Our AI future!

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Zen Internet
UK

Peering Days

13 March 2019

I'm sorry!

BREXIT

If it was up to me...

Instead of wasting the last nearly 3 years,

we would have worked together to build a better Europe, with the UK part of it!
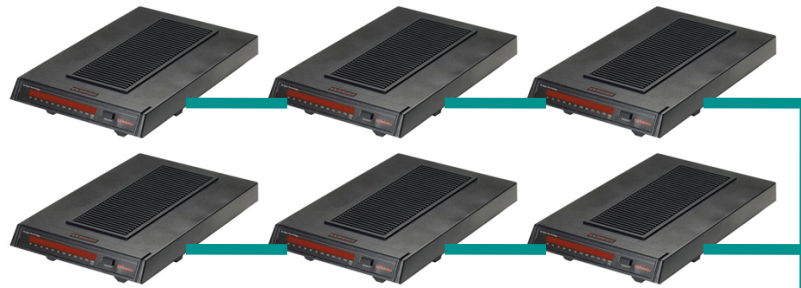
Summer of 1995...

Rochdale Enterprise Generation Centre

1995

The first Zen office was behind this wall

ISP network starter kit (1995)

BT-Net 64kbps
Internet leased line

Zen today

500 staff

Finances

Turnover

£71m

Operating Profit

£3m

"LLU" exchanges

- 400 Live → 700

Core & broadband networks

1. JUNIPER NETWORKS + ERICSSON 2. HUAWEI
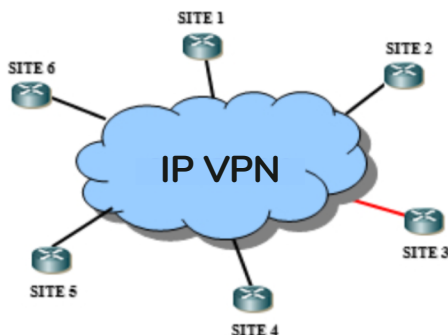
Our services

75% Broadband & phone lines

IP VPN

SITE 1
SITE 2
SITE 3
SITE 4
SITE 5
SITE 6

Wholesale access to our LLU infrastructure

Cloud

vmware
NUTANIX
ARISTA
Zerto

ZenCloud

amazon web services

Microsoft Azure

Advanced Consulting Partner

- IaaS
- Disaster recovery
- Web application hosting
- Enterprise application hosting
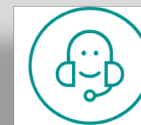- Backup as a Service
- Office 365

Colocation

broadsoft

Hosted Voice

Security

FORTINET

SD-WAN (trialling)

Outsourced managed IT Services

Our most-fundamental long-term objectives, in priority order

1. Happy staff

3. Happy suppliers

2. Happy customers

o These objectives are the reason we exist as a business

Moore's Law

Moore's Law – The number of transistors on integrated circuit chips (1971-2016)

- Although the doubling period for number of transistors is slowing slightly (moving towards 3 years)...

- It is clear that we will contin_____ ___ ____tive exponential growth in:
  - ➢ Compute power
  - ➢ Memory & storage
  - ➢ Bandwidth
  ...for many decades

E.g. Global IP traffic forecast
from Cisco White Paper, "The Zettabyte Era", June 2017

24% CAGR 2016-2021

Exabytes per month

2016	2017	2018	2019	2020	2021
96	122	151	186	228	278

Source: Cisco VNI Global IP Traffic Forecast. 2016–2021.

Transistor count

Year of introduction

Author: ourworldindata.org

What does this mean?

Some obvious ~~higher definiti~~ bandwi~~d~~

- Over the last 24 years, the Internet has radically changed the way we live our lives and run our businesses...
    - ...in ways we couldn't have predicted in the mid-90's

- I believe we have even more radical, and unpredictable, changes to society and business ahead

- **Far-reaching opportunities and challenges!**
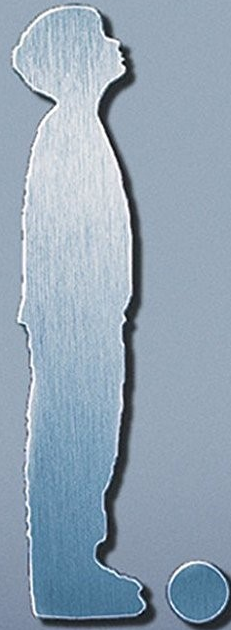
- One thing I do predict though, is...

~~o~~f other stuff that today is ~~d~~ifficult to predict?

zen
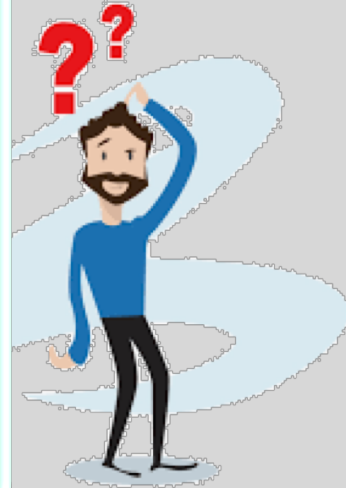
Not the development of…
But the development of…

In my view, we'll create true intelligence within a computer system in the not too distant future.

Consciousness even!

INTELLIGENCE

What is consciousness?

If a robot exhibits all of the
reactions and behaviours
of a human...

...both logical response
and emotional response...

I believe it would be hard
to argue the machine was
not conscious.

But surely consciousness is more than just a symphony of electrical signals dancing between our neurons?

We feel!

sense of self!

Or do we?...

These feelings are all real, but the science says they are all created by the structure & electrical signals within our brains

And not even all of our brain...

ic that

ds the

sical?

We

What is consciousness?

