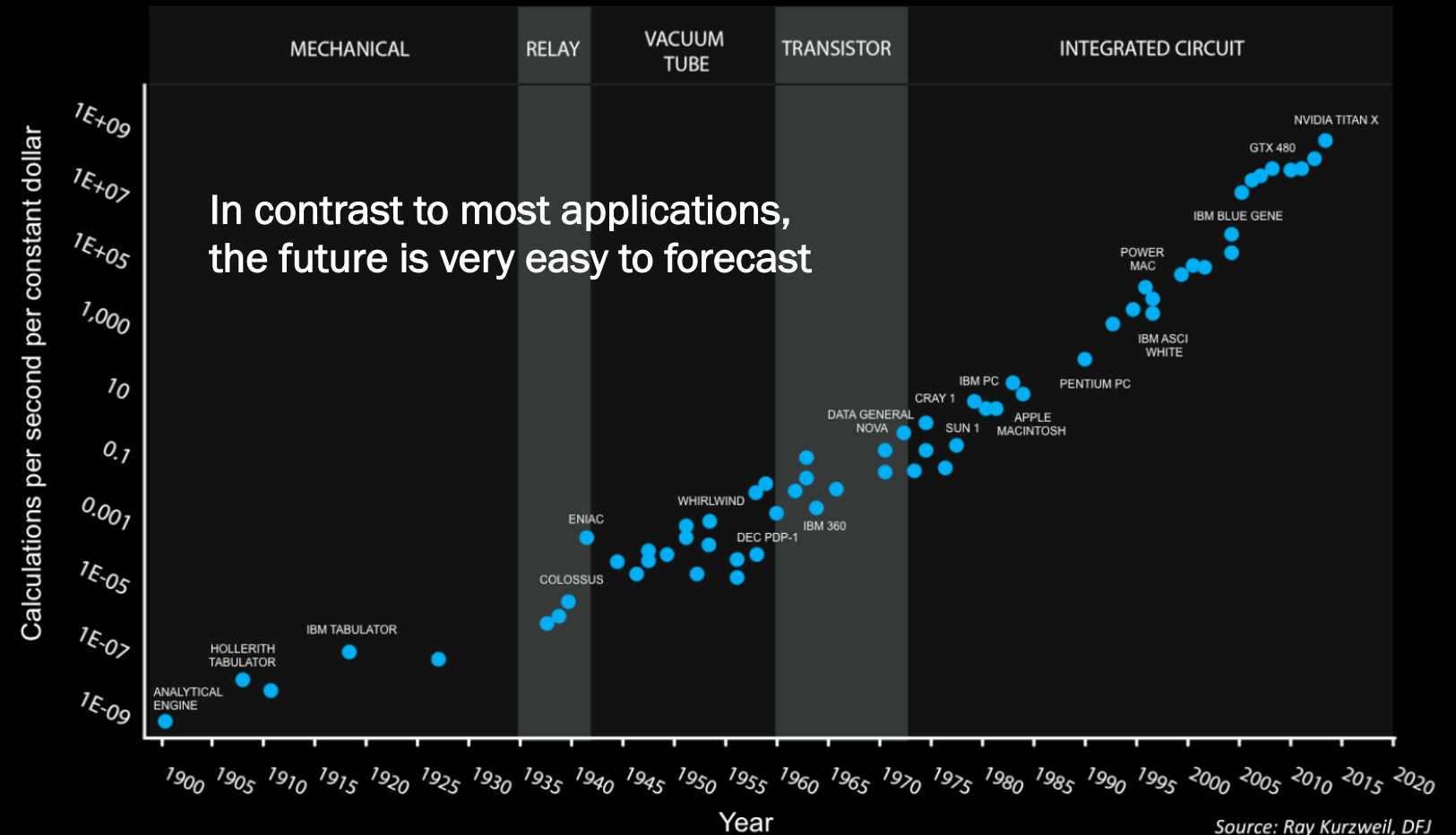
Rise of the Machines

Revolution #1: Computing Power



Rise of the Machines

Revolution #1: Computing Power



Rise of the Machines

Revolution #2:

