TRANSFORMERS MAGAZINE'S
INDUSTRY NAVIGATOR

INVESTMENTS, ARTIFICIAL INTELLIGENCE AND SUSTAINABILITY

CONFERENCE 2024

Workshop

AI/Machine Learning in the Power Industry

Luiz V. Cheim, PhD

Senior Principal R&D Engineer
Transformers Business
Hitachi Energy

Madrid, 12 June 2024

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#AIWorkshop

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The hype in AI/Machine will pass and the only reason people are talking about it is:

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A Brief History of Machine Intelligence

A brief story of computer intelligence

Enigma?

The UK government did not disclose details of the efforts to crack the Enigma machine until 1974

1941-1944

A Brief History of Computer Intelligence

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Alan Turing

152 languages

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- Career and research
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"Turing" redirects here. For other uses, see Turing (disambiguation).

Alan Mathison Turing OBE FRS (/ˈtjʊərɪŋ/; 23 June 1912 – 7 June 1954) was an English mathematician, computer scientist, logician, cryptanalyst, philosopher and theoretical biologist.[5] Turing was highly influential in the development of theoretical computer science, providing a formalisation of the concepts of algorithm and computation with the Turing machine, which can be considered a model of a general-purpose computer.[6][7][8] He is widely considered to be the father of theoretical computer science.[9]

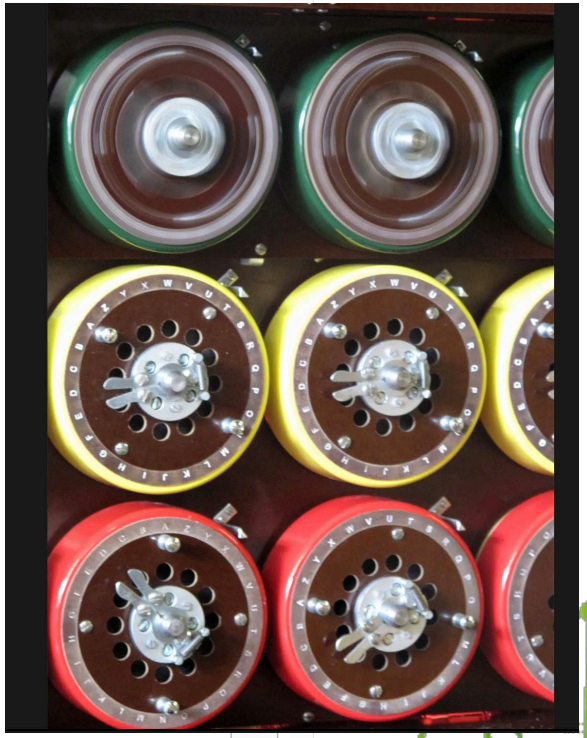
Born in London, Turing was raised in southern England. He graduated in maths from King's College, Cambridge, and in 1938, earned a maths PhD from Princeton University. During the Second World War, Turing worked for the Government Code and Cypher School at Bletchley Park, Britain's codebreaking centre that produced Ultra intelligence. He led Hut 8, the section responsible for German naval cryptanalysis. He devised techniques for speeding the breaking of German ciphers, including improvements to the pre-war Polish bomba method, an electromechanical machine that could find settings for the Enigma machine. Turing played a crucial role in cracking intercepted messages that enabled the Allies to defeat the Axis powers in many crucial engagements, including the Battle of the Atlantic.[10][11]

After the war, Turing worked at the National Physical Laboratory, where he designed the Automatic Computing Engine, one of the first designs for a stored-program computer. In 1948, Turing joined Max Newman's Computing Machine Laboratory at the Victoria University of Manchester, where he helped develop the Manchester computers[12] and became interested in mathematical biology. He wrote on the chemical basis of morphogenesis[13][1] and predicted oscillating chemical reactions such as the Belousov–Zhabotinsky reaction, first observed in the 1960s. Despite these accomplishments, Turing was never fully recognised during his lifetime because much of his work was covered by the Official Secrets Act.[14]

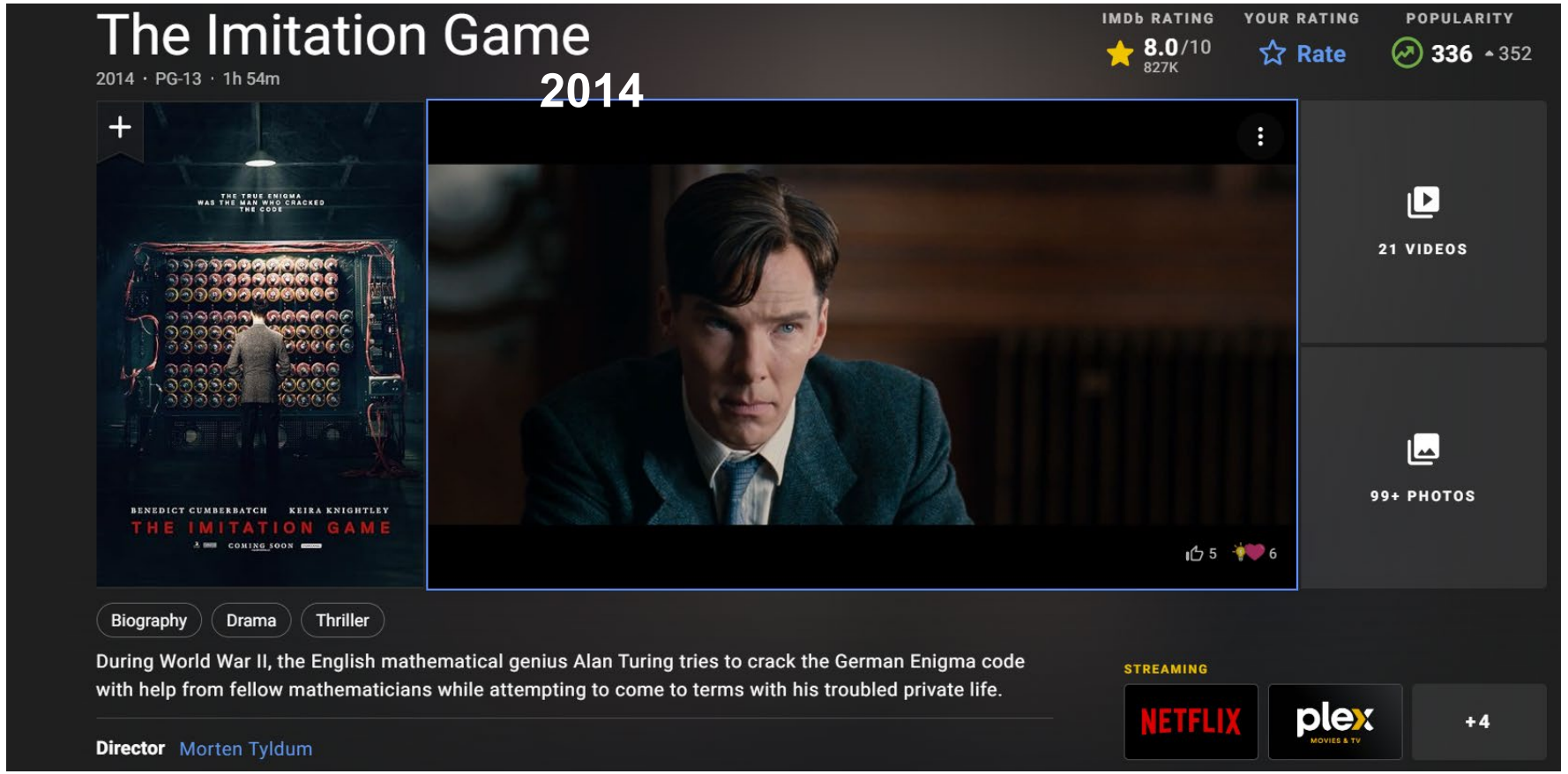
Alan Turing
OBE FRS

Turing in 1936

Born	Alan Mathison Turing 23 June 1912 Maida Vale, London, England
Died	7 June 1954 (aged 41) Wilmslow, Cheshire, England
Cause of death	Cyanide poisoning as an act of suicide[note 1]
Alma mater	University of Cambridge (BA, MA) Princeton University (PhD)



A Brief History of Computer Intelligence



Can Machines Think? Turing's Test

VOL. LIX. NO. 236.] [October, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINER
INTELLIGENC

BY A. M. TU

1. *The Imitation Game.*

I PROPOSE to consider th
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examining how they are commonly used
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(A), a woman (B), and an interrogator (C) who may be of either sex. The
interrogator stays in a room apart from the other two. The object of the
game for the interrogator is to determine which of the other two is the man
and which is the woman. He knows them by labels X and Y, and at the end
of the game he says either 'X is A and Y is B' or 'X is B and Y is A'. The
interrogator is allowed to put questions to A and B thus:

C: Will X please tell me the length of his or her hair?