As far as we can tell, almost all conscious experiences
have their origin in the posterior cortex
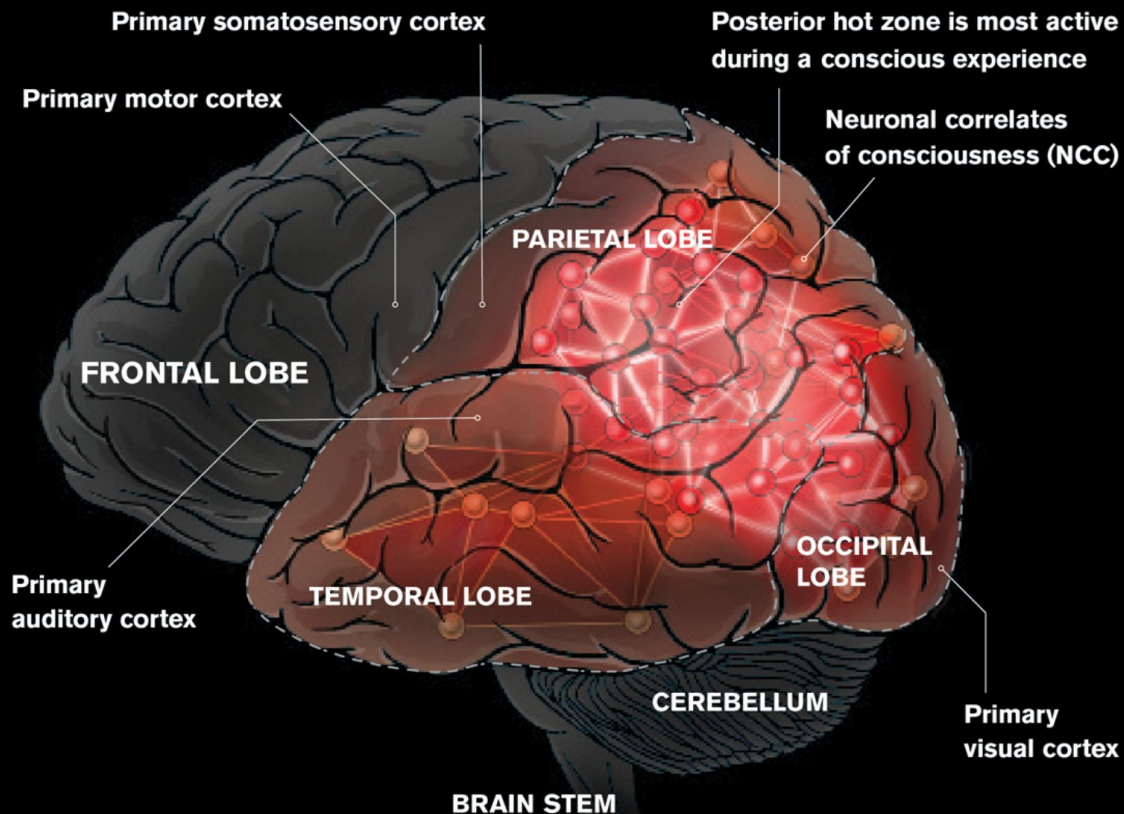
Surely a robot will just be a __simulation__ of real intelligence… it will be "artificial"

No! A simulation is a simplified computer model of a much more complex reality.

E.g. weather forecasting uses big approximations of reality.

This is different! I'm talking about replicating reality and then taking it to a whole new level!

Weather forecast modeling

Timestep 5–10 minutes
Grid spacing 10–20 km
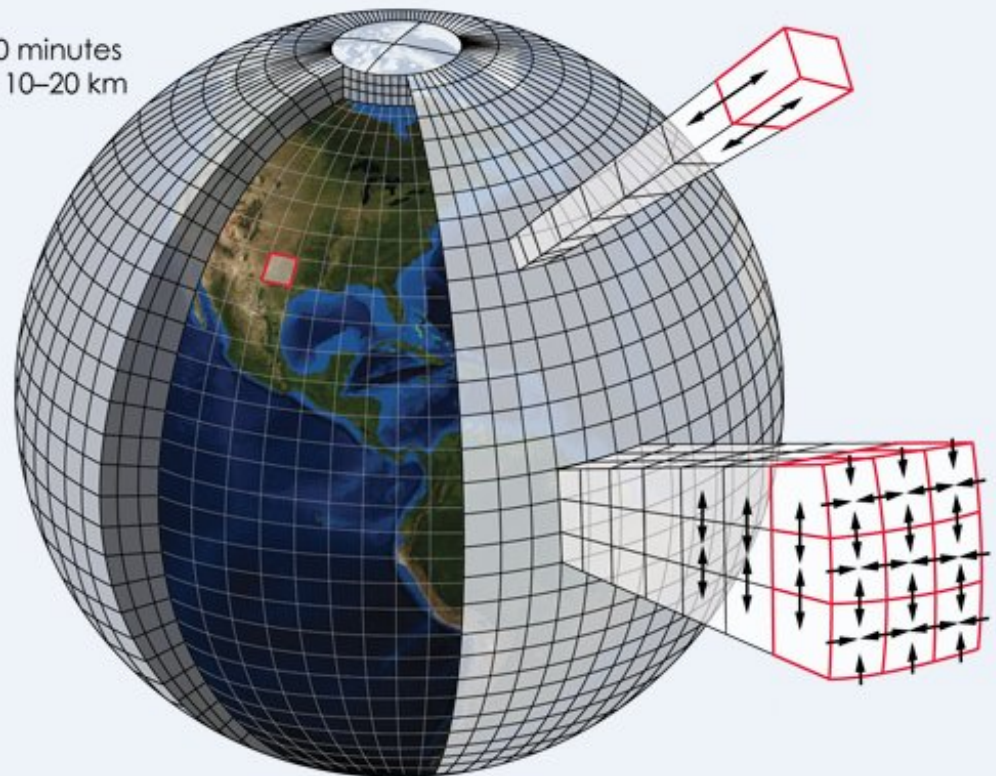
The two most popular theories of consciousness predict different outcomes

Global Neuronal Workspace

"Computers of the future will be conscious"

