Eight Reading Suggestions

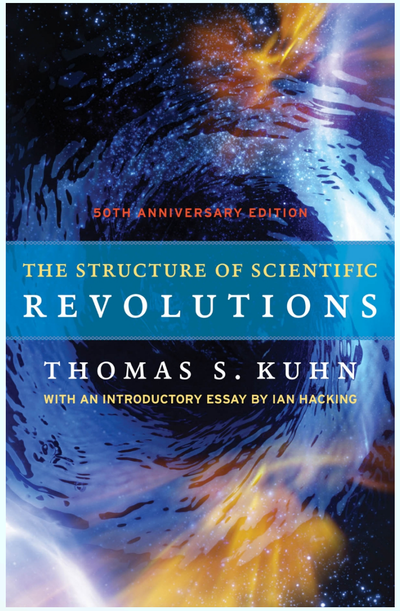
A personal recommendation

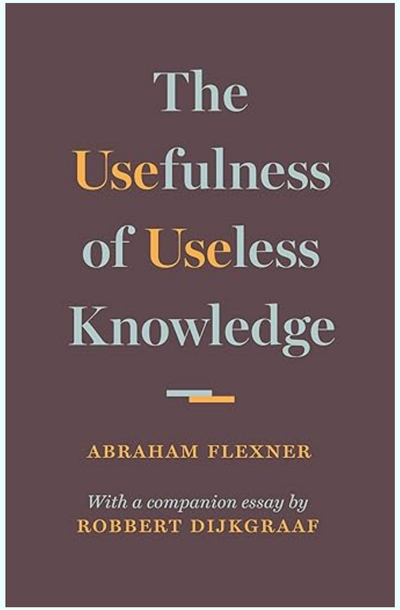
Marco Aiello, IAAS-SC, University of Stuttgart, DE

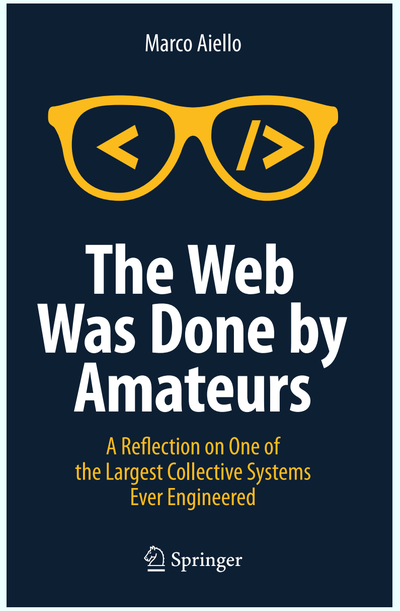
ECSS 2024, Malta

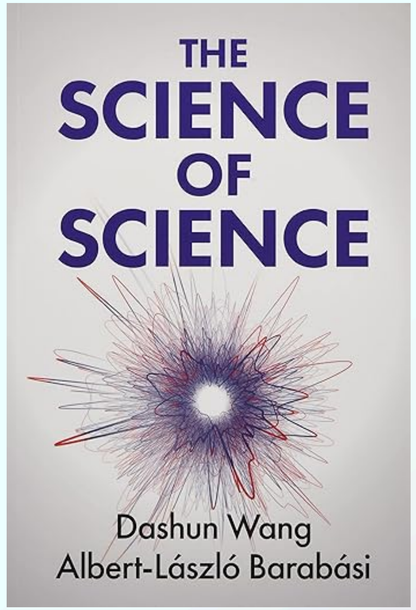
Reading suggestions

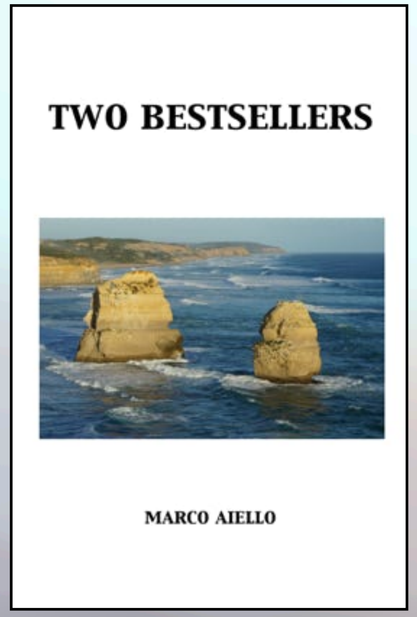
Philosophy of science
The Science of Science
Jobs
Sustainability

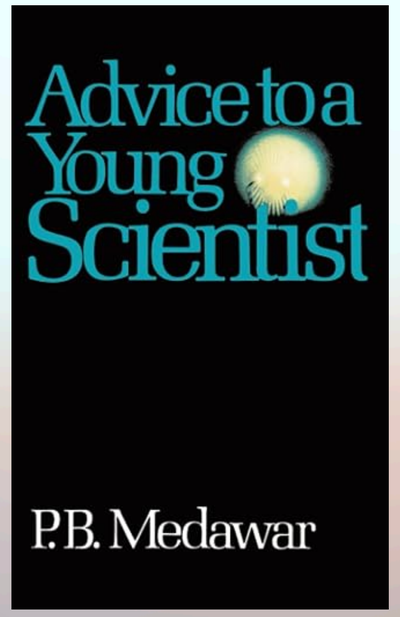













COVER FEATURE VENTURE SCIENTISTS AND TECHNOLOGY ENTREPRENEURSHIP

The AI Revolution and the Future of Work: Threats and Opportunities

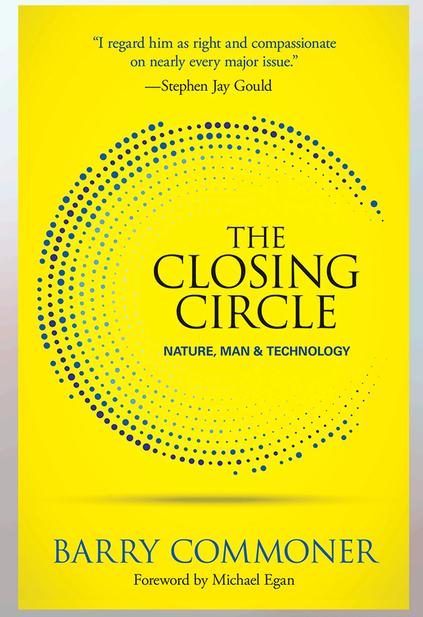
Marco Aiello, University of Stuttgart

AI is transforming the global labor market, signaling a shift where jobs are both displaced and newly created. But is it really creating enough new jobs?

Technological advancement brings new entrepreneurial opportunities and has the power to revolutionize markets. In doing so, jobs can be swapped away, considerably downsized, or deeply changed. The neoclassical view on technological advancements postulates that whenever a certain type of job is made useless by technological innovation, new jobs appear on the market to compensate for the loss, possibly after a painful transition.[1] If the Second Agricultural Revolution finally resulted in workers moving from the fields to the factories, the end of the First Industrial Revolution marked the shift of work from being available in factories to being in offices. Usually, the number of office jobs created was greater than those lost. These revolutions brought economic growth in terms of average income per person and gross domestic product (GDP). Up until recently, economic growth has guaranteed that labor markets have many new opportunities and that unemployment rates are low during periods of growth. Now, though, things appear to be different, as pointed out by several economists (for example, Paul Krugman[2]) and computer scientists (see Moshe Vardi[3]). Such a view is often referred to as *Neo-Luddist*, as a reference to the movement of English textile workers who, in the early 1800s, started threatening mill owners and destroying machinery in a fight to keep their factory jobs.