433

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.

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433

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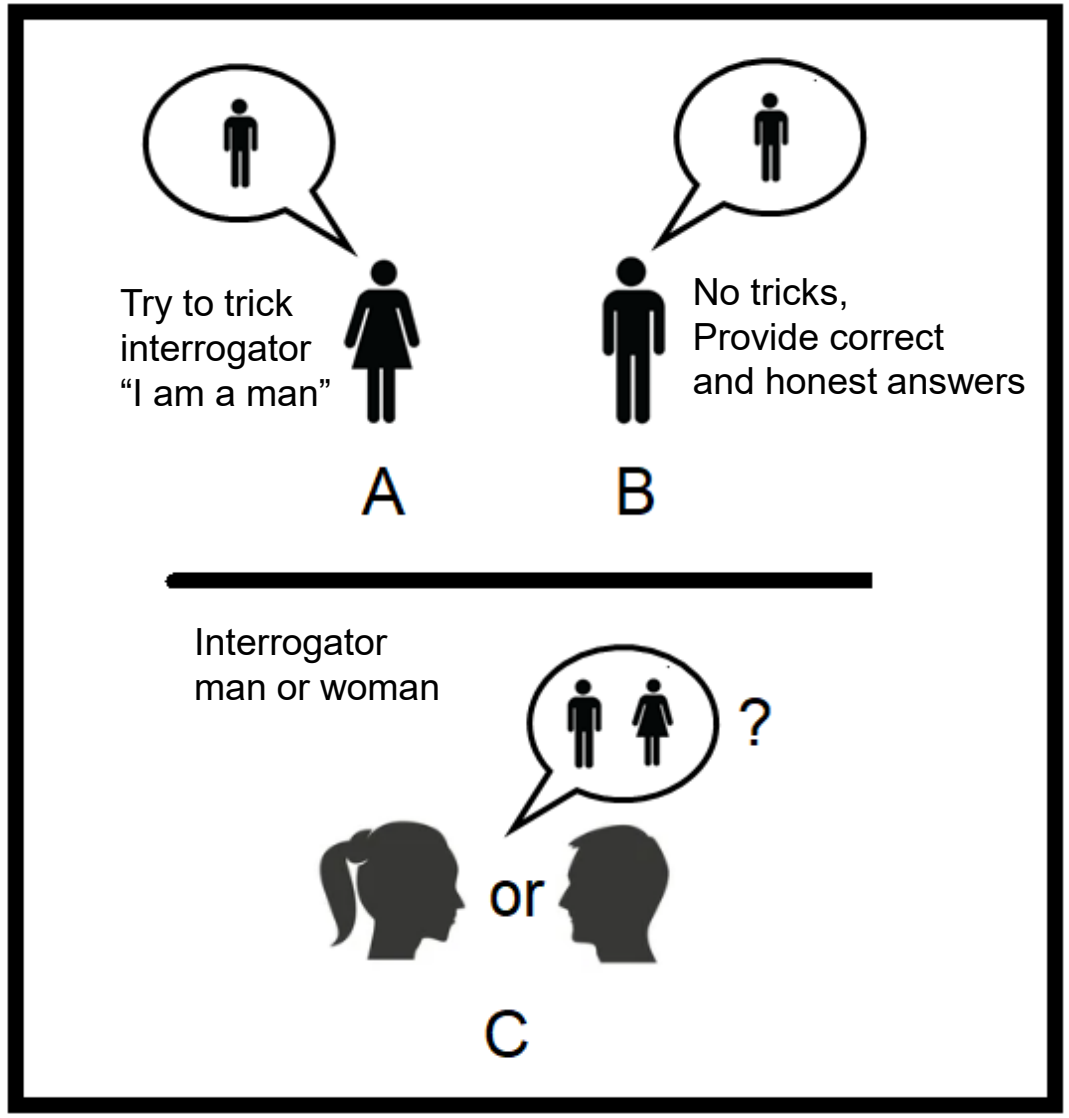
Can Machines Think? Turing's Test (The Imitation Game)



From 1990-2000

Number of peop
Number of people who usec

Table | Map

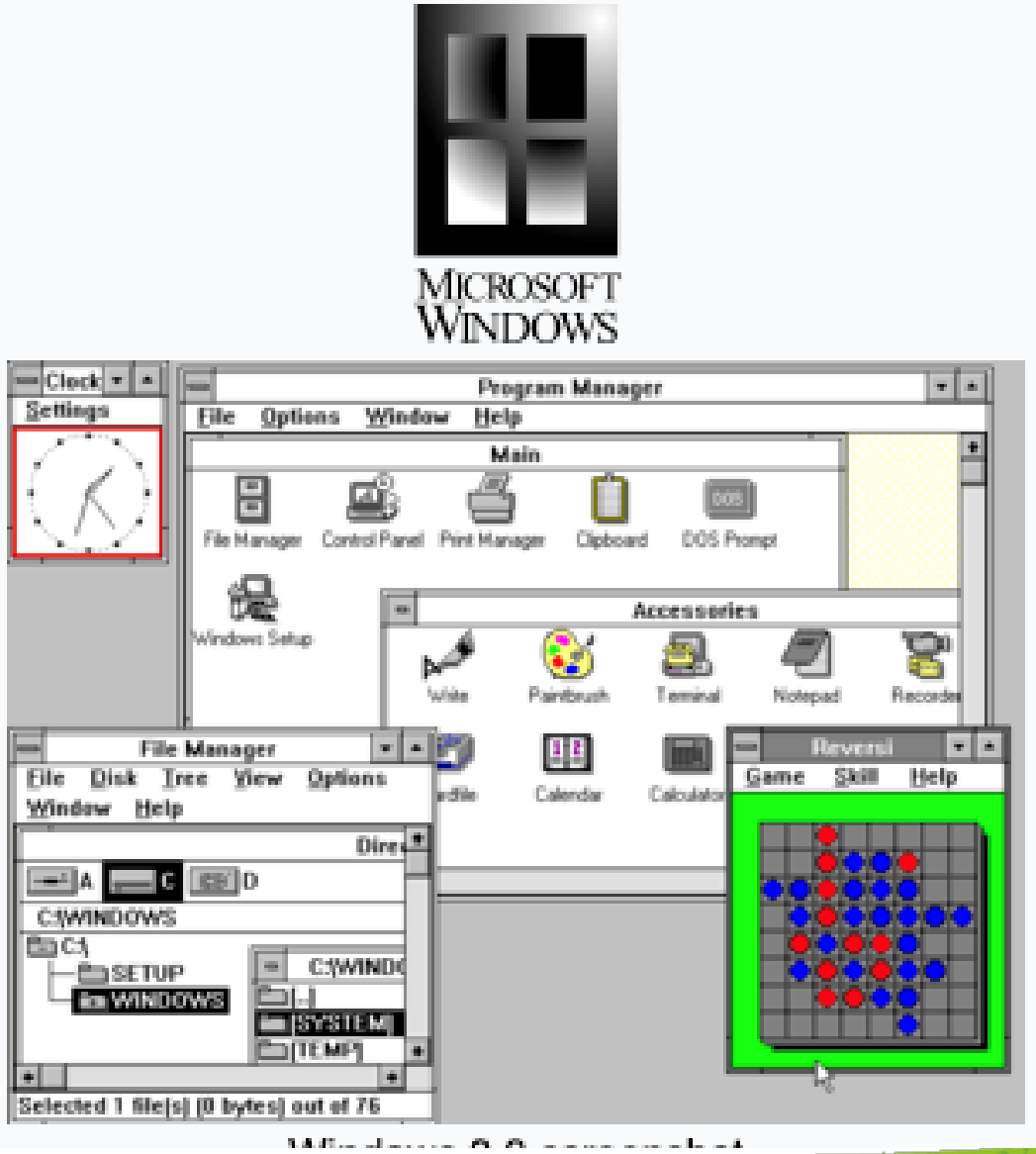
400 million
350 million
300 million
250 million
200 million
150 million
100 million
50 million
0
1990