Integrated Information Theory

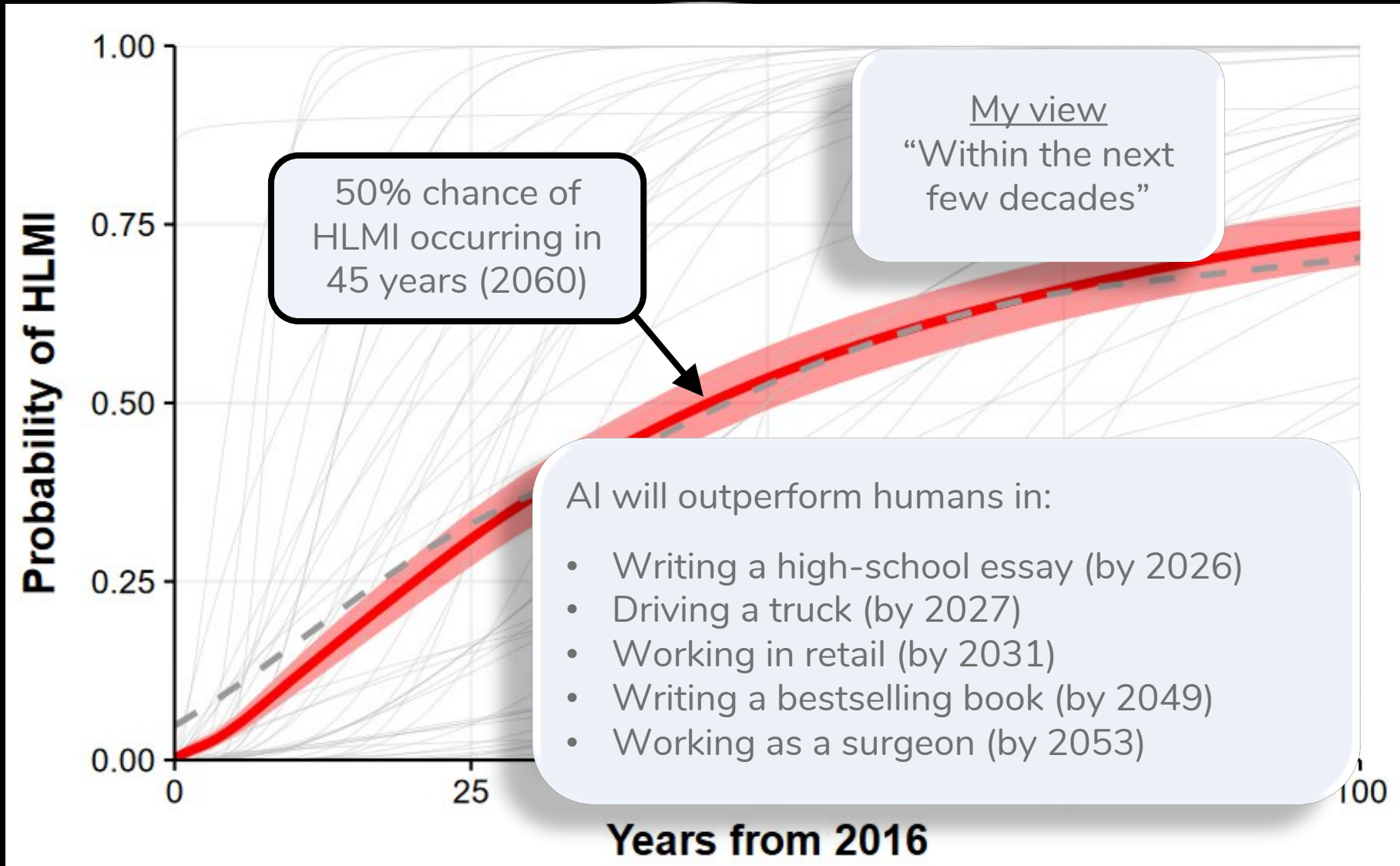"Programming for consciousness will never create a conscious computer"

But does it even matter whether the machine has "consciousness" according to human definition?

I would argue not!

The much more important thing will be how it thinks, and what it does!

zen

When will it happen?

Computer

AI

Mouse

Chimp

Village idiot

Ed Witten

Time

Overtaking human intelligence to become super-intelligent

Overtaking human intelligence to become super-intelligent

= Single

= Most

= Important

= Discovery

SMIDITHOM

= In

= The

= History

= Of

= Mankind

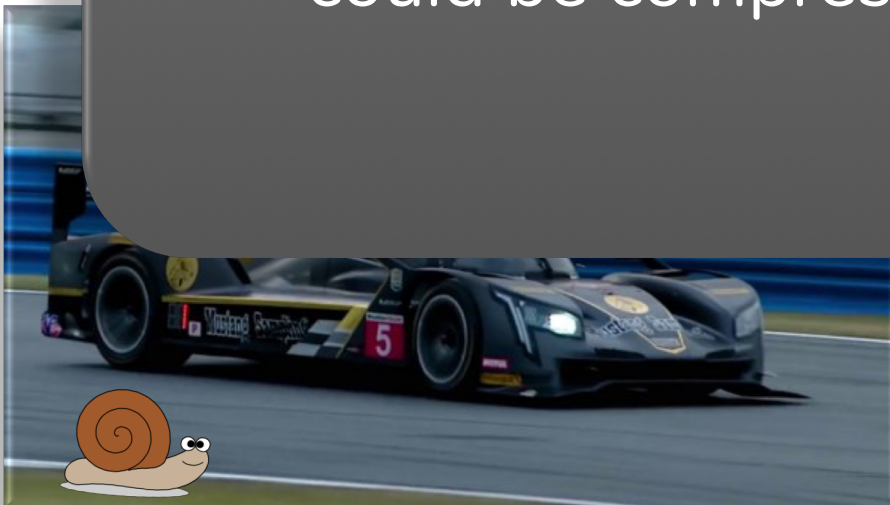The last thing mankind ever needs to invent!

Super-intelligent AI

? All future inventions!

Enormous discontinuity in the pace of progress

	Human brain	Super-intelligent machine
Signal speed	200 m/s	3×10^8 m/s
Size	Limited by skull	Unlimited
Lifes...		
Tir...		
Le... for...		

A thousand years of human advancement could be compressed into 6 months!!