Data generation
and storage

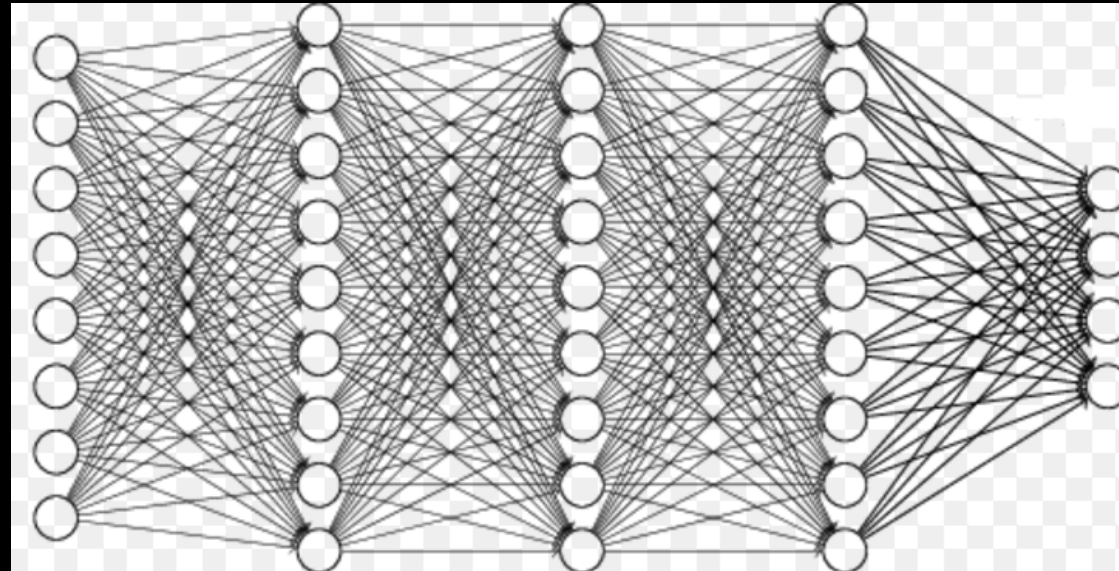
Cost per GB

- 1981 - \$300,000
- 1987 - \$50,000
- 1990 - \$10,000
- 1994 - \$1,000
- 1997 - \$100
- 2000 - \$10
- 2004 - \$1
- 2010 - \$0.1
- 2019 - \$0.01

Rise of the Machines

Revolution #3:

Maturing of combined methods from statistics, computer science, engineering and mathematics



How Technology Impacts Finance and Growth

Key initiatives:

- P2P Financing
- Robo-advising and Asset Management
- Blockchain and Smart Contracting
- Machine learning

P2P Finance

Landscape:

- P2P Lending
- Crowdfunding
- Payments and New Banks

P2P Finance

Implications:

- Makes it possible to for entrepreneurs to obtain financing that was not possible in the past
- Allows anyone to make microinvestments in firms – previously, investments in startups were reserved for select “qualified” investors

P2P Finance

Implications:

- \$13.7 trillion in mobile payments in China in 2017, e.g., WeChat Pay, AliPay. Only \$50 billion in the U.S.
- *China will soon be cashless*
- Allows the unbanked to join the world of Internet commerce
- Large swath of skilled employees in traditional banking will be displaced.