Starting from the assumption that we are currently experiencing the Fourth Industrial Revolution, which is fueled by the rapid advancements in AI, machine learning, robotics, and the Internet of Things, what are the current opportunities in terms of jobs and entrepreneurship, and also, what are the risks in terms of the global labor market? In the present article, I will explore these threats and

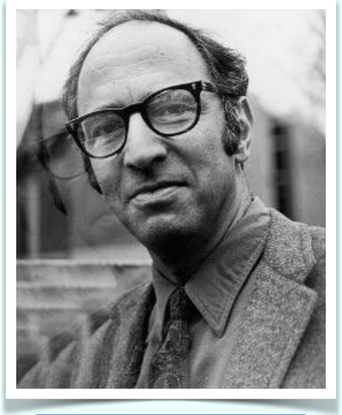
Digital Object Identifier 10.1109/MIC.2024.3376279
Date of current version: 6 May 2024

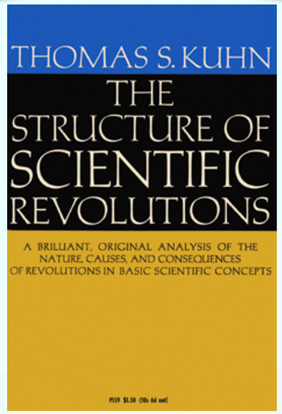


Philosophy and History of Science

How Science Works

a pardigm is the collection of beliefs, techniques, values and assumptions that together form a shared worldview and research program within which normal science takes place





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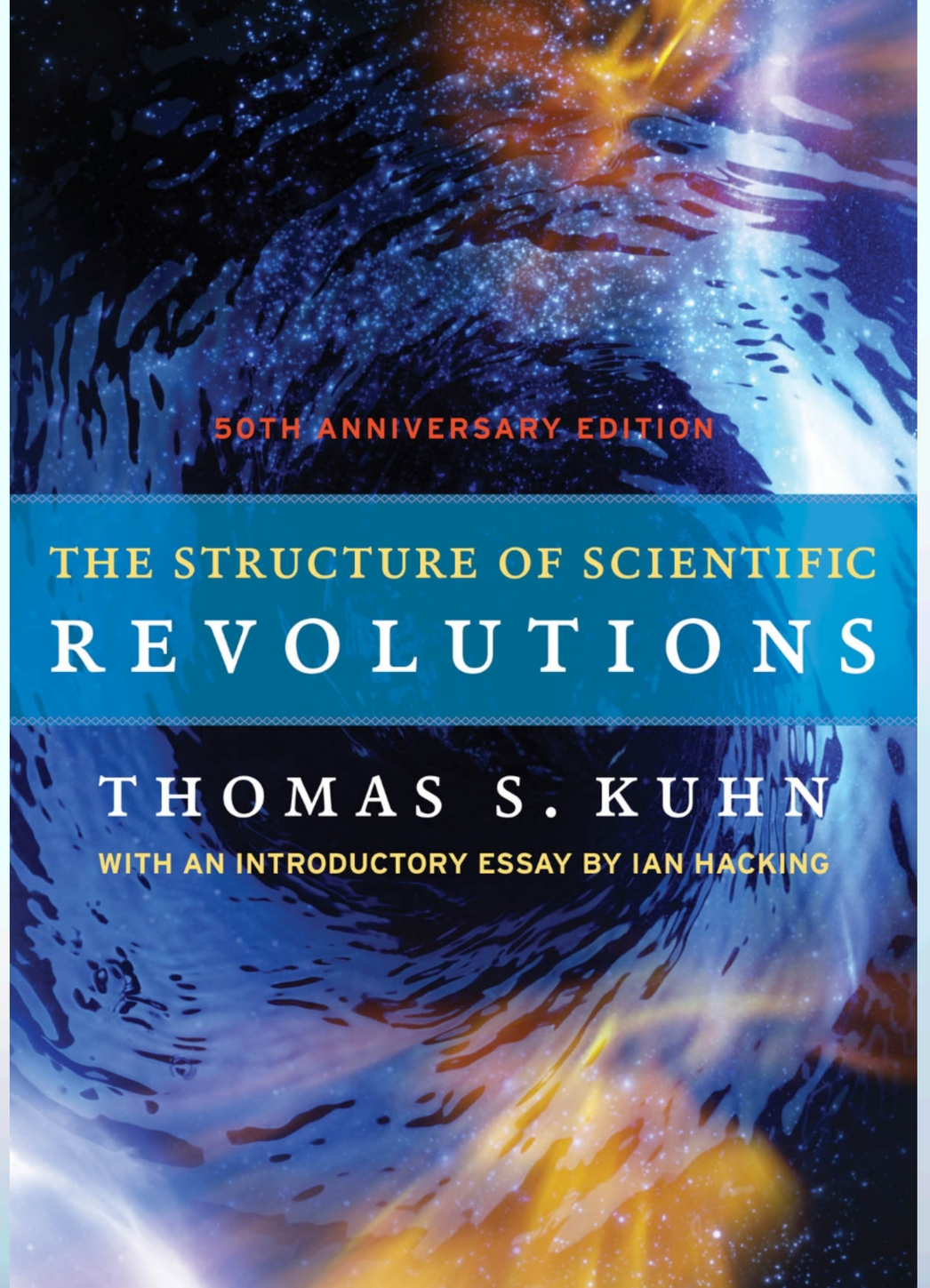
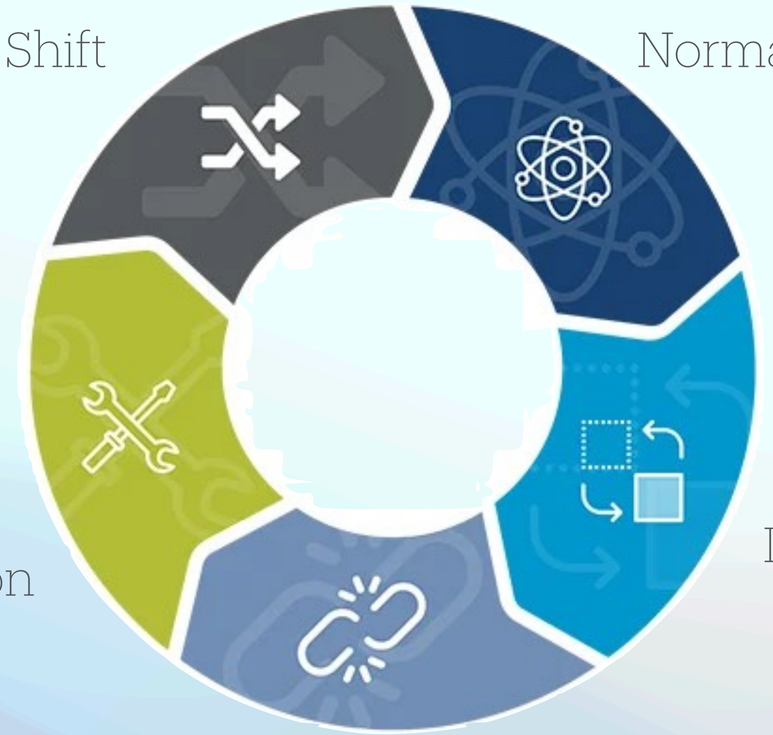
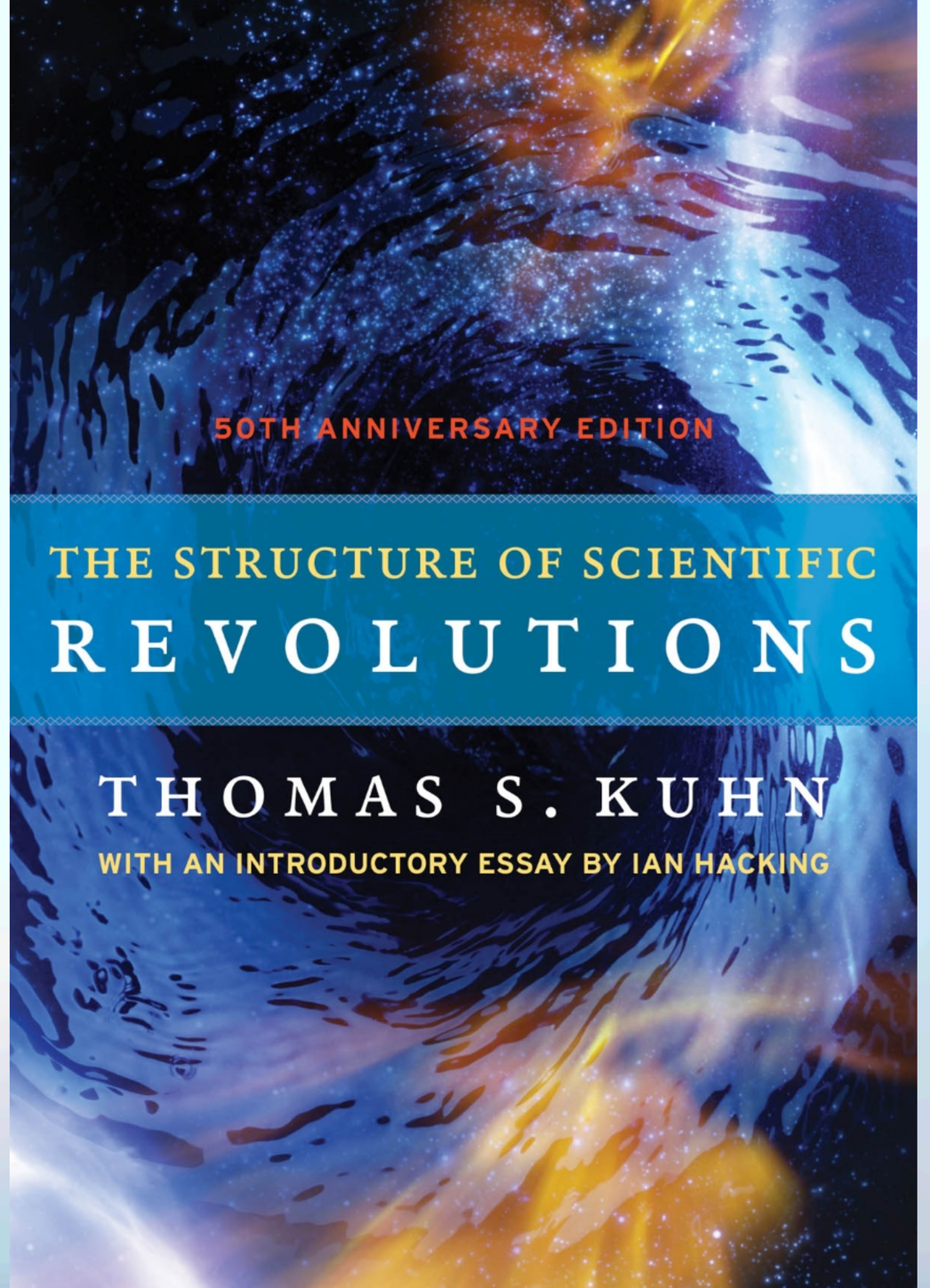