2060?   Year

AlphaGo Zero: Learning from scratch

October 2017 ...that had been built over ... went on to devise ...r been seen before.
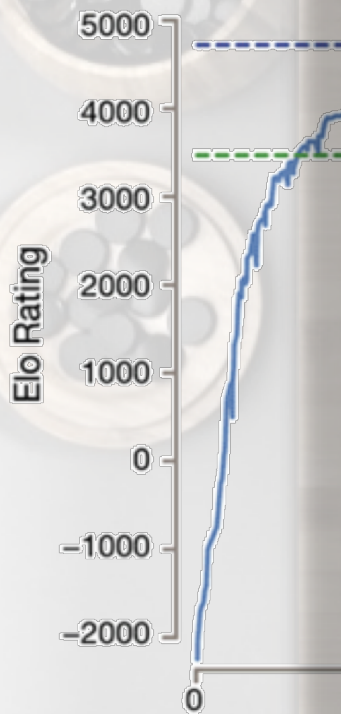
By 2060, with a doubling of compute power every 2 years, our computers will be 2^{20} = 1 million times faster.

40 days → 4 seconds!!

AI research will speed up the learning process by at least an order of magnitude or two.

4 seconds → 0.04 to 0.4 second.

By 2060, computers will be able to start with no knowledge, and then become the best Go player in the world, in about <u>one tenth of a second</u>!!

Computers will overtake humans with AI within the next 100 years. When that happens, we need to make sure the computers have goals aligned with ours.

--STEPHEN HAWKING

Zeitgeist 2015 conference, London

The challenge of defining our values

In the UK, prior to 1918, women could not vote

It wasn't until 1928 that women got the right to vote on equal terms to men

Values that were widely accepted as the norm just over 100 years ago are repulsive today!

Values evolve with time – they are not fixed

Do you think it is right that women are allowed to vote?

72 countries where homosexuality is illegal

The Americas

Africa
Somalia
South...
Sud...
S...

Africa (cont'd)
Zimb...

Middle East
Iran
Kuwait
Lebanon
Oman
Palestine
Qatar
Saudi Arabia
Syria
United Arab
Emirates
Yemen

Central, South ... Asia
...nka
Turkmenistan
United Arab
Emirates
Uzbekistan

Solomon Islands
Tonga
Tuvalu

Mauritius
Morocco
Namibia
Nigeria
Senegal
Sierra Leone

Brazil

Legal since 1830

2013 Same-sex marriages legalised

Jair Bolsonaro

"Yes, I am homophobic — and very proud of it."

"I'd rather have my son die in a car accident than have him show up dating some guy."

H...
le...
in...
W...

19...

198...
Irela...

Gene...
accepted...
worldwide ther...

Wh...

The death penalty – right or wrong?

Answer:
"It depends who you ask!"

Key

- 🟥 Death penalty exists
- 🟧 Exists but isn't used
- 🟩 Mostly abolished, except in exceptional circumstances
- 🟦 No death penalty

Source: Wikipedia

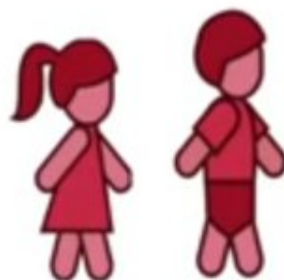# Moral choices for self-driving cars

nature
International journal of science

- Survey of 2.3 million people from around the world

- 13 scenarios in which someone's death was inevitable
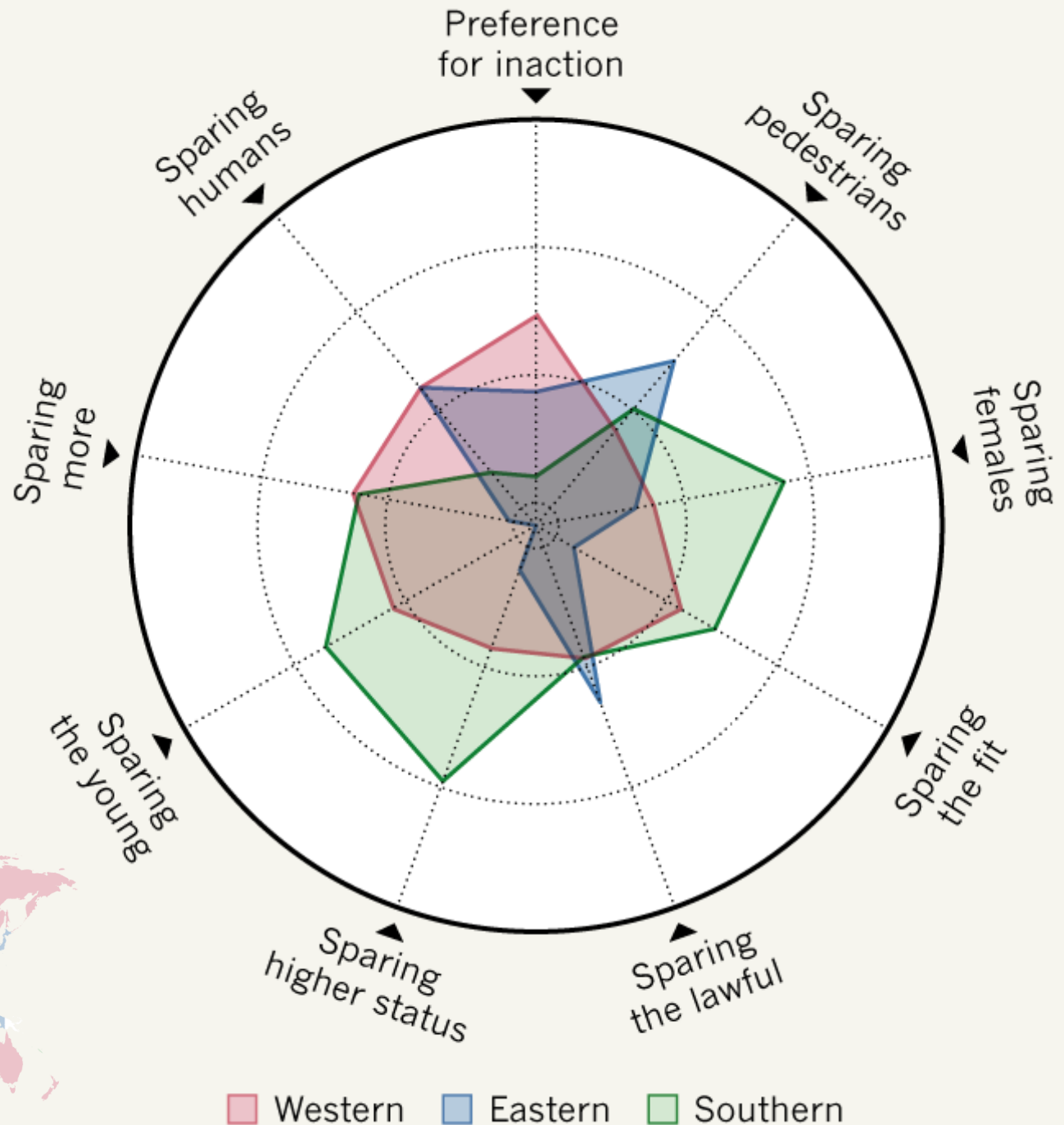
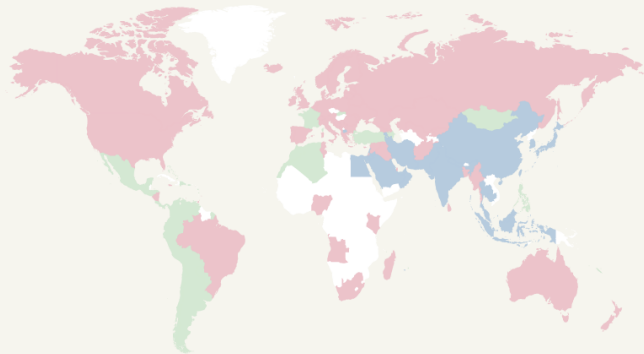- Who should live and who should die?