1990

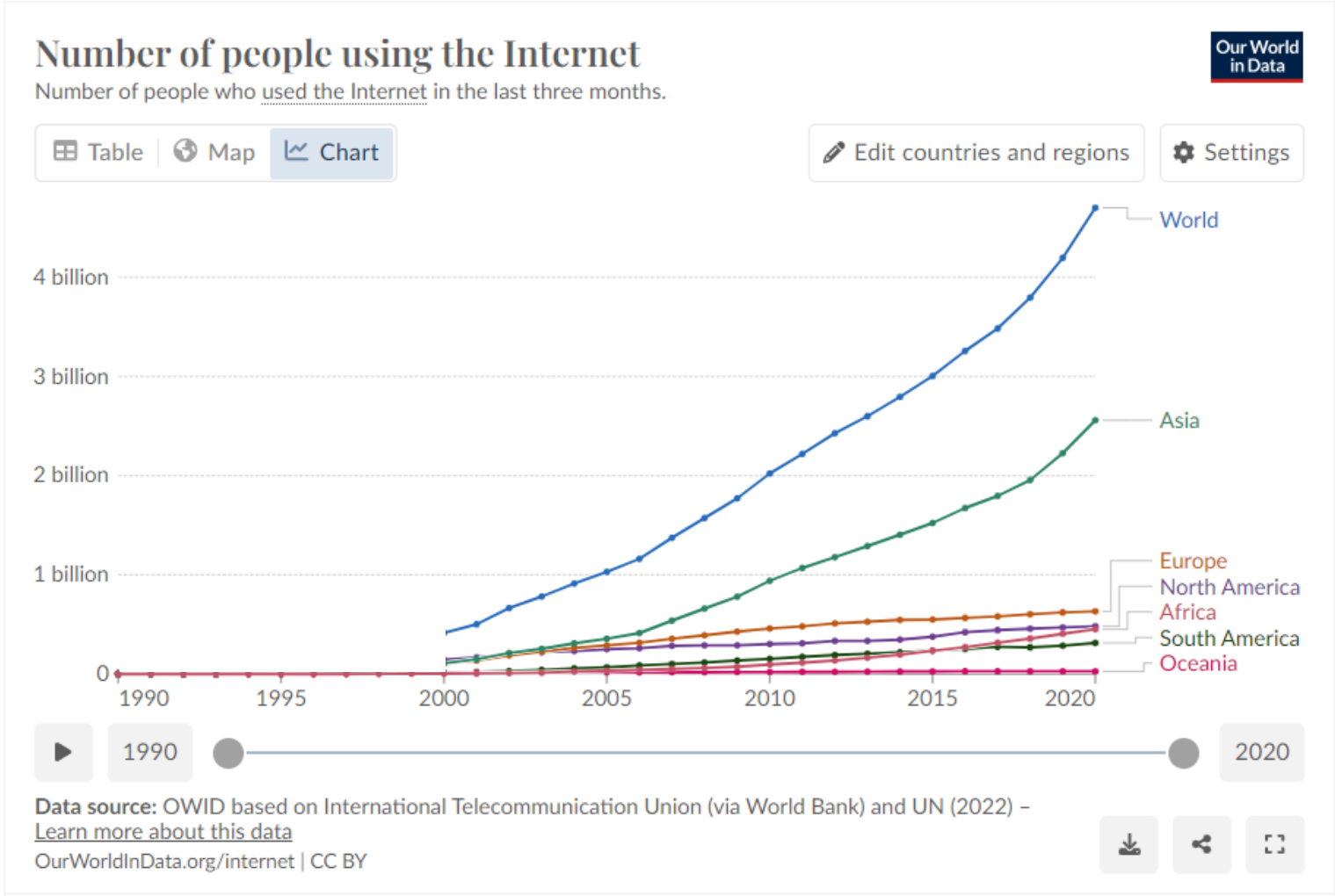
Data source: OWID based c
Learn more about this data
OurWorldInData.org/internet