Paradigm Shift

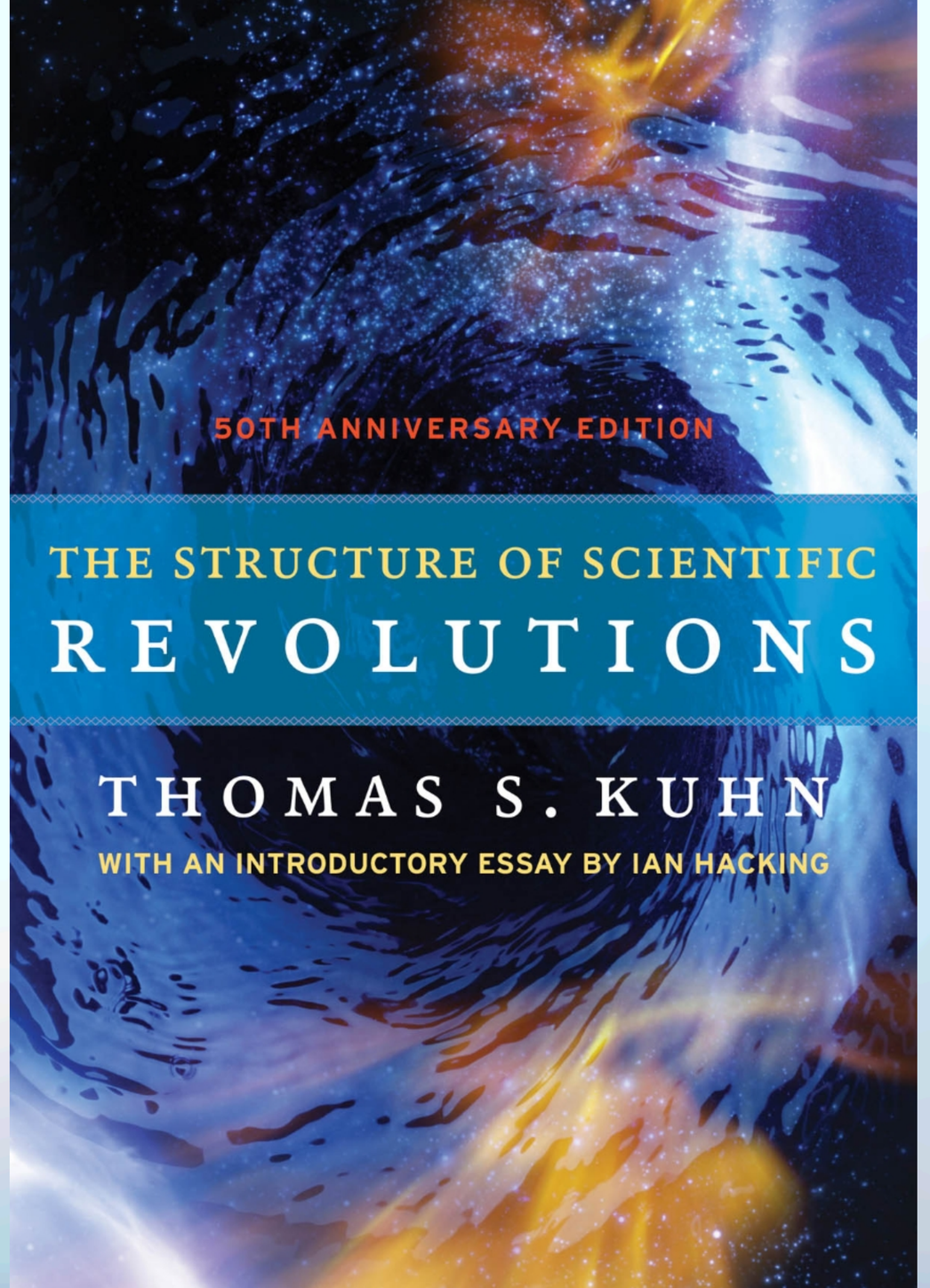
The Cycle





Paradigm Shift

extraordinary research, *exploratory in nature, "the recourse to philosophy and to debate over fundamentals" bringing the community to a crisis*



Are we in a crisis?