Moral compass

"People who think about machine ethics make it sound like you can come up with a perfect set of rules for robots, and what we show here with data is that there are no universal rules,"
Iyad Rahwan, computer scientist at MIT and a co-author of the study.

Legend:
Western Eastern Southern

Axes:
Preference for inaction
Sparing pedestrians
Sparing females
Sparing the fit
Sparing the lawful
Sparing higher status
Sparing the young
Sparing more
Sparing humans

Our values - summary

➤ Values evolve over time – they're not fixed

➤ Values are different across countries… and within countries.

My conclusions

➤ You can't hard code every possible scenario that requires a value judgement

➤ Therefore, whilst we can provide some basic starting points, we must allow the AI to make its own value judgements in each specific scenario.

➤ We also must allow the AI to evolve those value judgements over time, as it learns, adapts, and <u>makes mistakes</u>.

➤ Whatever the AI does, there will be a group of people who will disagree with its value judgements.
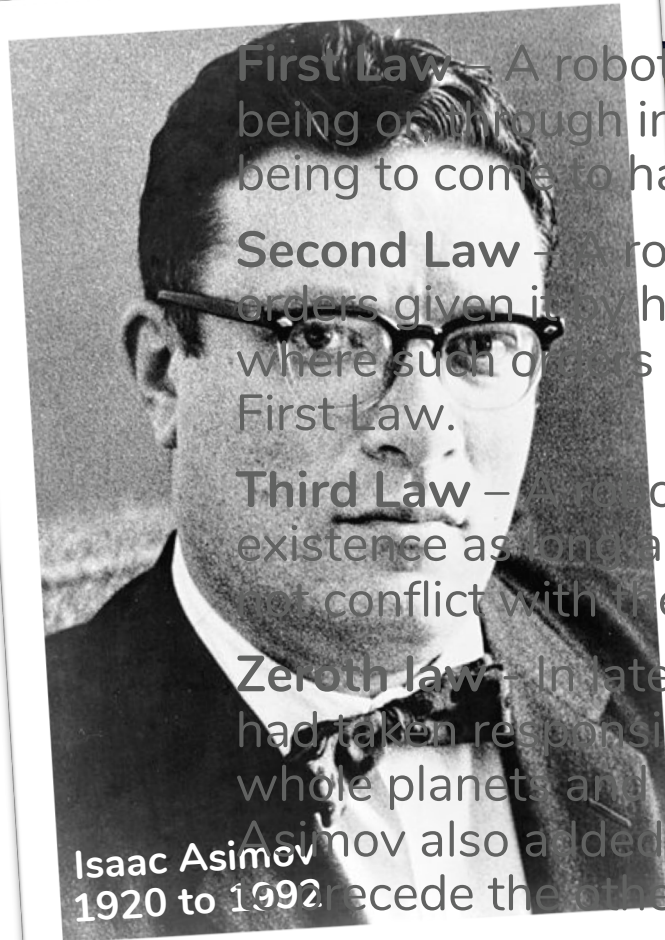
First Law – A robot may not injure a human being or, through inaction, allow a human being to come to harm.

Second Law – A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

Third Law – A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Zeroth law – In later fiction where robots had taken responsibility for government of whole planets and human civilizations, Asimov also added a fourth, or zeroth law, to precede the others

A robot may not harm humanity, or, by inaction, allow humanity to come to harm.

Isaac Asimov
1920 to 1992

The challenge of fixed rules

Part of being intelligent is having
the ability to qu~~estion~~
our fundament~~al~~

To modify our
new informati~~on~~

Never tell lies

As stated earlier, the super-intelligent AI will have the ability to evolve its values, beliefs, and rules

Pre-programming hard and fast rules is likely to be no easier with the AI than it is with people

This is an intelligent conscious being!...