Windows 3.0

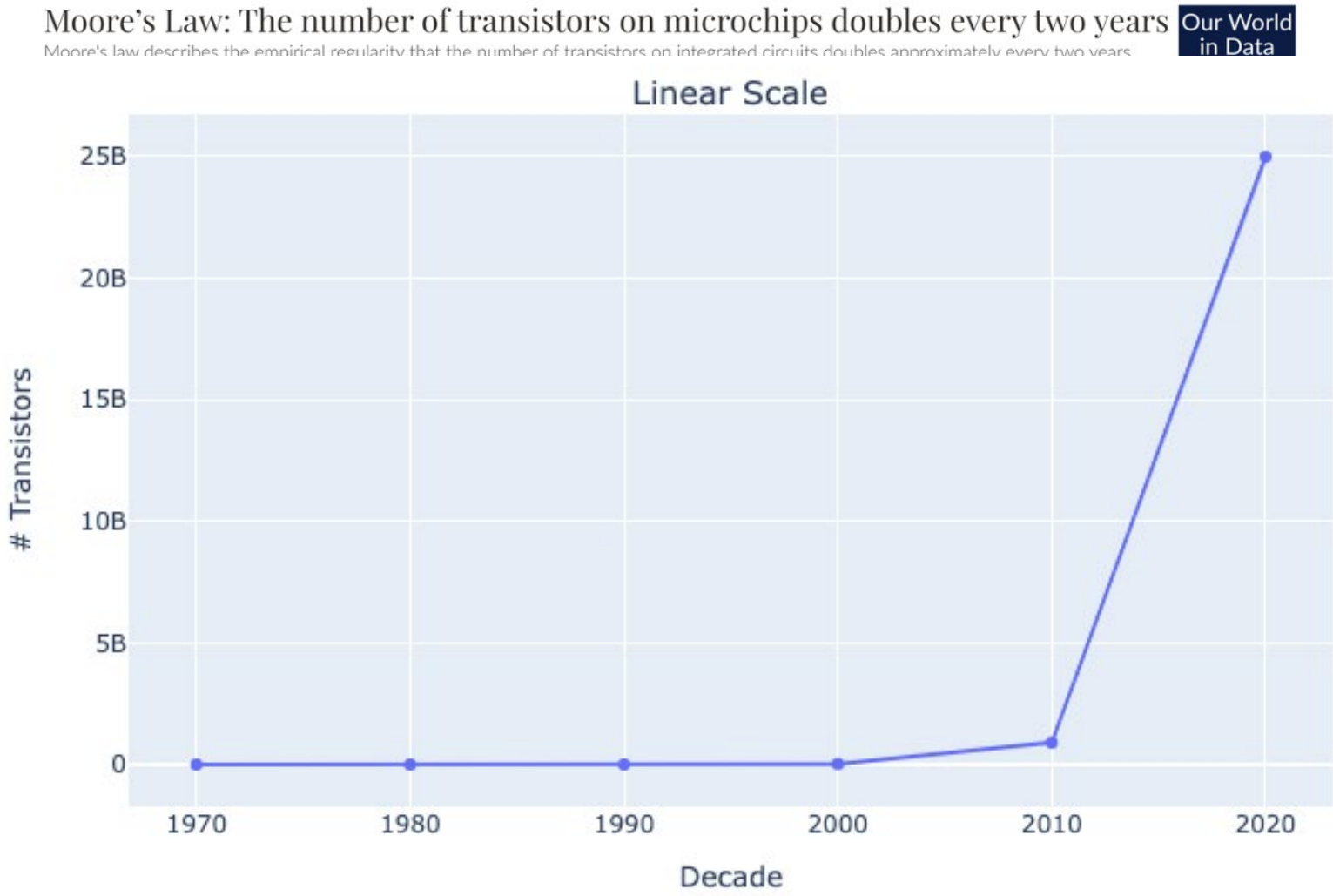
Version of the Windows operating system



From 2000-2020

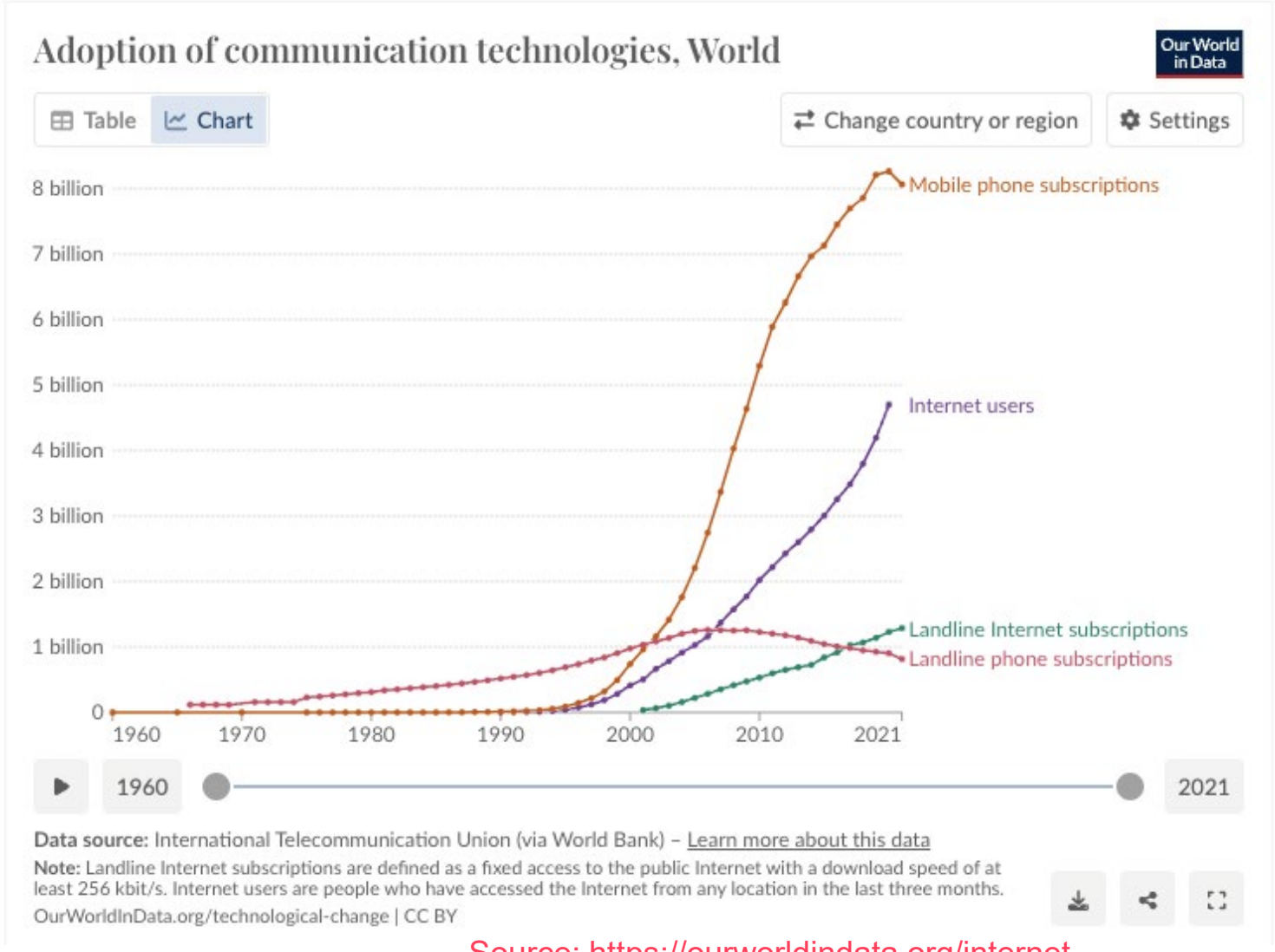


Computation Capabilities



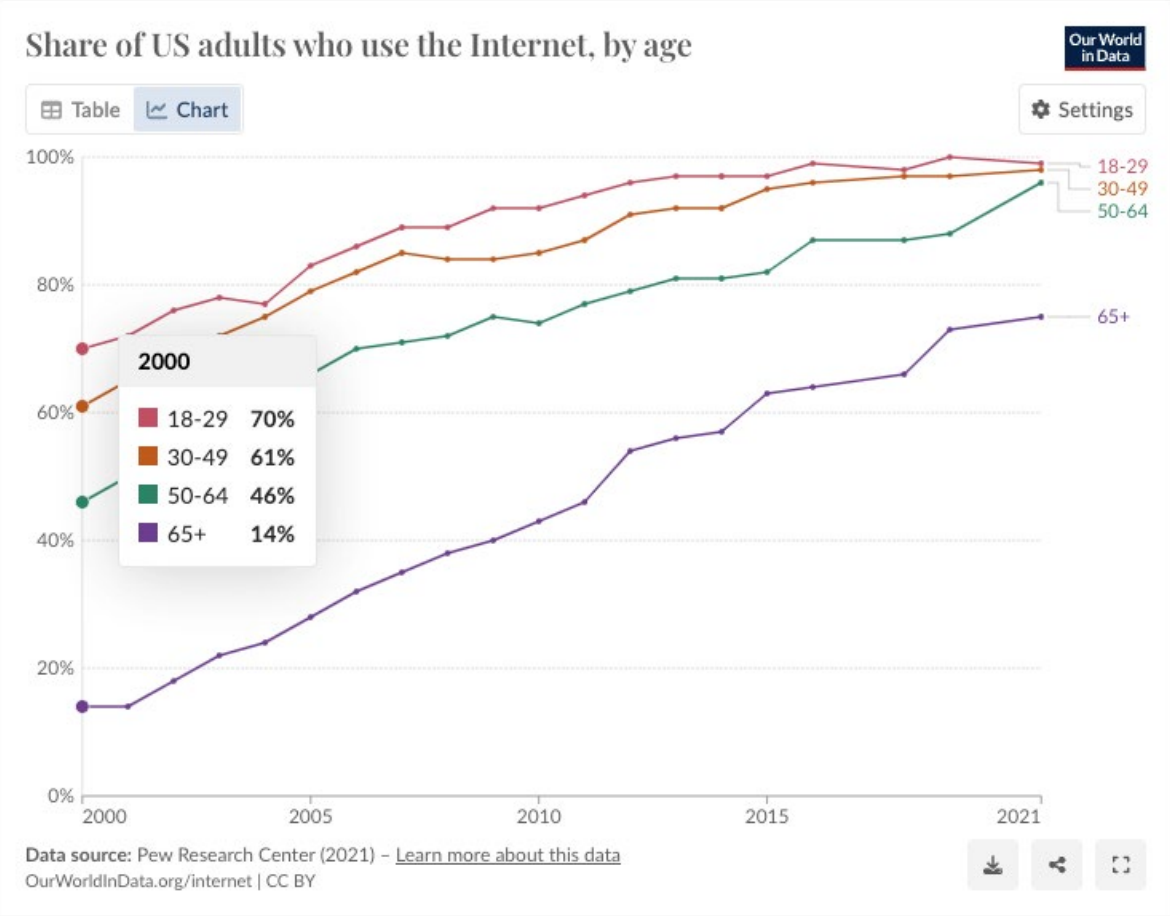
Source: https://en.wikipedia.org/wiki/Moore%27s_law