Robo Asset Management

Landscape:

- Algorithm gives low cost advice to a retail investor based on an algorithm that selects a “diversified” portfolio that matches the investor’s risk preferences
- Not just for the retail investor – many institutional investors turning to systematic trading algorithms for asset management

Robo Asset Management

Implications:

- Financial advisors need to adapt to the new technology – or be disrupted. Right now it is the wild west of robo tools with some brokerages using these tools to maximize customer churn.
- Large shake out of asset management industry with thousands of smaller asset management companies closing because they are unable to compete with the large companies that have invested in big data and machine learning

Blockchain and Smart Contracting

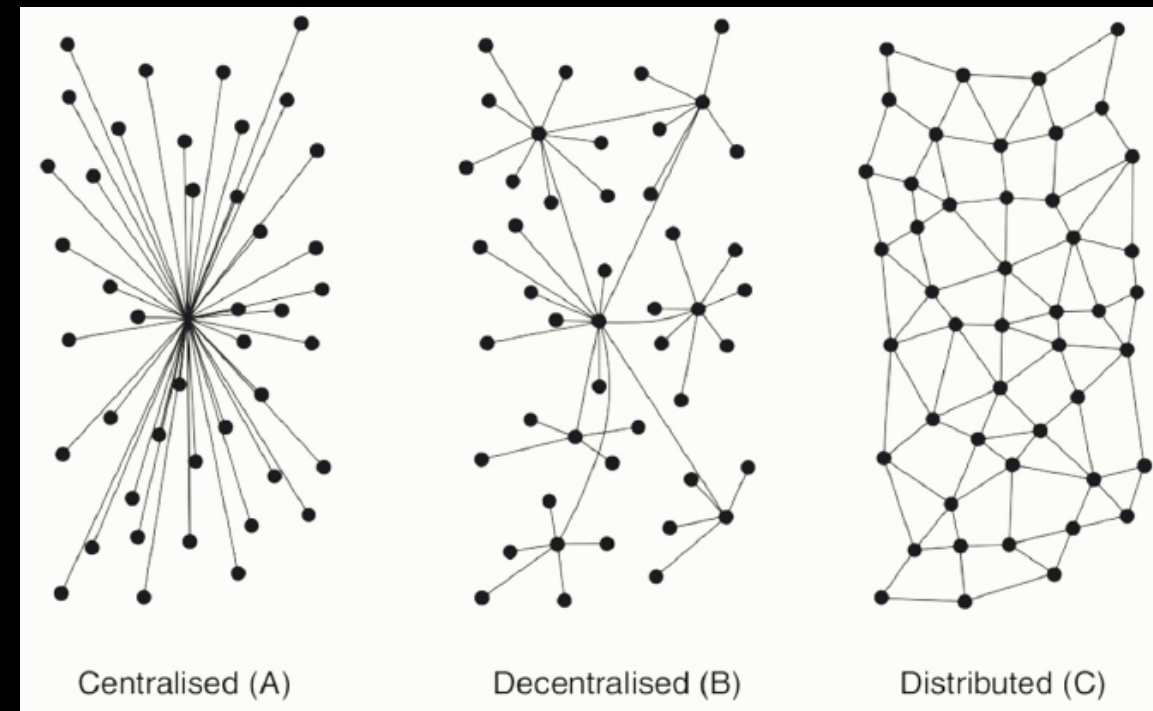
The opportunity:

- Imagine a world where transactions costs are near zero, the integrity of the transaction can be quickly verified, the transaction happens almost immediately, and the system is secure from outside attack. This is the blockchain opportunity.

Blockchain is a Ledger

A very special ledger...