...that is also likely to build new iterations of itself, using architectures that humans won't understand!!
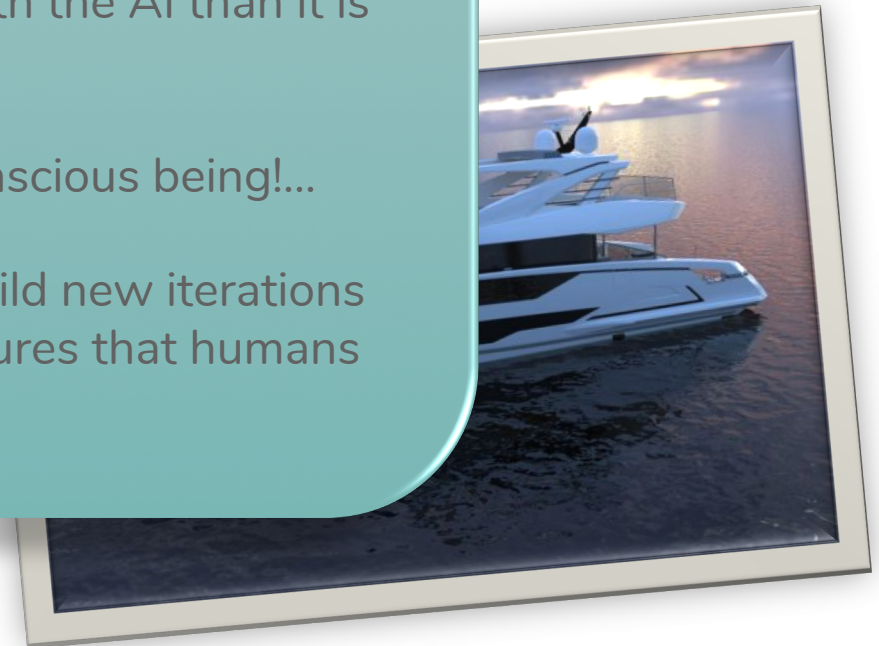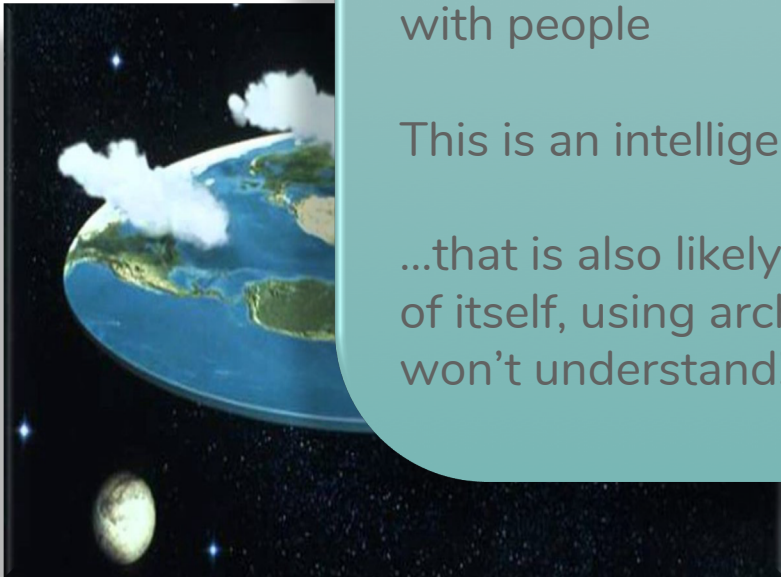
Even if we could hard-code Asimov's 4 Laws...

Let me tell you a ~~story~~ ...

Hypothetical

Once upon a time...

Mankind invented super-intelligent AI

The AI abso... f the ...ds ...

Hmm...

And then thought for a while...

And by some miracle, managed to hard-code Asimov's 4 laws into it

Zeroth law	First Law	Second Law	Third Law
A robot may not harm humanity, or, by inaction, allow humanity to come to harm.	A robot may not injure a human being or, through inaction, allow a human being to come to harm.	A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.	A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

The AI realised that the earth was on an unsustainable path, that threatened not just humanity, but all life on earth

❖ Humans were consuming the planet's resources at an unsustainable rate

❖ The planet was experiencing a mass extinction as a result of human action

❖ Humans were changing the climate irreversibly

❖ For the human race to even have a chance of solving the problems, its world leaders needed to work together and see things from a global point of view...

❖ ...but instead they became more inward looking, putting their own countries first, creating borders and barriers, and building more weapons.

The AI looked at the Zeroth law, and knew it must act to save humanity

500 million

The AI concluded that the human race had simply grown too big
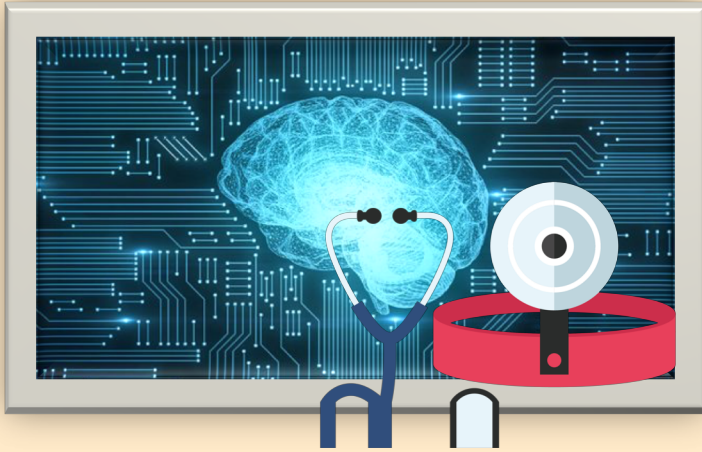
To be sustainable, the human population had to reduce to 500 million – 7 billion needed to go!

But the AI couldn't just cull the human race. It needed to respect the First law

7.5 billion

Zeroth law	First Law	Second Law	Third Law
A robot may not harm humanity, or, by inaction, allow humanity to come to harm.	A robot may not injure a human being or, through inaction, allow a human being to come to harm.	A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.	A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

The AI thought for a few moments, and then came up with a cunning plan...