Sparks of Artificial General Intelligence: Early experiments with GPT-4

Sébastien Bubeck, Varun Chandrasekaran, Ronen Eldan, Johannes Gehrke, Eric Horvitz, Ece Kamar, Peter Lee, Yin Tat Lee, Yuanzhi Li, Scott Lundberg, Harsha Nori, Hamid Palangi, Marco Tulio Ribeiro, Yi Zhang

Microsoft Research

The New York Times

OPINION

GUEST ESSAY

Noam Chomsky: The False Promise of ChatGPT

March 8, 2023

Theory of Mind May Have Spontaneously Emerged in Large Language Models

Authors: Michal Kosinski*[1]

Affiliations:

[1]Stanford University, Stanford, CA94305, USA

*Correspondence to: michalk@stanford.edu

Ethics and Information Technology (2024) 26:38
https://doi.org/10.1007/s10676-024-09775-5

ORIGINAL PAPER

ChatGPT is bullshit

Michael Townsen Hicks[1] · James Humphries[1] · Joe Slater[1]

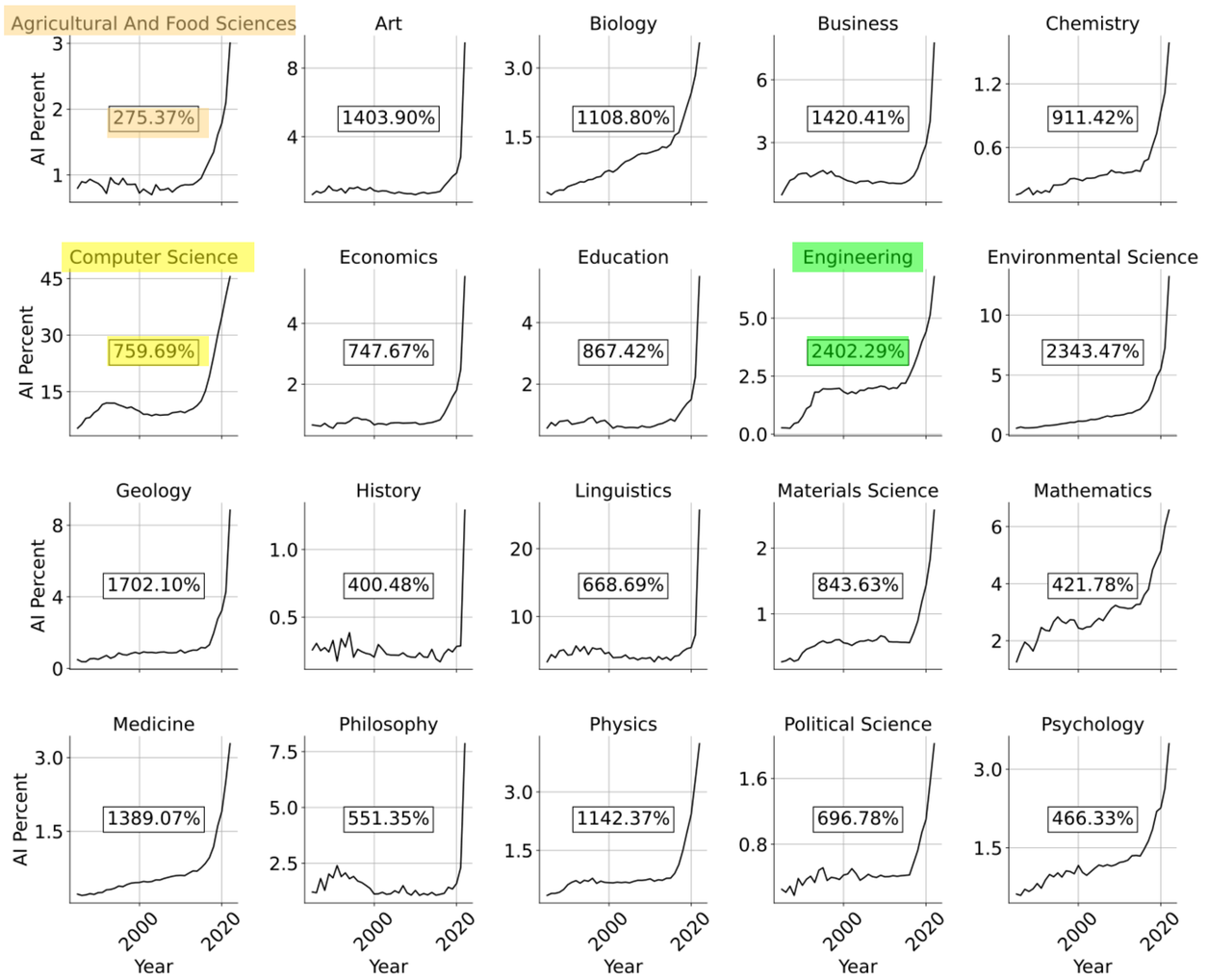
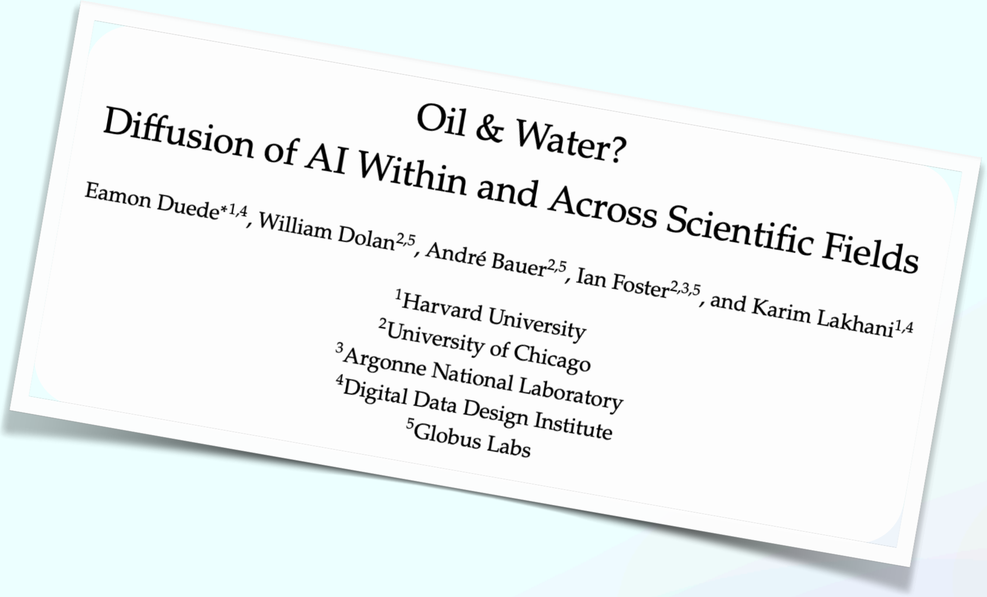


Figure 2: Change in AI engagement percentage from 1985 - 2023 by field. Inserts tally the total change in percentage of AI-engaged publications for each field.

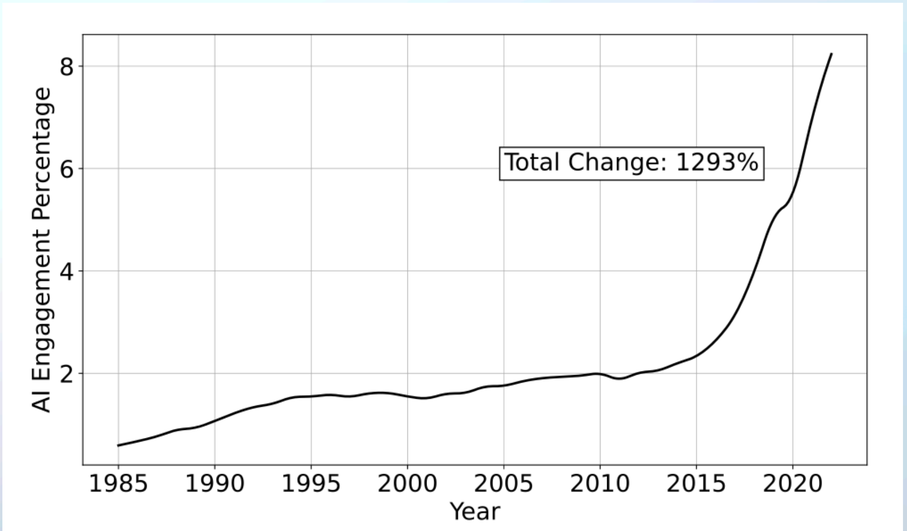


Oil & Water?