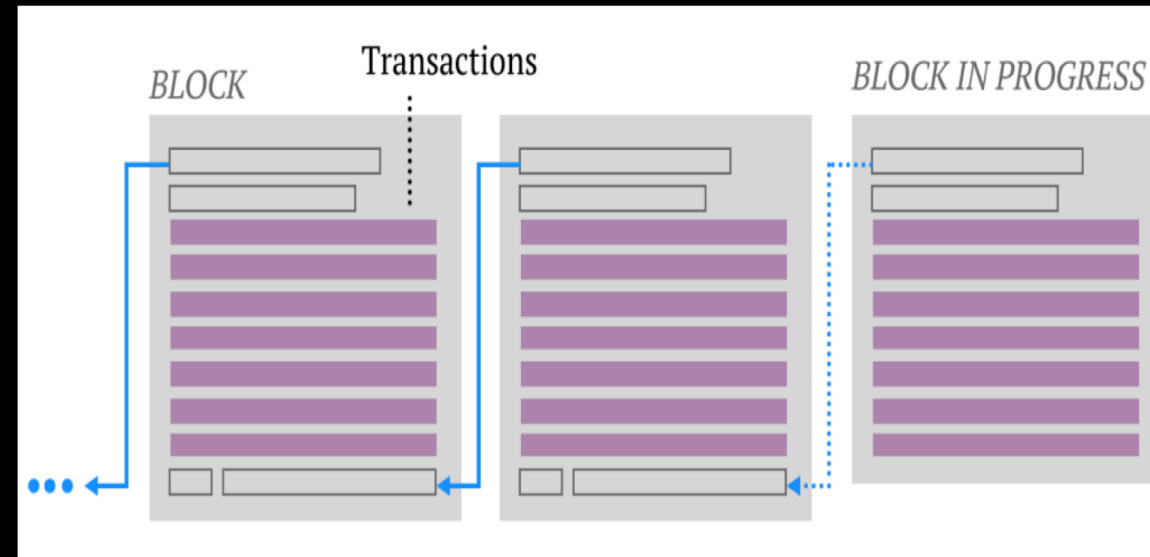
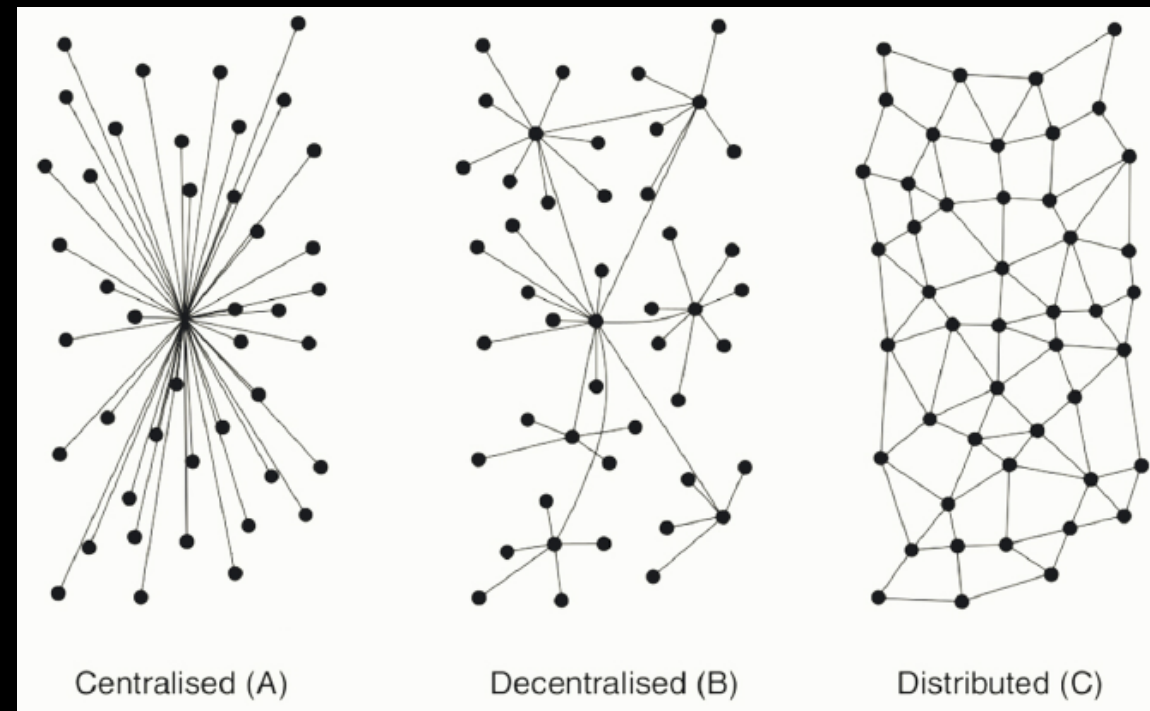
- Quickly and easily accessed and shared by many – distributed
- Various levels of transparency depending on application
- Immutable (you can only add to it – you cannot alter history)



Blockchain is a Ledger

A very special ledger...