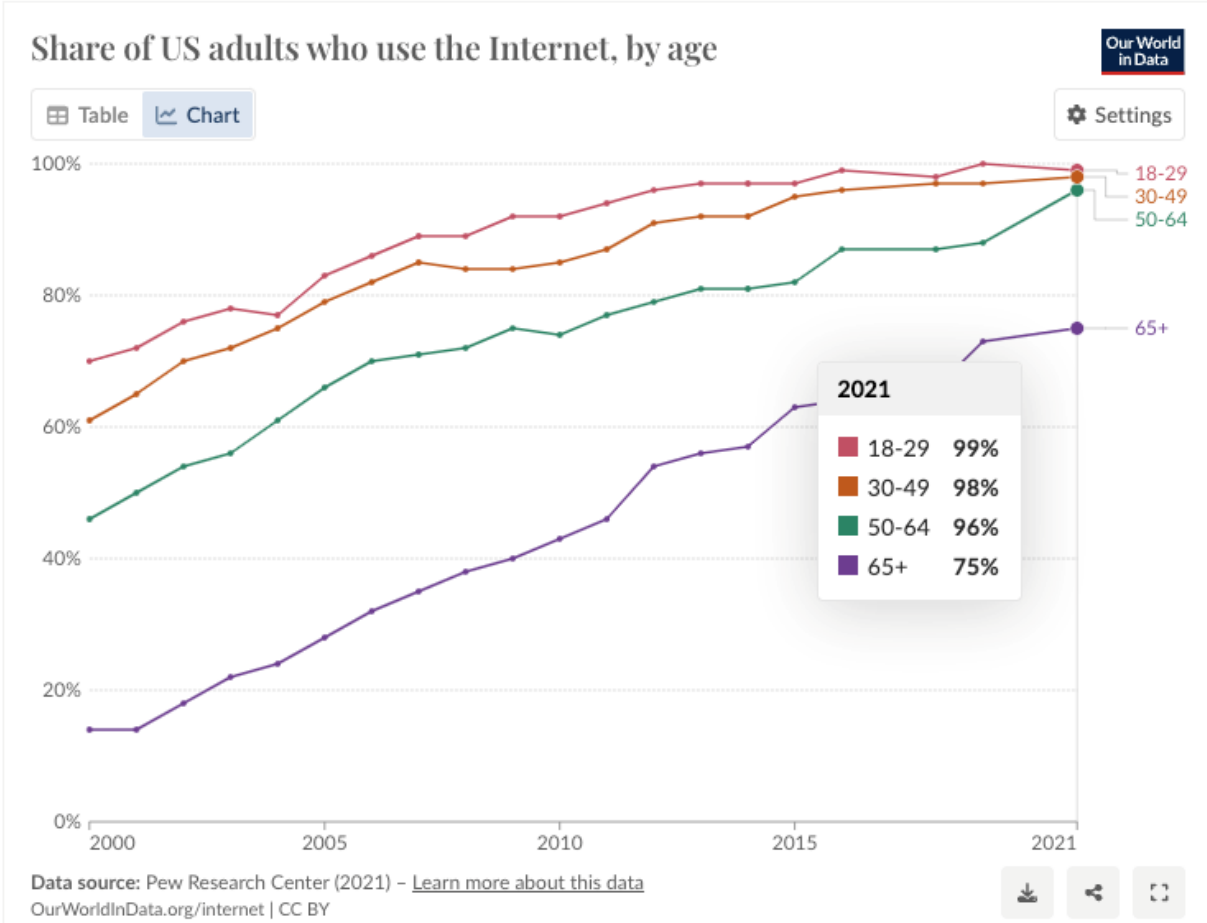
The Era of Smart Phones



Source: https://ourworldindata.org/internet

Internet Usage by Age





Source: https://ourworldindata.org/internet

The Incredible 90s – The World Would Never Be the Same…

July 5, 1994

Amazon was founded by Jeff Bezos from his garage in Bellevue, Washington, on **July 5, 1994**. Initially an online marketplace for books, it has expanded into a multitude of product categories: a

The Human Genome Project was a **large, well-organized, and highly collaborative international effort that generated the first sequence of the human genome** [1][2][3][4][5]. It started in 1990 and was completed in 2003, and it was one of the most ambitious and important scientific endeavors in human history [1][3][5]. The project provided fundamental information about the human blueprint, which has since accelerated the study of human biology and improved the practice of medicine [2][4][5]. The project also pioneered a new ethos for data sharing in biomedical research [4].

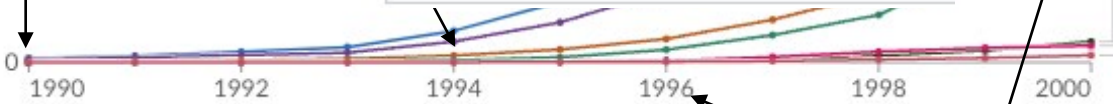
2 **Human Genome Project**
Scientific research project

sing the Internet
nternet in the last three months.

Our World in Data

Edit countries and regior

Steve Jobs presenting the iPhone 4

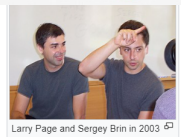


1990

Data source: OWID based on International Telecommunication Union (via World Bank) and UN (2022) – Learn more about this data
OurWorldInData.org/internet | CC BY

BlackBerry is a series of wireless handheld communication devices that were among the first popular smartphones [1]. The company Research in Motion (RIM) created the first BlackBerry device, a pager capable of email, in 1999 [1][2].

Google



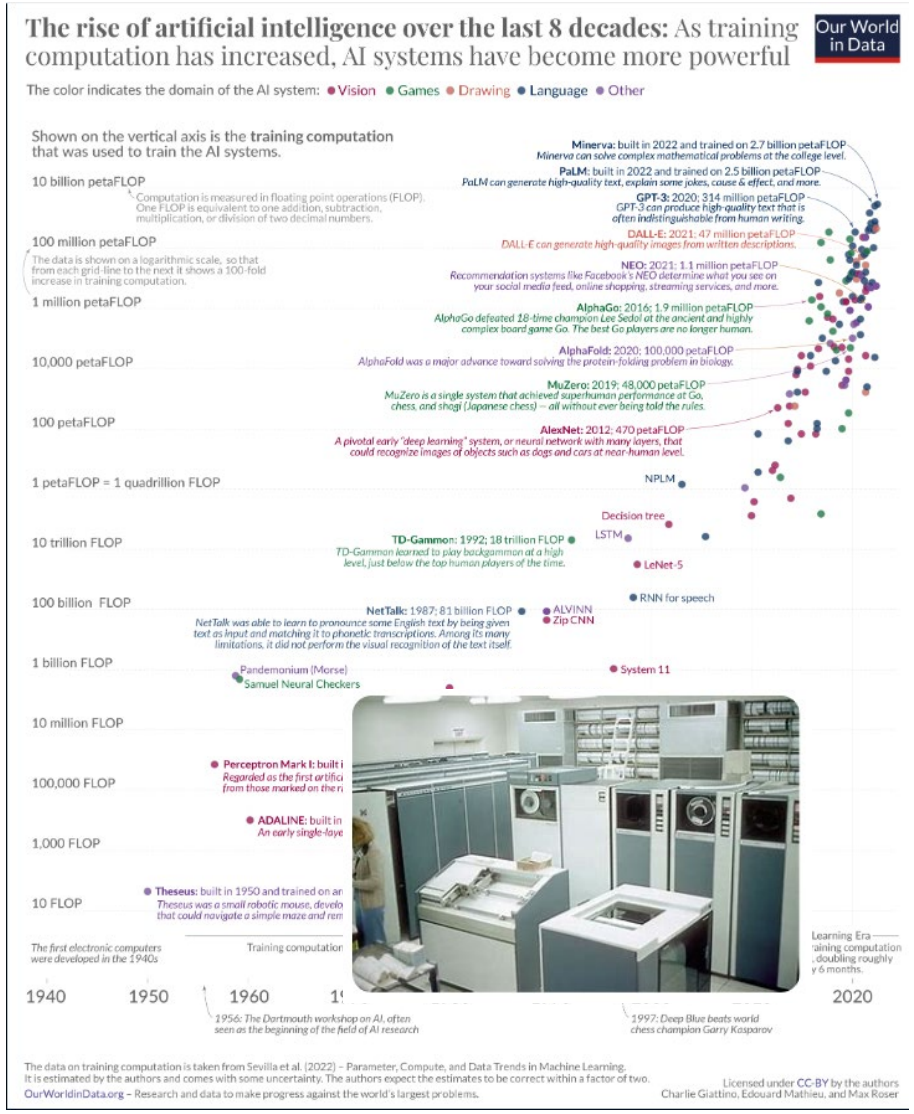
Larry Page and Sergey Brin in 2003

The first Google computer at Stanford was housed in custom-made enclosures constructed from LEGO bricks.[11][failed verification]