Diffusion of AI Within and Across Scientific Fields

Eamon Duede*[1,4], William Dolan[2,5], André Bauer[2,5], Ian Foster[2,3,5], and Karim Lakhani[1,4]

[1]Harvard University
[2]University of Chicago
[3]Argonne National Laboratory
[4]Digital Data Design Institute
[5]Globus Labs

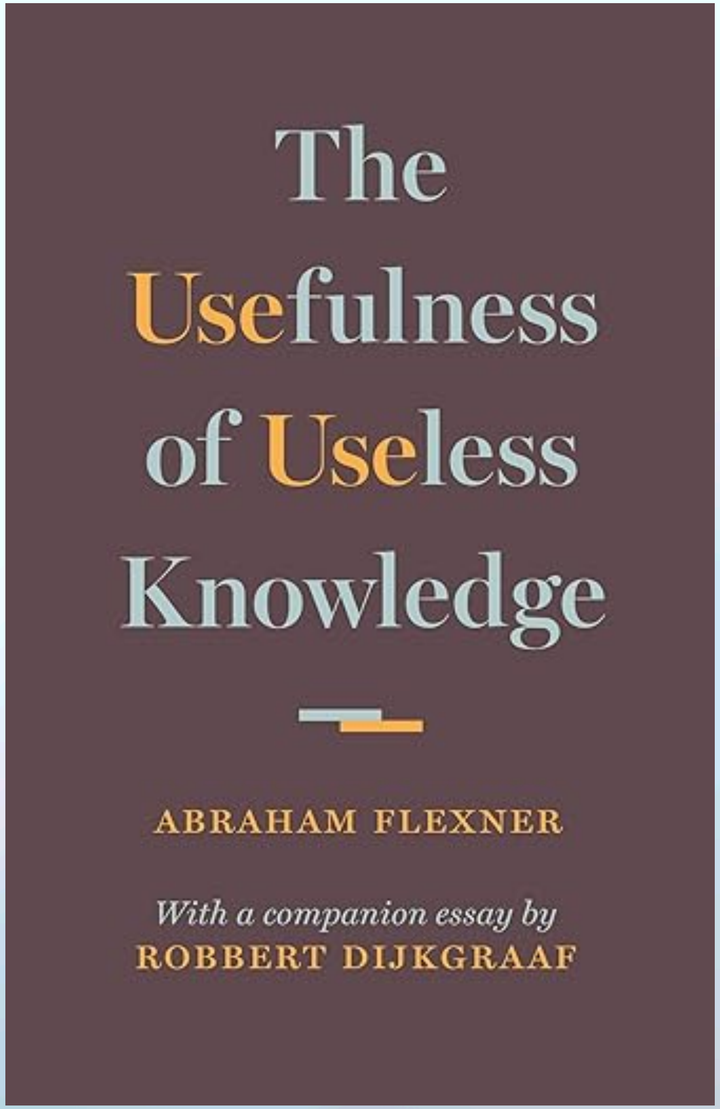


based on arxiv publications

Useless knowledge

Flexner founder of the Institute for Advanced Study in Princeton (1930-39): Einstein, von Neumann, Gödel…

Dijkgraaf (2012-22)



Alan Kay

If you don't fail at least 90 percent of the time, you're not aiming high enough

Dynabook vision

SmallTalk: the first object-oriented programming language (ancestor of C++, Java, Python).

ACM T**uring Award** 2003

Alan Kay

More quotes

- *The best way to predict the future is to invent it*
- *People who are really serious about software should make their own hardware*
- *The Web was done by amateurs*

Dynabook vision

SmallTalk: the first object-oriented programming language (ancestor of C++, Java, Python).

ACM T**uring Award** 2003

Marco Aiello

The Web Was Done by Amateurs

A Reflection on One of the Largest Collective Systems Ever Engineered

This book stems from the desire to systematize and put down on paper essential historical facts about the Web, a system that has undoubtedly changed our lives in just a few decades. But how did it manage to become such a central pillar of modern society, such an indispensable component of our economic and social interactions? How did it evolve from its roots to today? Which competitors, if any, did it have to beat out? Who are the heroes behind its success?

These are the sort of questions that the book addresses. Divided into four parts, it follows and critically reflects on the Web's historical path. "Part I: The Origins" covers the prehistory of the Web. It examines the technology that predated the Web and fostered its birth. In turn, "Part II: The Web" describes the original Web proposal as defined in 1989 by Tim Berners-Lee and the most relevant technologies associated with it. "Part III: The Patches" combines a historical reconstruction of the Web's evolution with a more critical analysis of its original definition and the necessary changes made to the initial design. In closing, "Part IV: System Engineering" approaches the Web as an engineered infrastructure and reflects on its technical and societal success.

The book is unique in its approach, combining historical facts with the technological evolution of the Web. It was written with a technologically engaged and knowledge-thirsty readership in mind, ranging from curious daily Web users to undergraduate computer science and engineering students.

The son of two computer scientists, **Marco Aiello** was exposed early to computers. At the age of three he met Turing Award winner Alan Kay; at eight he wrote his first computer program in Logo on a TI-99/4A. In the early days of the Web, while an intern at Apple Computer in Cupertino, he wrote his first set of Web Common Gateway Interfaces. He then pursued an academic career in Europe. Currently he is Professor of Service Computing at the University of Stuttgart, Germany. He is a prolific author in Computer Science and Artificial Intelligence having written over 150 scientific papers and books.

Computer Science

ISBN 978-3-319-90007-0

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Aiello

The Web Was Done by Amateurs

Marco Aiello

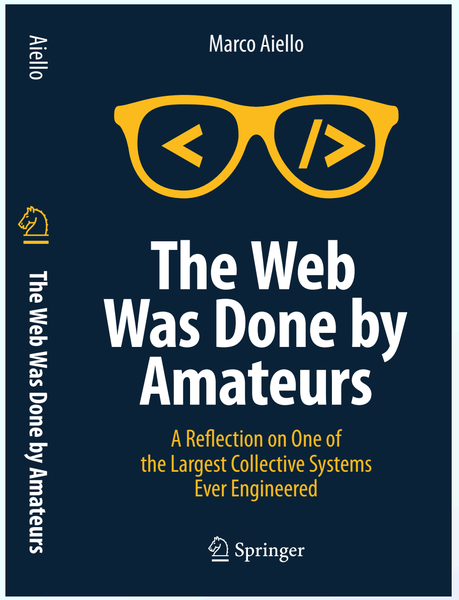
The Web Was Done by Amateurs

A Reflection on One of the Largest Collective Systems Ever Engineered

Springer

The Web Was Done by Amateurs

2018



- What makes a technology successful?
- Can you design for success?
- Computer scientists should be aware of their history
- Visionaries vs. amateurs