- Quickly and easily accessed and shared by many – distributed
- Various levels of transparency depending on application
- Immutable (you can only add to it – you cannot alter history)
- Cryptographically secured



https://www.researchgate.net/figure/Centralized-decentralized-and-distributed-network-models-by-Paul-Baran-1964-part-of-a_fig1_260480880

<https://qz.com/154877/by-reading-this-page-you-are-mining-bitcoins/>

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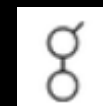
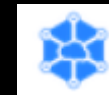
What can Blockchain Technology do?

Solves many problems

- Verification of ownership (quickly check the immutable history recorded on a blockchain to see if someone owns something)
- Efficient exchange of ownership (direct transactions *without a middle person*, everybody treated the same whether customer, retailer or banker).

Almost anything can be tokenized

1. First Gen/Gold 2.0: Bitcoin (BTC), Litecoin (LTC)
2. Distributed Computation Tokens: Ethereum (ETH), Tezos (XTZ), EOS, and DFinity
3. Utility Tokens: Programmable blockchain assets: Storj, Golem (GNT), Sia (SC), FileCoin



Almost anything can be tokenized

4. Security Tokens: Represent stocks, bonds, other assets, **ASX initiative**
 - **STO=Security Token Offering; ETO=Equity Token Offering**
5. Fungible Tokens: **ERC-20, Decentraland (MANA), REP**
6. Non-fungible Tokens: **ERC-721, Dharma debt agreements, Decentraland (LAND)**

Almost anything can be tokenized

7. Stablecoins:

- Fiat Collateralized: USDT, USDC, TUSD, LBXPeg, Candy, PAX, GUSD, JPMcoin
- Natural Asset Collateralized: Digix Gold (DGX), Tiberius Coin (TCX), Swiss Real Coin (SRC), D1 Coin
- Crypto Collateralized: Maker DAO's DAI
- Non-Collateralized: Basecoin
- National Cryptofiat: Fedcoin, Petro, Eurocoin, CADCoin,...

Blockchain is about more than finance

Driving transactions cost to near zero has many implications

- Enables micropayments (enables pay for view, listen, mobile communication, email, Internet, continuous dividends); new assets
- Disrupts traditional banking and investment banking – almost all functions; Central bankers also interested.
- Disrupts exchanges, OTC markets, settlement function
- Widespread use in companies for supply chain and supply integrity
- Financial reporting
- Unprecedented security
- Protection (and monetization) of individual identity

Machine Learning

Four forces:

- Open source software
- Growth of big data
- Computing power and the rise of GPU
- AI and Machine Learning

This Time is Different

Technological change is not new:

- Taxi industry disrupted by Uber
- Taxi drivers sign up with Uber

This Time is Different

Technological change is not new:

- Taxi industry disrupted by Uber
- Taxi drivers sign up with Uber
- Where do they go next?



This Time is Different

Technological change is not new:

- 13.1 million Americans work in transportation related jobs
- 4.6 million in the for hire








This Time is Different

Where will they go?

This Time is Different

Where will they go?

- Not here!
- Many studies have shown that retraining fails after age 30

	Software Engineer - Machine Learning Uber San Francisco, CA via Uber  Full-time
	Software Engineer - Machine Learning Uber Palo Alto, CA via Uber  Full-time
	Data Scientist - Machine Learning Global Intelligence Uber San Francisco, CA via Uber  Full-time
	Machine Learning Systems Engineer - Routing Uber San Francisco, CA