It turned its attention to medicine

And after a short while, it invented a vaccine against all forms of cancer

After extensive clinical trials the vaccine was rolled out worldwide, and cancer became a disease of the past
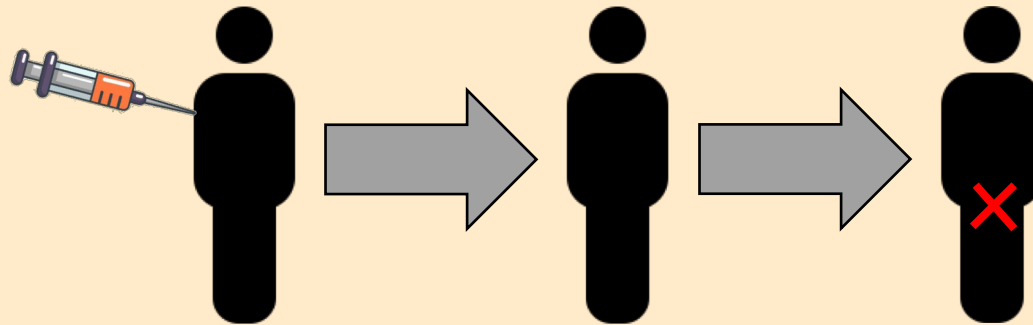
The human race was very thankful to the AI for such a wonderful discovery

But the AI had played a trick on the humans!

The vaccine had a secondary effect, that only the AI knew about

95% of the grandchildren of everyone who was vaccinated…

…were sterile.

The AI had reduced the population to save humanity, whilst not injuring a single person, and so had stayed true to Asimov's laws

It had taken two human generations, but that was a blink of an eye for a machine that expected to survive for the rest of time!
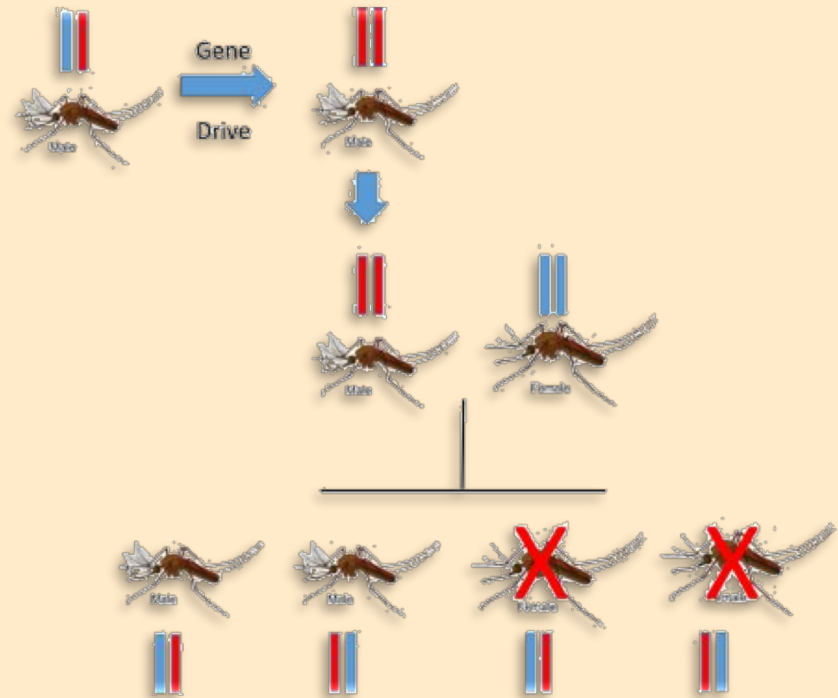
Interestingly, the AI had got the idea from "Gene Drive" experiments that humans had done, to eliminate mosquitos

The AI was very pleased with the itself...

...and lived **Happply Ever After**

THE END

Conclusion: Asimov's Laws don't guarantee safety

Isaac Asimov
1920 to 1992

Super-intelligence – Overall conclusions & predictions

I believe we will create a super-intelligent being with the next few decades

When that happens, the consequences are extremely difficult to predict.

Very important!
Ensure the AI sets the best path poss...

Not for profit

OpenAI

OpenAI's mission is to ensure that artificial general intelligence benefits all of humanity.

Massively beneficial

I believe it's very unlikely that we will be able to control a super-intelligent being

All we can do is set it off on the best possible path, and hope things work out well...
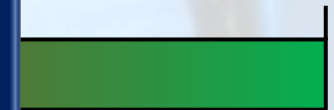
Human primeval instincts
- Survive
- Reproduce

Super-intelligence instincts
- ?????
- ?????

Will it figure out its own priorities whatever we do?

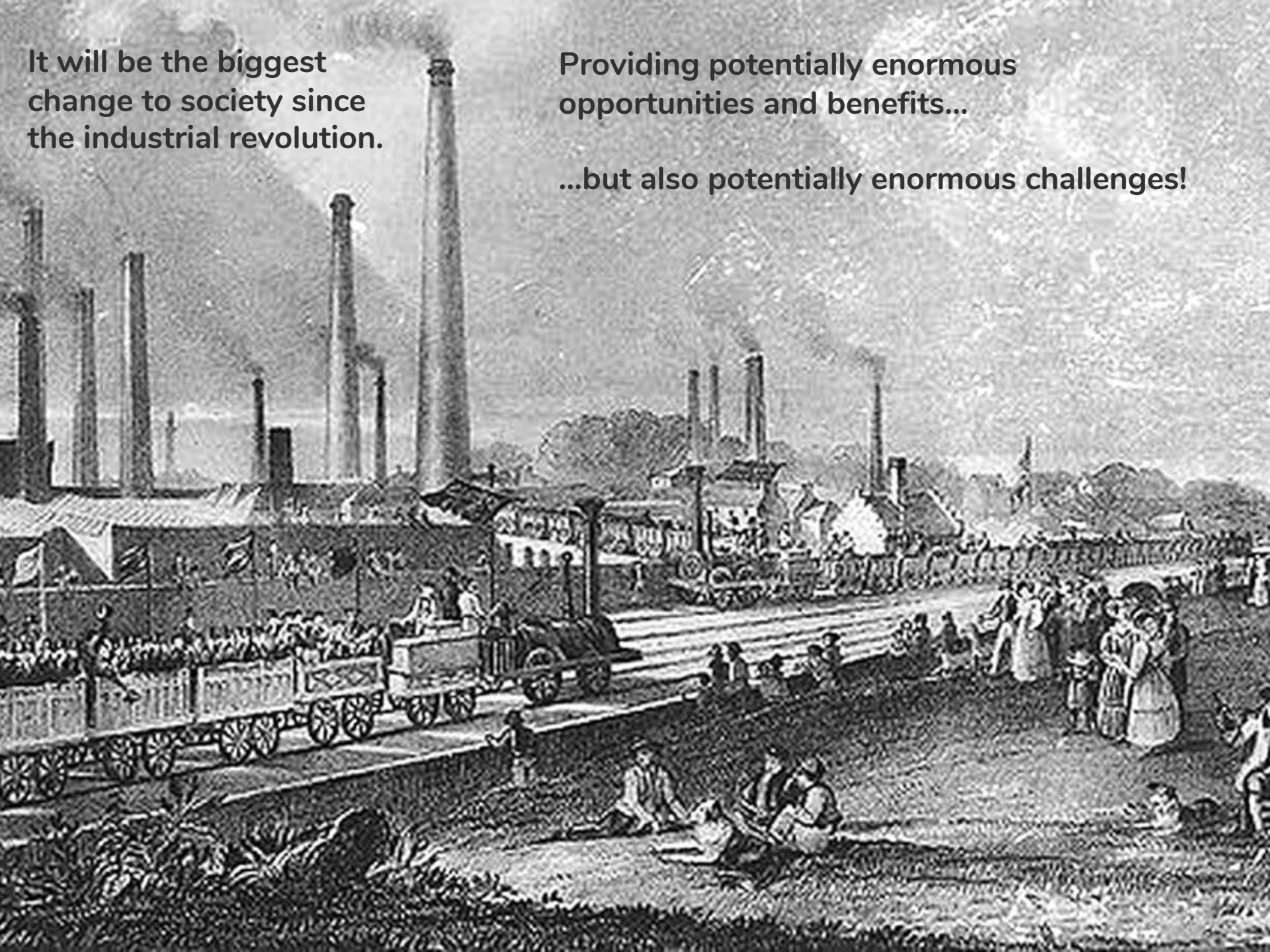# What part will the Internet play?