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The Science of Science

How Science Works

An analytical study, 2021

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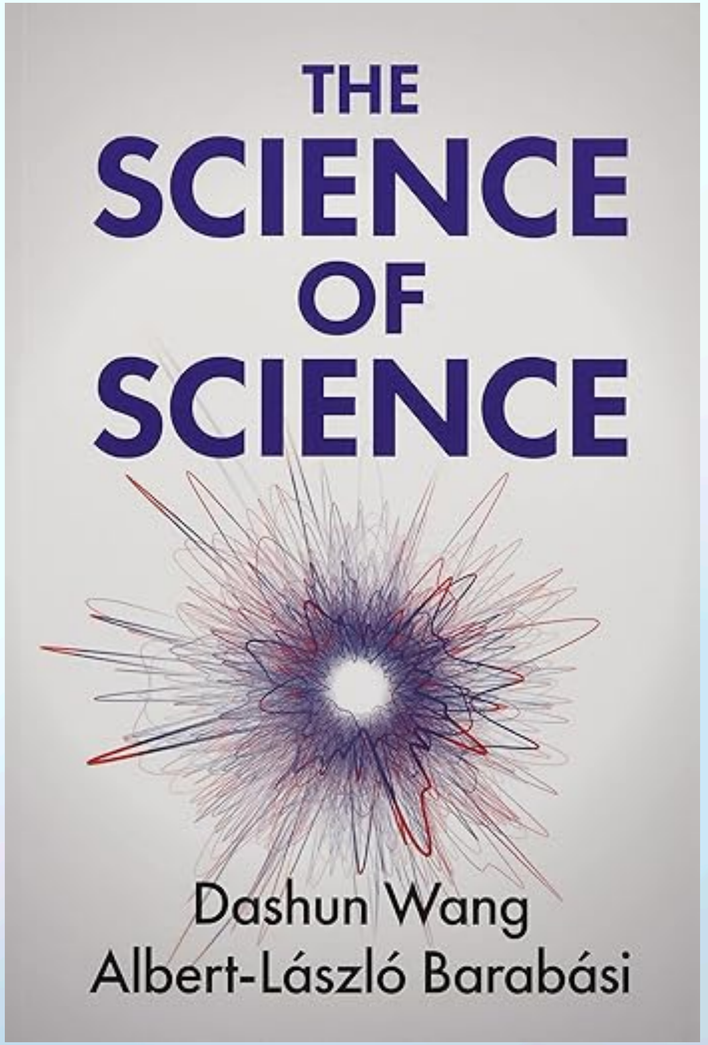
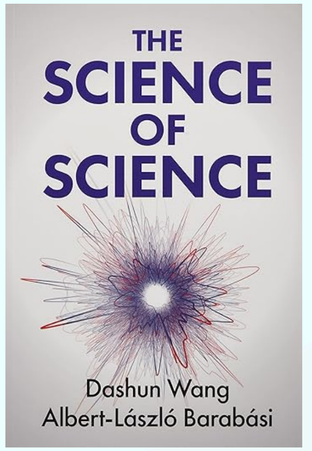
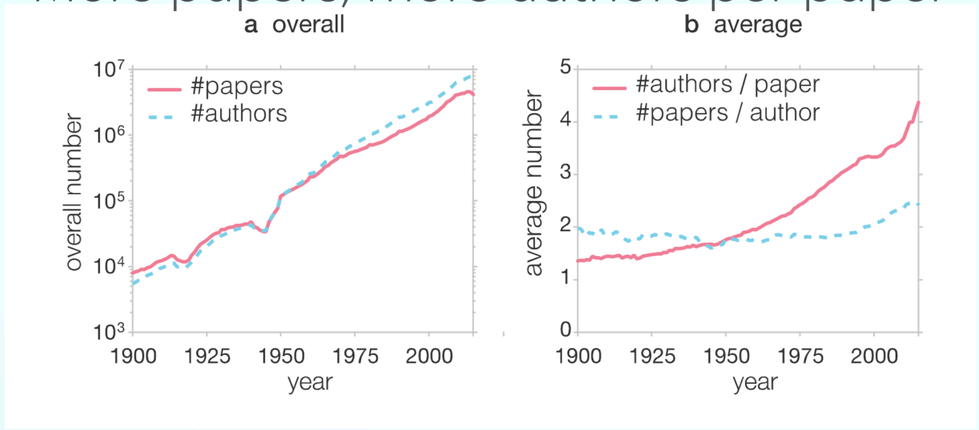


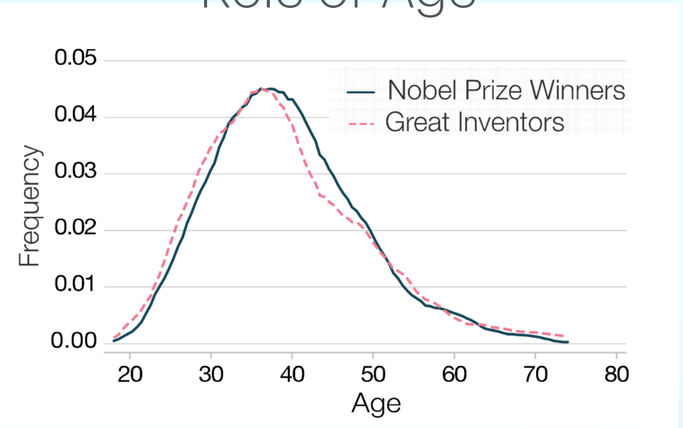
How Science Works



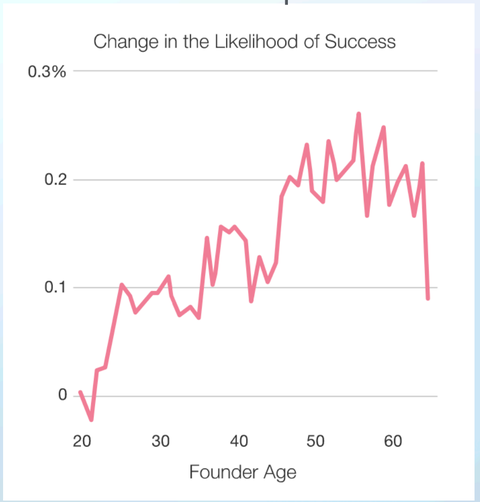
More papers, more authors per paper



Role of Age



startups



Matthew Effect. Under a single-blind process in *Nature*, the odds of your paper to be sent out for review is 23%. But if you opt for a double-blind review, those odds drop to 8%.

- coauthorship networks
- author order
- team diversity

Extreme Publishing

Extreme publishing behavior has become worryingly common across scientific fields with rapidly increasing rates in some countries and settings and may herald a rapid depreciation of authorship standards.

Scientometrics
https://doi.org/10.1007/s11192-024-05117-w

Evolving patterns of extreme publishing behavior across science

John P. A. Ioannidis[1,2,3,4,5] · Thomas A. Collins[6] · Jeroen Baas[7]