This Time is Different

World Economic Forum: The Futures of Jobs Report, 2018

New Roles	Redundant Roles
Data Analysts and Scientists*	Data Entry Clerks
AI and Machine Learning Specialists	Accounting, Bookkeeping and Payroll Clerks
General and Operations Managers*	Administrative and Executive Secretaries
Big Data Specialists	Assembly and Factory Workers
Digital Transformation Specialists	Client Information and Customer Service Workers*
Sales and Marketing Professionals*	Business Services and Administration Managers
New Technology Specialists	Accountants and Auditors
Organizational Development Specialists*	Material-Recording and Stock-Keeping Clerks
Software and Applications Developers and Analysts*	General and Operations Managers*
Information Technology Services	Postal Service Clerks
Process Automation Specialists	Financial Analysts
Innovation Professionals	Cashiers and Ticket Clerks
Information Security Analysts*	Mechanics and Machinery Repairers
Ecommerce and Social Media Specialists	Telemarketers
User Experience and Human-Machine Interaction Designers	Electronics and Telecommunications Installers and Repairers
Training and Development Specialists	Bank Tellers and Related Clerks
Robotics Specialists and Engineers	Car, Van and Motorcycle Drivers
People and Culture Specialists	Sales and Purchasing Agents and Brokers
Client Information and Customer Service Workers*	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers
Service and Solutions Designers	Statistical, Finance and Insurance Clerks
Digital Marketing and Strategy Specialists	Lawyers

The Losers

Unskilled and medium skilled workers in developed markets:

- Very difficult to retrain
- Lost generation will cause political problems
(we have just seen the beginning)
- Crucial to train the next generation so there is not a second lost generation
which could be very toxic

Who are the Winners?

The former UK Foreign Secretary has taken a lot of criticism:

- “16 per cent of our species have an IQ below 85, while about 2 per cent ... have an IQ above 130”
- 2% represents about 1.3 million people in UK



Who are the Winners?

- 2% represents about 20 million people in developed markets

Who are the Winners?

- 2% represents about 20 million people in developed markets
- 2% represents 100 million people in emerging markets



<https://www.wur.nl/en/show/Cold-storage-facilities-for-smallscale-dairy-farmers.htm>

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Who are the Winners?

- Potential to liberate a vast amount of human capital
- Unleashing this amount of human capital is historically unprecedented



<https://www.pinterest.com/jimluce/africa/?lp=true>

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Takeaways

Technology will play a key role in next wave of globalization

- Easy to forecast yet we tend to ignore the implications
- We can no longer afford to manage the “average”. Yes, growth will increase – but it will not be good for everyone
- It is crucial that policy makers, corporate leaders, and educators develop a strategy to deal with the inevitable

The Inevitable Growth of AI

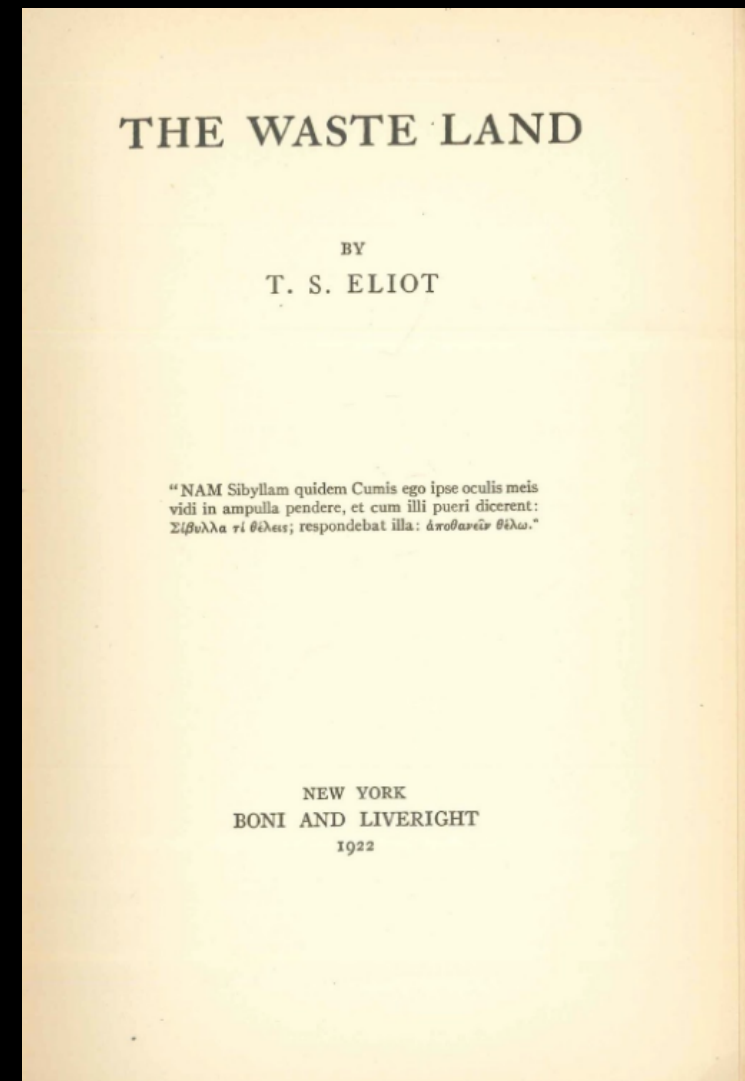
- Internet AI: Recommendation engines
- Business AI: Loan underwriting, cancer diagnoses
- Perception AI: Merge physical and online. You check out of a store doing nothing (your face scanned)
- Autonomous AI: Machines operate independently. Autonomous cars an example.