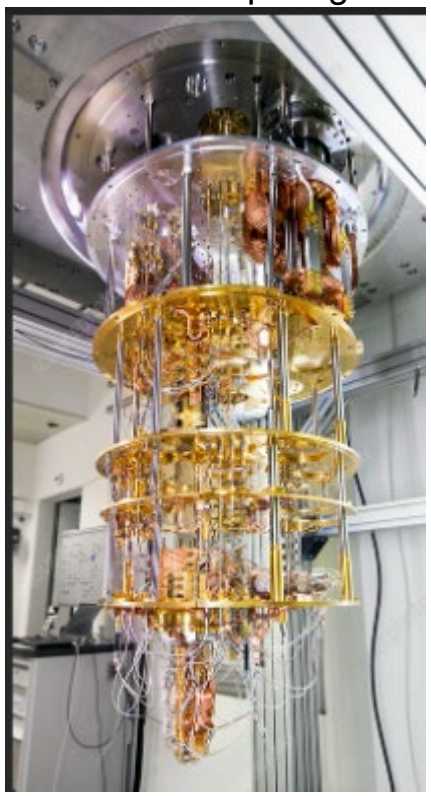
The research project was nicknamed "BackRub", and it was soon joined by Brin, who was supported by a National Science Foundation Graduate Fellowship.[10] The two had first met in the summer of 1995, when Page was part of a group of potential new students that Brin had volunteered to give a tour around the campus and nearby San Francisco.[8] Both Brin and Page were working on the Stanford Digital Library Project (SDLP). The SDLP's goal was "to develop the enabling technologies for a single, integrated and universal digital library" and it was funded through the National Science Foundation, among other federal agencies.[10][11][12][13] Brin and Page were also part of a computer science research team at Stanford University that received funding from Massive Digital Data Systems (MDDS), a program managed for the Central Intelligence Agency (CIA) and the National Security Agency (NSA) by large intelligence and military contractors.[14]

Page's web crawler began exploring the web in March 1996, with Page's own Stanford home page serving as the only starting point.[8] To convert the backlink data that is gathered for a given web page into a measure of importance, Brin and Page developed the PageRank algorithm.[8] While analyzing BackRub's output which, for a given URL, consisted of a list of backlinks ranked by importance, the pair realized that a search engine based on PageRank would produce better results than existing techniques (existing search engines at the time essentially ranked results according to how many times the search term appeared on a page).[8][15]

Evolution of Algorithms and Computation Power

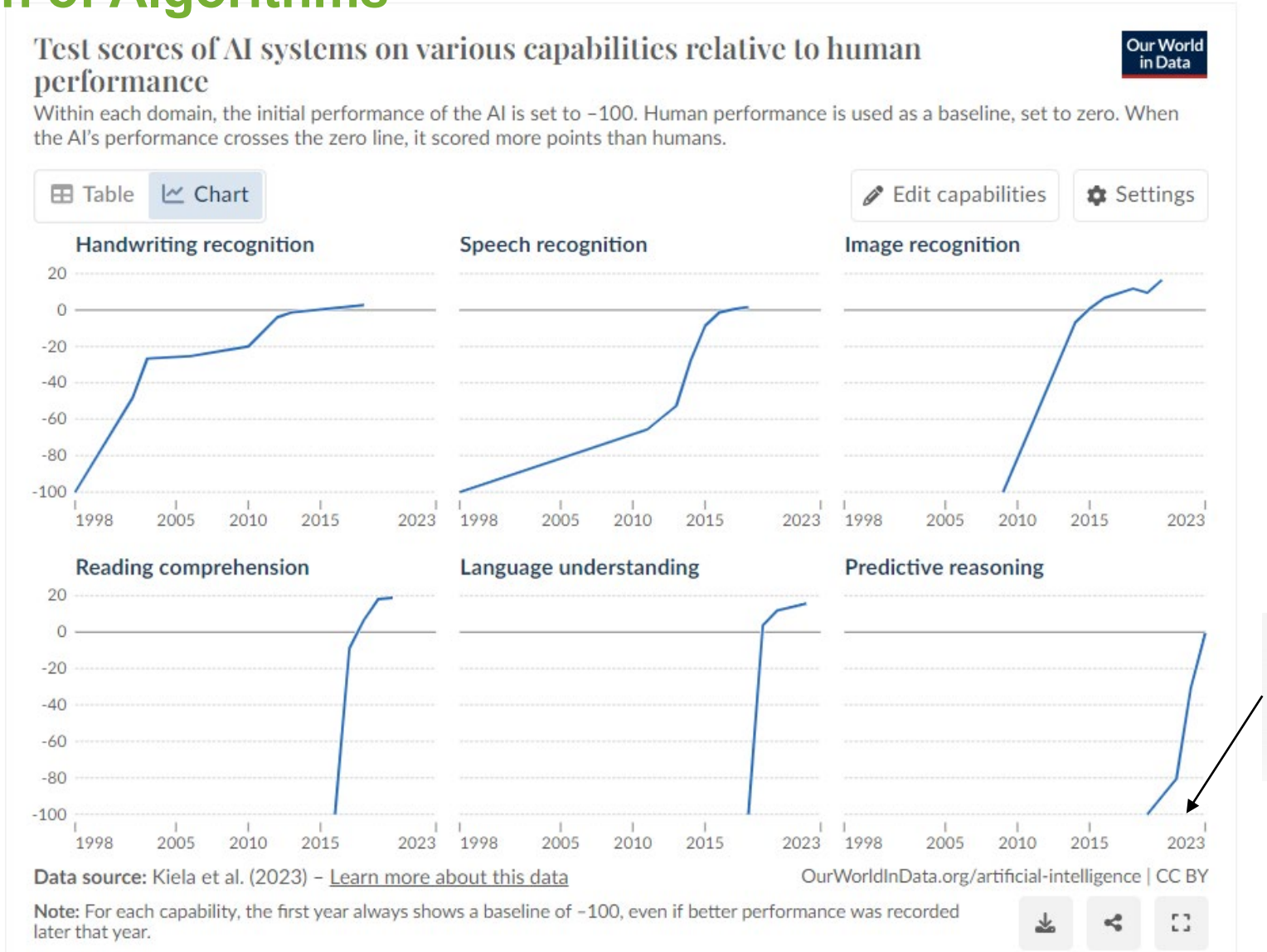


Quantum Computing?



2050?

Evolution of Algorithms



Questions 2-5

Implementing AI/Machine Learning Across the Board

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The major challenge and limitation for implementing AI in the industry as a whole is:

ⓘ Start presenting to display the poll results on this slide.

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How can my company deploy AI/Machine Learning tools that can be used by multiple departments (transformers)?