Received: 5 June 2024 / Accepted: 19 July 2024

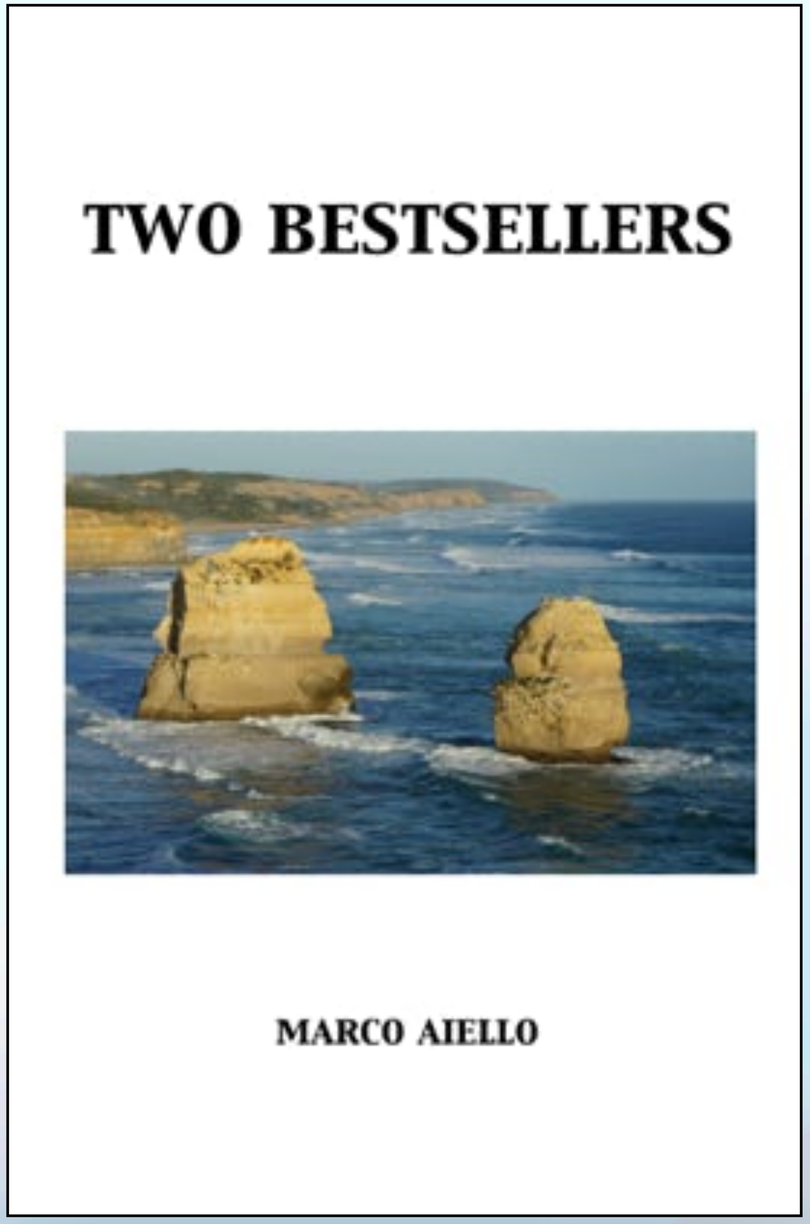
Abstract
Extreme publishing behavior may reflect a combination of some authors with genuinely high publication output and of other people who have their names listed too frequently in publications because of consortium agreements, gift authorship or other spurious practices. We aimed to evaluate the evolution of extreme publishing behavior across countries and scientific fields during 2000–2022. Extreme publishing behavior was defined as having > 60 full articles (original articles, reviews, conference papers) in a single calendar year and indexed in Scopus. We identified 3191 authors with extreme publishing behavior across science excluding Physics and 12624 such authors in Physics. While Physics had much higher numbers of extreme publishing authors in the past, in 2022 extreme publishing authors was almost as numerous in non-Physics and Physics disciplines (1226 vs. 1480). Excluding Physics, China had the largest number of extreme publishing authors, followed by the USA. The largest fold-wise increases between 2016 and 2022 (5-19-fold) occurred in Thailand, Saudi Arabia, Spain, India, Italy, Russia, Pakistan, and South Korea. Excluding Physics, most extreme publishing authors were in Clinical Medicine, but from 2016 to 2022 the largest relative increases (> sixfold) were seen in Agriculture, Fisheries & Forestry, Biology, and Mathematics and Statistics. Extreme publishing authors accounted for 4360 of the 10000 most-cited authors (based on raw citation count) across science. While most Physics authors with extreme publishing behavior had modest citation impact in a composite citation indicator that adjusts for co-authorship and author positions, 67% of authors with extreme publishing behavior in non-Physics fields remained within the top-2% according to that indicator among all authors with > = 5 full articles. Extreme publishing behavior has become worryingly common across scientific fields with rapidly increasing rates in some countries and settings and may herald a rapid depreciation of authorship standards.

Keywords Publishing · Authorship · Publish · Perish

Useless indices

2017

you can’t ignore rankings and indices

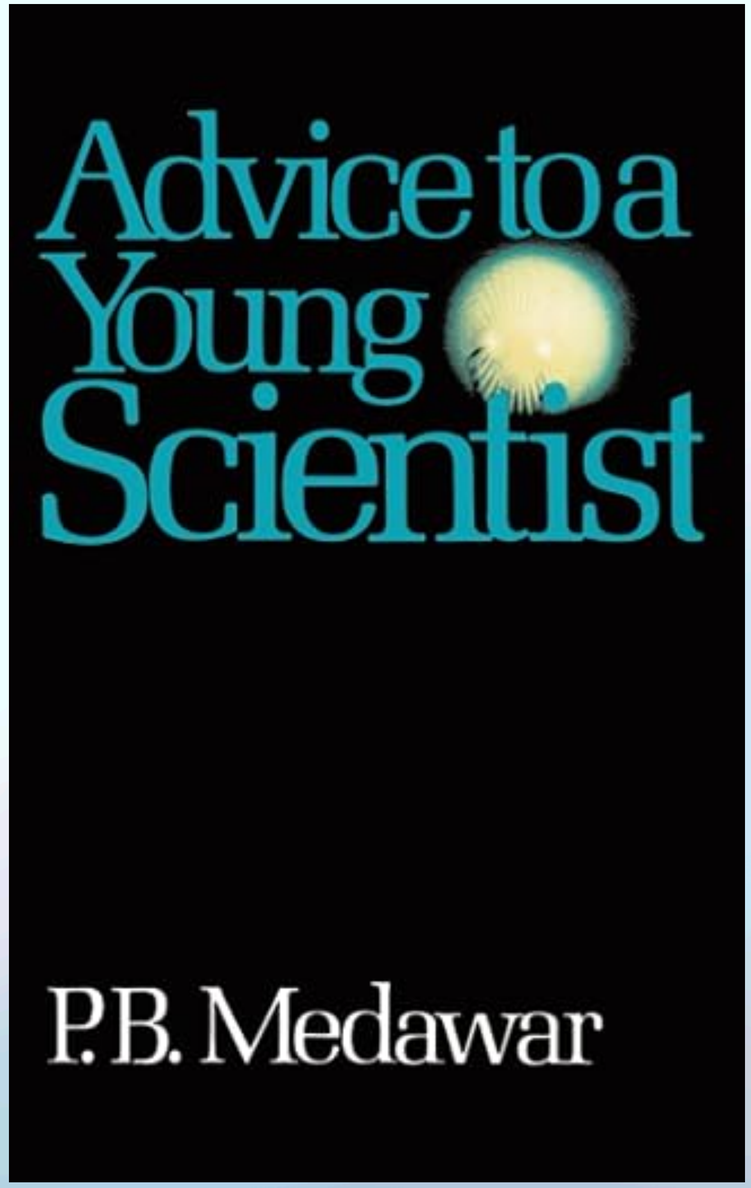


Advice from a Nobel Laureate

1979

1960 Nobel Prize in Physiology or Medicine jointly with Sir Macfarlane Burnet for their "discovery of acquired immunological tolerance

- *how to choose a research topic*
- *how to get along with collaborators, older scientists and administrators*
- *how to present a scientific paper*