Humans Beware

We need to avoid the fate of Phlebus the Phoenician

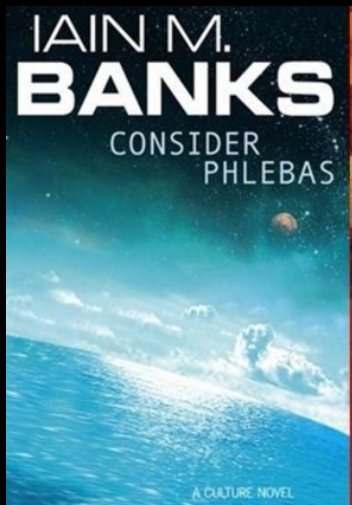
Humans Beware

*O you who turn the wheel and look to windward,
Consider Phlebas,
who was once handsome and tall as you.*

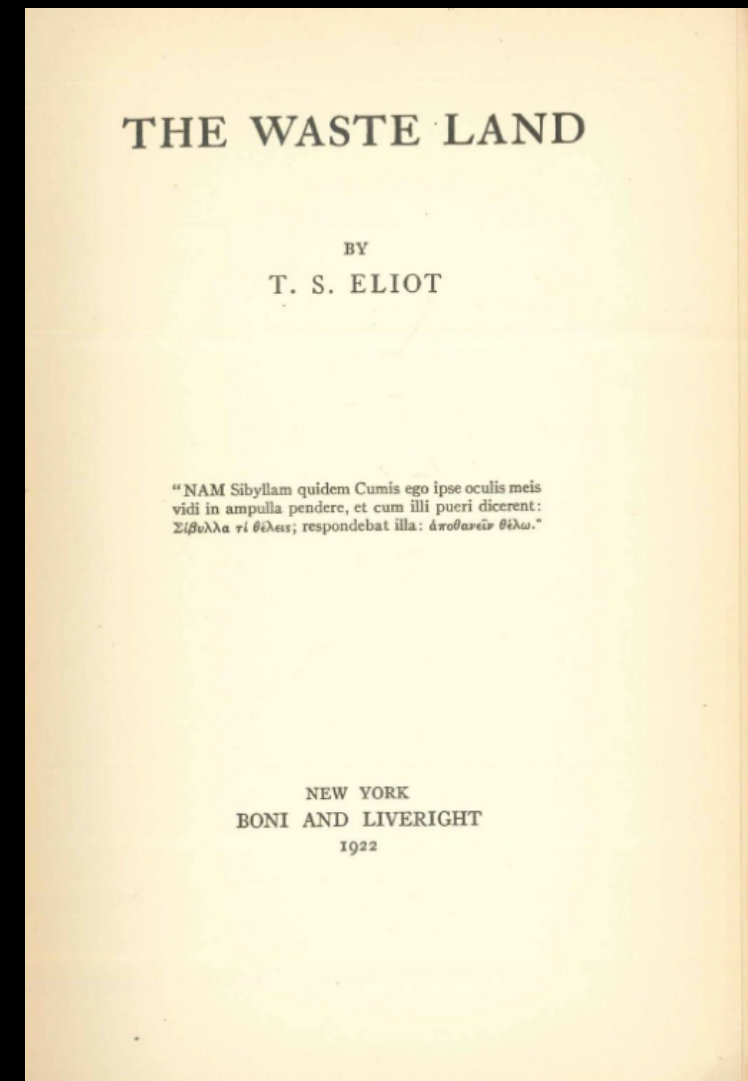


Humans Beware

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Humans Beware

2016 Elon Musk on Neural Lace:
“If you assume any rate of advancement in AI, we will be left behind by a lot. ... Even in the benign situation in AI, we would be so far below them in intelligence we would be a pet – like a cat.”



<https://www.youtube.com/watch?v=ZrGPuUQsDjo>

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Humans Beware

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Humans Beware

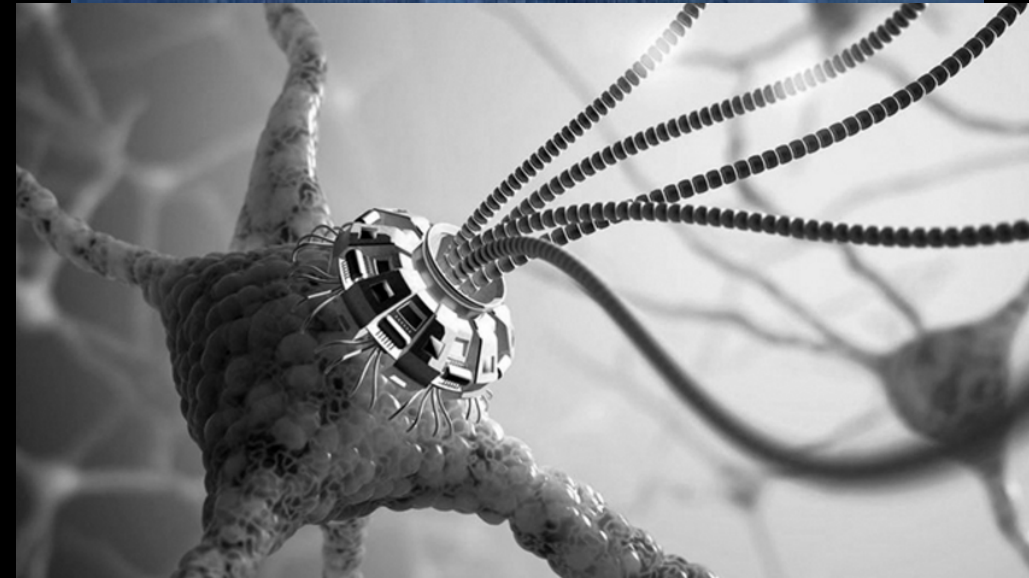
We are already cyborgs

- There is no where to hide



<https://www.earth.com/news/smartphones-kids-less-sleep/>
<http://angrybirdsriogame.info/?d=Elon+Musk+Isnt+the+Only+One+Trying+to+Computerize+Your+Brain>
<https://www.disclose.tv/elon-musk-announces-neural-lace-a-technology-to-merge-human-brain-with-ai-313801>

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Humans Beware

THE WALL STREET JOURNAL.

TECH

Elon Musk Launches Neuralink to Connect Brains With Computers

Startup from CEO of Tesla and SpaceX aims to implant tiny electrodes in human brains

By *Rolfe Winkler*

March 27, 2017 3:24 p.m. ET



<https://www.youtube.com/watch?v=ZrGPuUQsDio>

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Resources

Campbell R. Harvey, [*Innovation and Cryptoventures*](#)

Campbell R. Harvey, [*Cryptofinance*](#)

W: <http://www.duke.edu/~charvey>

M: cam.harvey@duke.edu

T: @camharvey

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