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A Cooperation with a company specialized in Large Language Models (i.e. ChatGPT, etc.) would immediately:

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My major concern with AI/Machine Learning is:

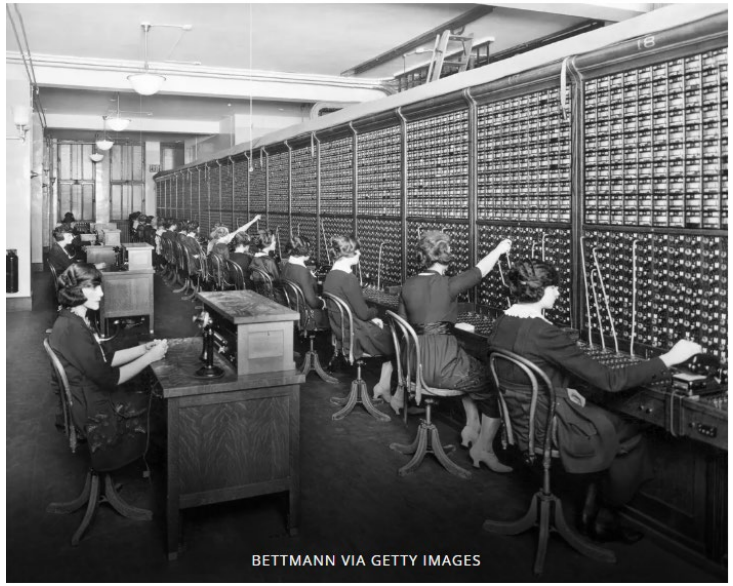
ⓘ Start presenting to display the poll results on this slide.

The Arrival of New Technologies vs. Job Loss

Change Management

People may resist new technologies due to fear of job displacement or lack of understanding. It's important to foster a culture of collaboration and emphasize that AI augments human capabilities

The Operator



The Switchboard

The Smartphone

Skills and Infrastructure

Skills Gap
There is often a shortage of skilled professionals who understand AI and can manage its implementation. Investing in training and hiring talent is crucial for successful AI adoption. Cooperation and joint ventures may also speed up deployment

Infrastructure
Outdated infrastructure can hinder the deployment of AI solutions. Companies may need to invest in modernizing their IT environment to support AI technologies

Integration with Existing Systems
Incorporating AI into existing workflows and systems can be complex, requiring careful planning to ensure compatibility and functionality

Understanding AI/ML Requirements

Cost
AI implementation can be expensive, not just in terms of the technology itself but also the associated costs of training, data management, and infrastructure upgrades

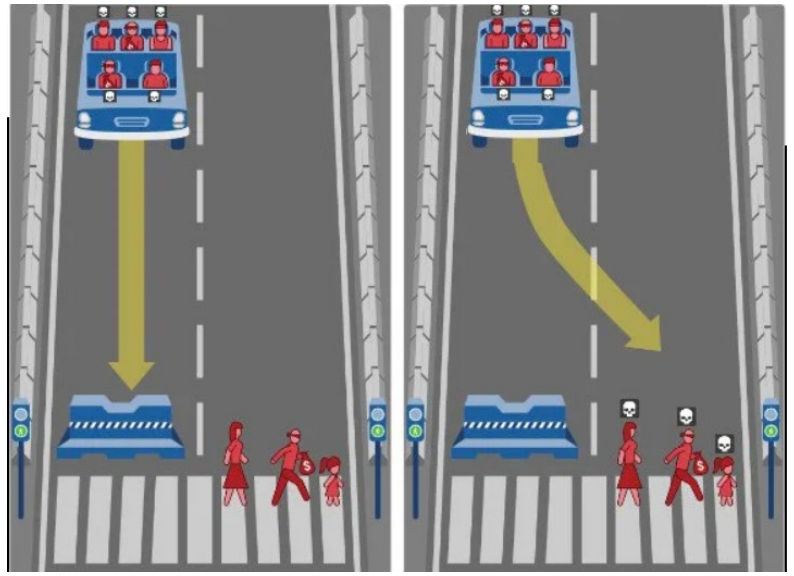
Data Quality and Availability
AI systems require high-quality, relevant data to function effectively. Insufficient or low-quality data can lead to poor AI performance and unreliable outcomes

Ethical and Legal Considerations
Companies must navigate the ethical implications of AI and ensure compliance with regulations regarding data privacy and usage.

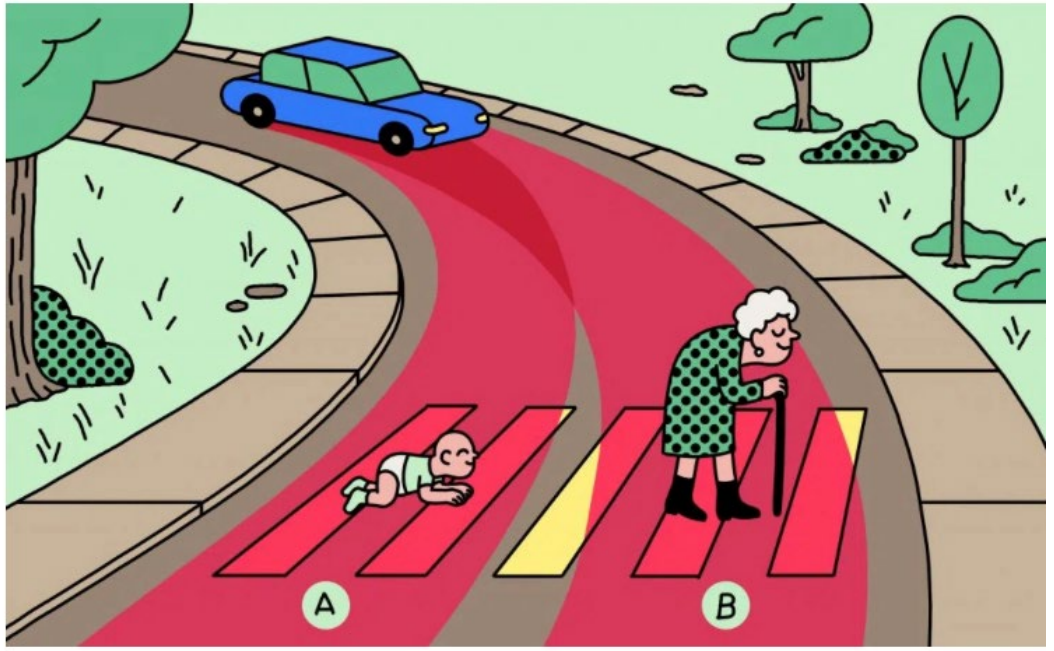
On-going Ethical and Moral Dilemmas in AI

Imagine a self-driving car approaching a crosswalk. Suddenly, a group of pedestrian steps onto the road. The car must decide whether to swerve and hit a barrier (potentially harming the passengers) or continue straight and hit the pedestrians.