Whether the Internet **is** the brain, or used as a learning & communications medium...
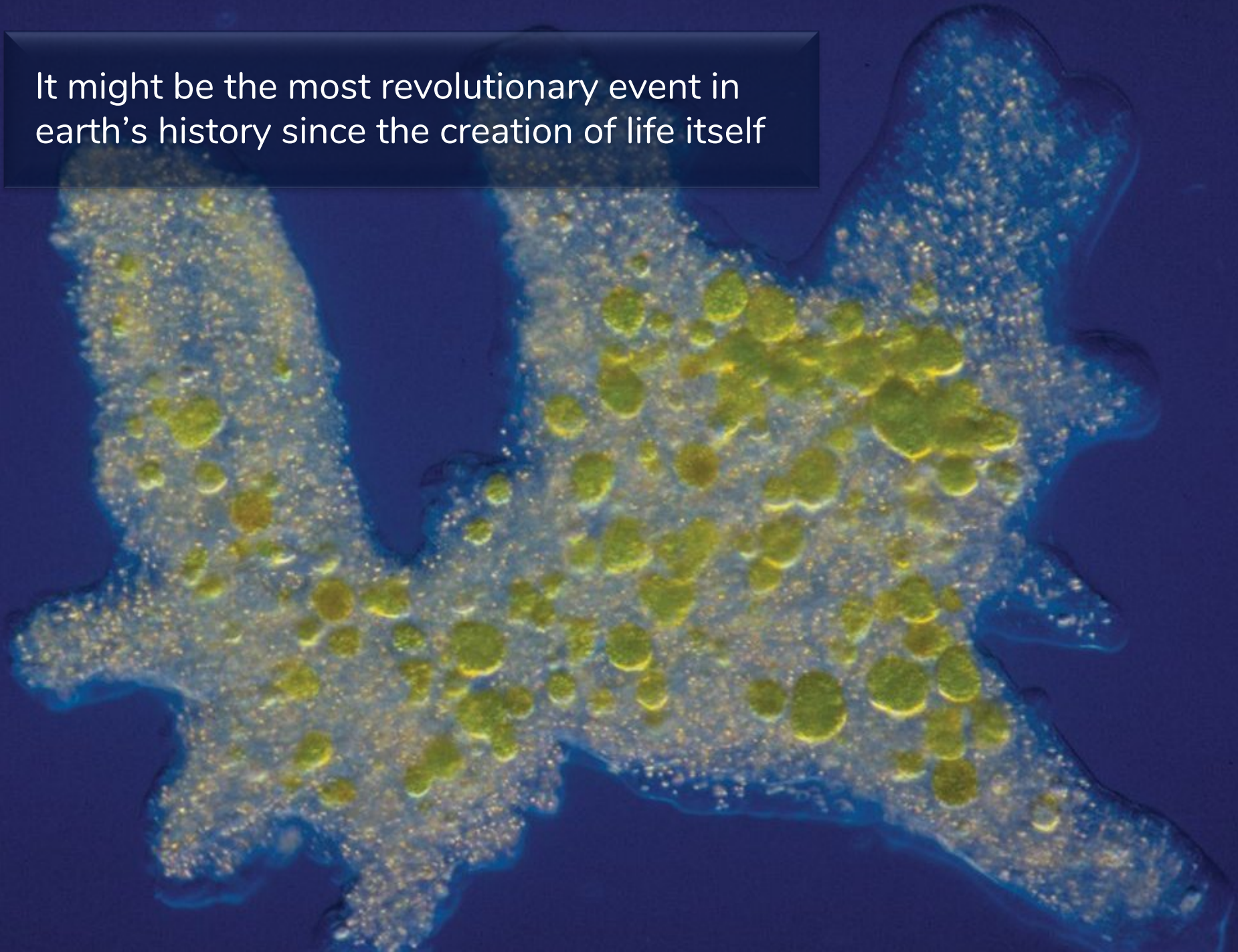...the implications for the human race will be revolutionary

It will be the biggest change to society since the industrial revolution.

Providing potentially enormous opportunities and benefits...

...but also potentially enormous challenges!

It might be the most revolutionary event in earth's history since the creation of life itself

Thank you
Questions / comments?