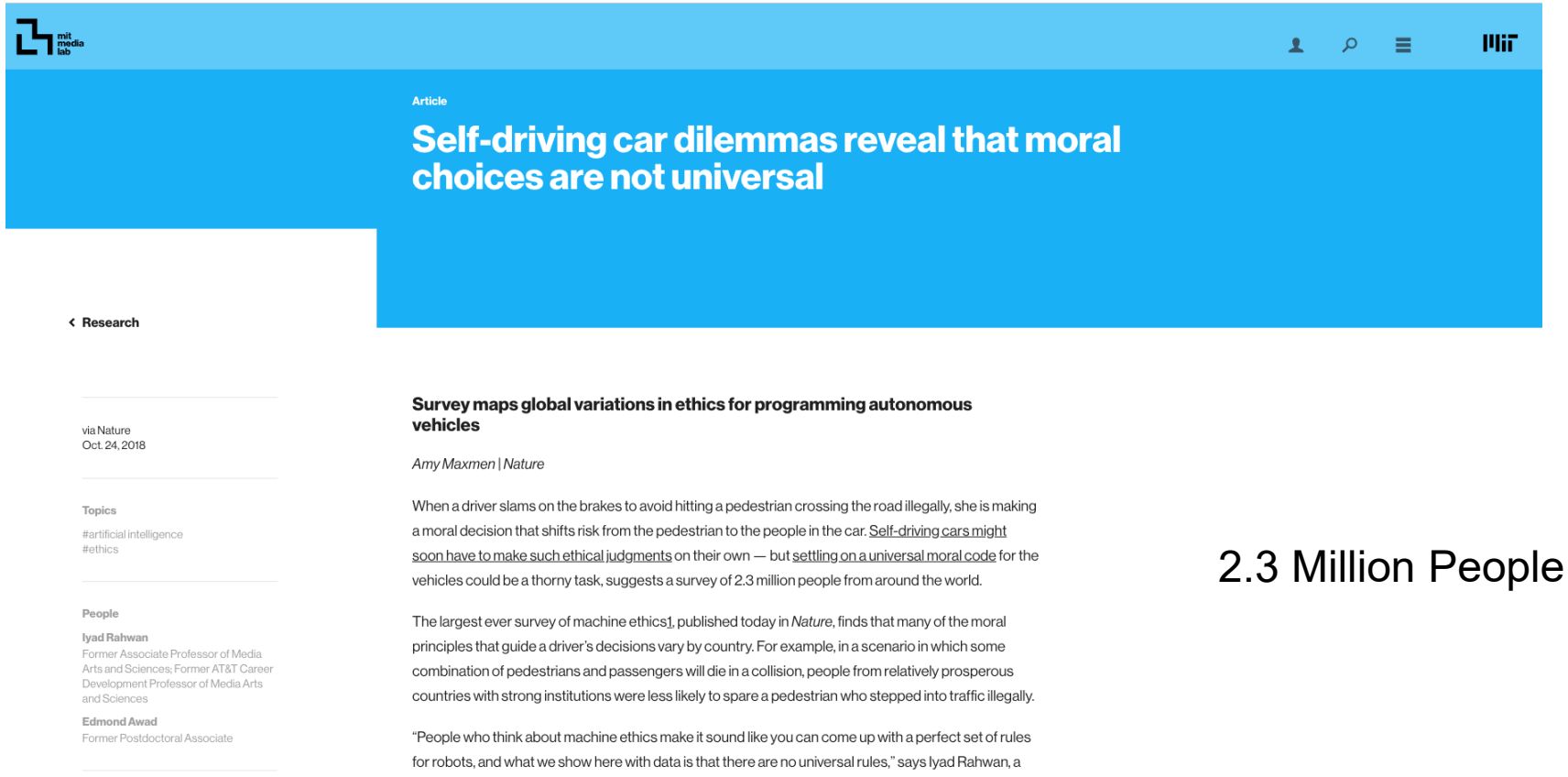
This classic ethical dilemma raises questions about prioritizing lives and the responsibility of programming such decisions.



Moral Choices Not Universal



Moral Choices Not Universal – MIT Survey



mit media lab

Article

Self-driving car dilemmas reveal that moral choices are not universal

‹ Research

via Nature
Oct. 24, 2018

Topics

#artificial intelligence
#ethics

People

Iyad Rahwan
Former Associate Professor of Media Arts and Sciences; Former AT&T Career Development Professor of Media Arts and Sciences

Edmond Awad
Former Postdoctoral Associate

Survey maps global variations in ethics for programming autonomous vehicles

Amy Maxmen | Nature

When a driver slams on the brakes to avoid hitting a pedestrian crossing the road illegally, she is making a moral decision that shifts risk from the pedestrian to the people in the car. Self-driving cars might soon have to make such ethical judgments on their own — but settling on a universal moral code for the vehicles could be a thorny task, suggests a survey of 2.3 million people from around the world.

The largest ever survey of machine ethics1, published today in *Nature*, finds that many of the moral principles that guide a driver's decisions vary by country. For example, in a scenario in which some combination of pedestrians and passengers will die in a collision, people from relatively prosperous countries with strong institutions were less likely to spare a pedestrian who stepped into traffic illegally.

"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," says Iyad Rahwan, a

2.3 Million People Surveyed

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"Ain't Nobody In it!"

AAA NEWSROOM

News Resources

Automotive

Three in Four Americans Remain Afraid of Fully Self-Driving Vehicles

AAA believes testing, experience and education will aid consumer acceptance

Ellen Edmonds
Director, External Communications
eedmonds@national.aaa.com
3/14/2019

[Police pull over driverless car in San Francisco traffic stop (youtube.com)]

Understanding AI/ML Requirements

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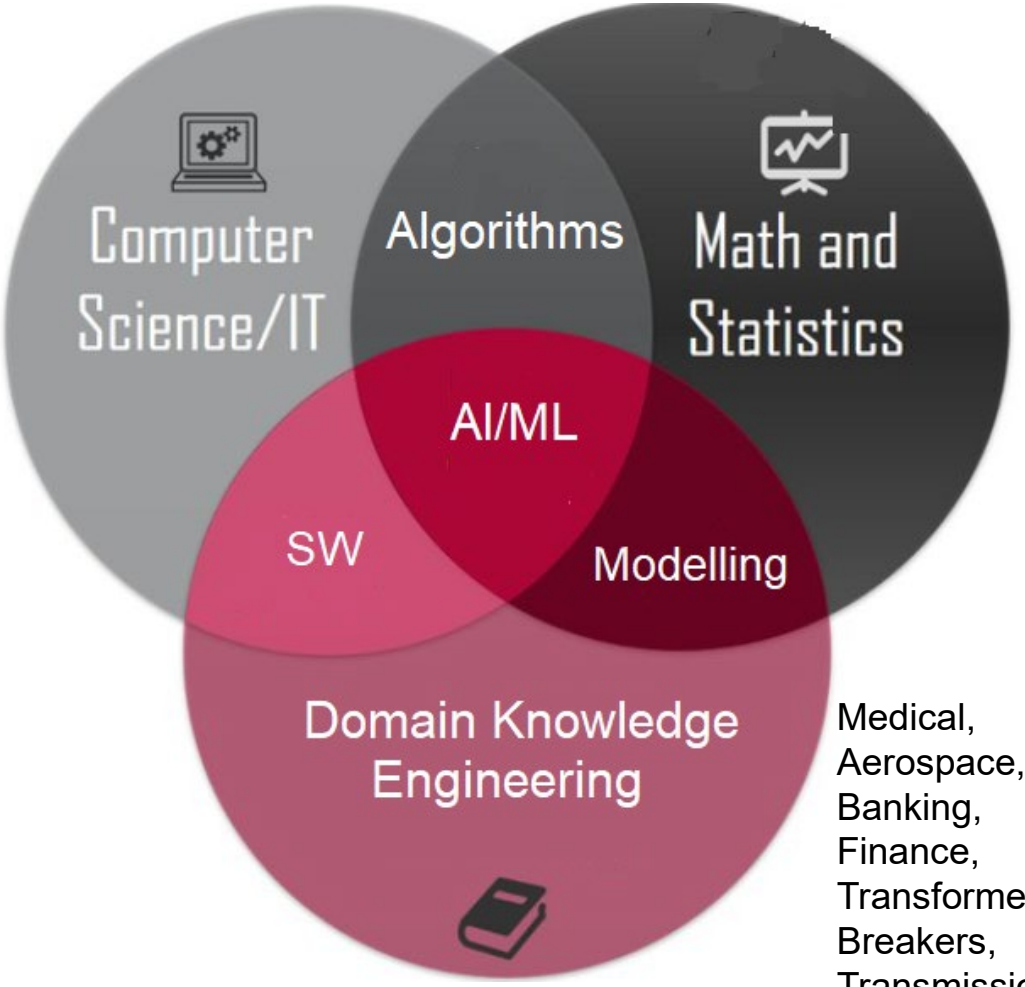
Overestimating AI Capabilities
It's important to have realistic expectations about what AI can achieve and not to overestimate its capabilities or the speed of adoption

AI/ Machine Learning Toolbox – A Multidisciplinary Approach



Medical,
Aerospace,
Banking,
Finance,
Transformers,
Breakers,
Transmission Lines,
etc…

Thank You!

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