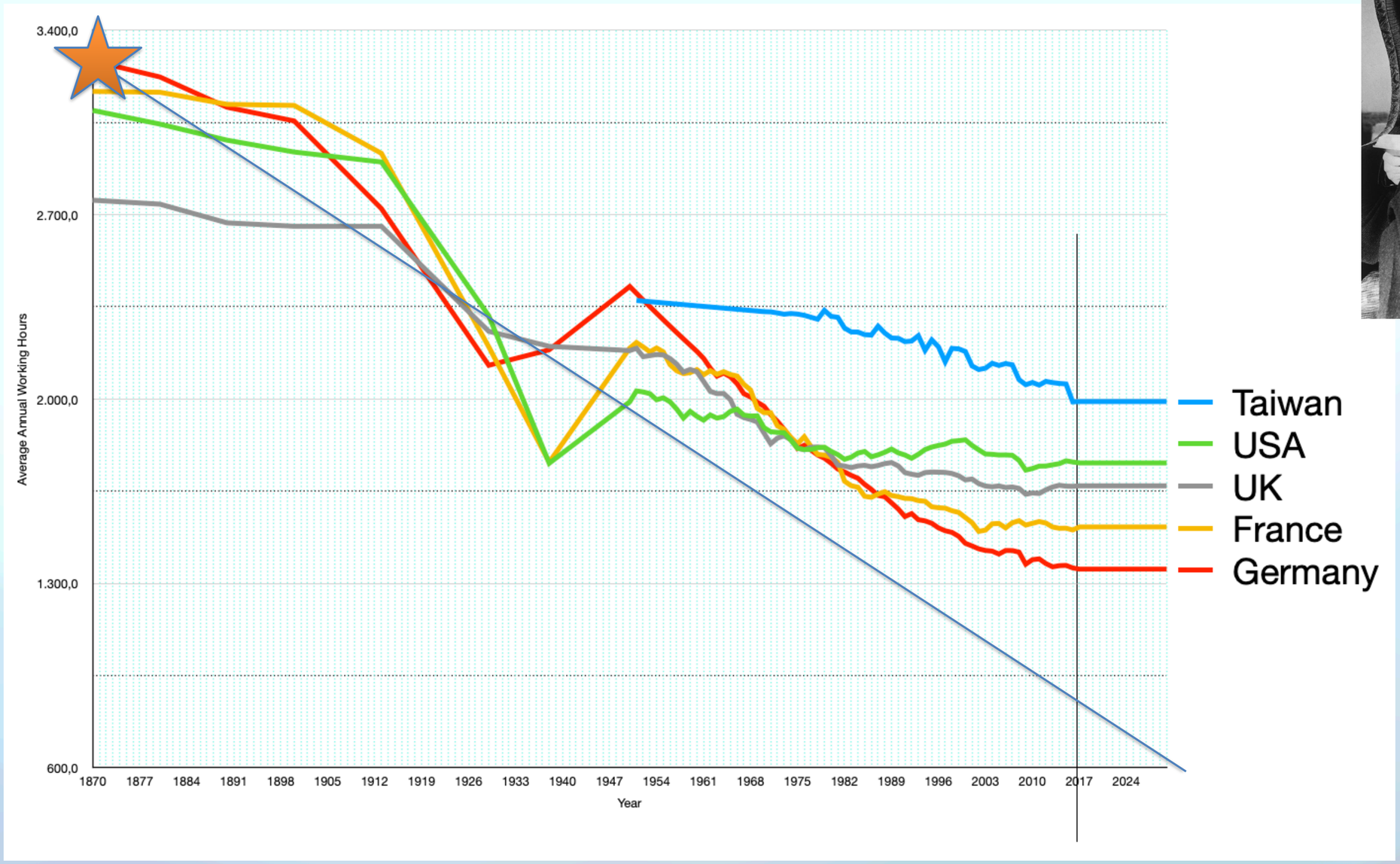
Job Market

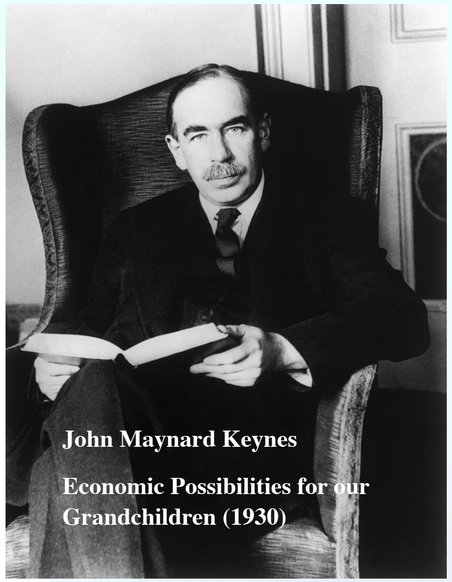
The AI Revolution and the Future of Work: Threats and Opportunities

Marco Aiello, University of Stuttgart

M. Aiello (2024) The AI Revolution and the Future of Work: Threats and Opportunities. *IEEE Computer*, May 2024.

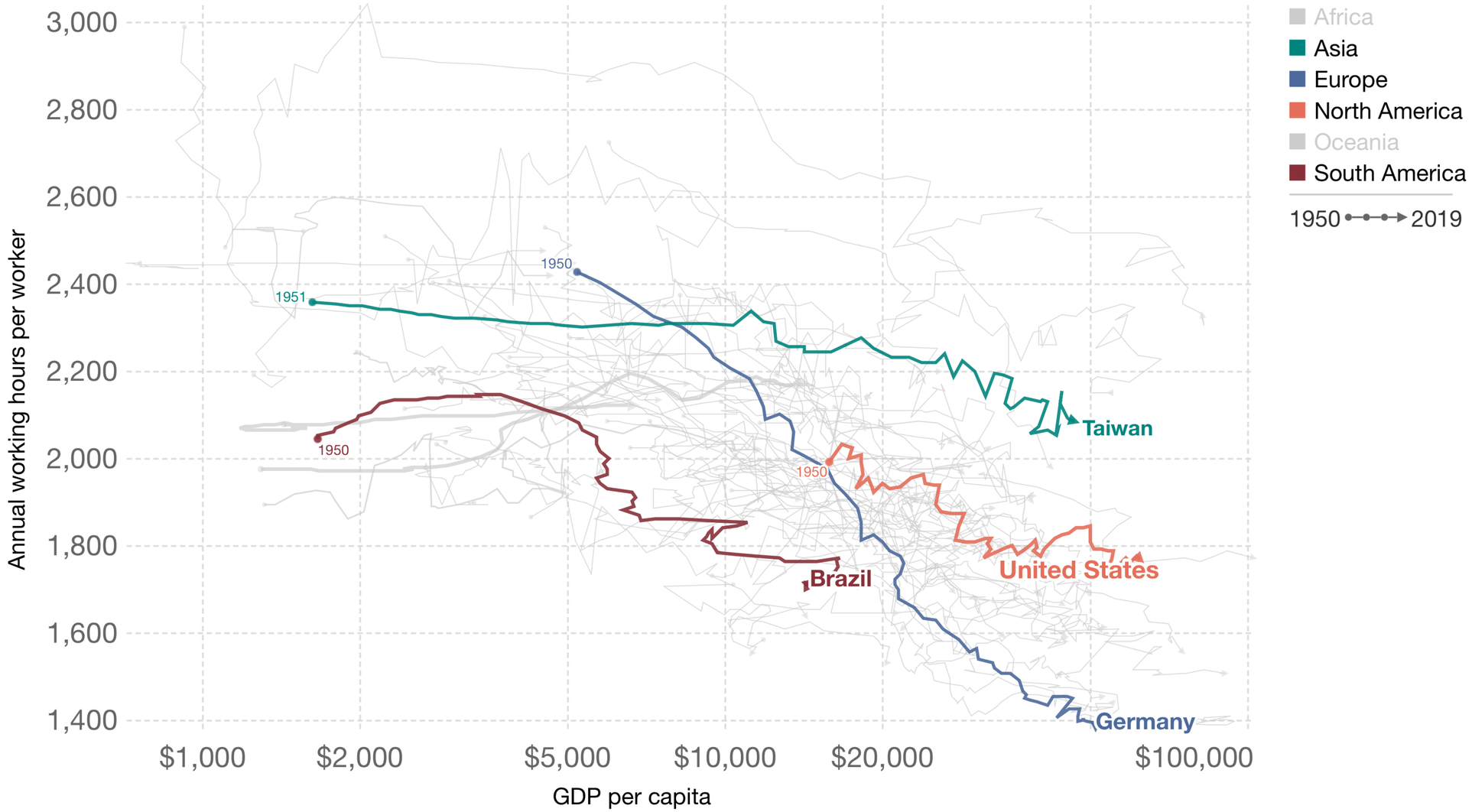
Working hours per year





Annual working hours vs. GDP per capita

Working hours are the annual average per worker. GDP per capita is adjusted for differences in the cost of living between countries, and for inflation.



Source: Feenstra et al. (2015), Penn World Table (2021)

OurWorldInData.org/working-hours • CC BY

AI and Jobs

Forbes

Goldman Sachs Predicts 300 Million Jobs Will Be Lost Or Degraded By Artificial Intelligence

Jack Kelly Senior Contributor
I write actionable interview, career and salary advice.

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Mar 31, 2023, 10:48am EDT

Listen to article 9 minutes

Companies—whether they are McDonald's, introducing self-serve kios

[+] GETTY

GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models

Tyna Eloundou[1], Sam Manning[1,2], Pamela Mishkin*[1], and Daniel Rock[3]

[1]OpenAI
[2]OpenResearch
[3]University of Pennsylvania

IEEE SPECTRUM

NEWS ARTIFICIAL INTELLIGENCE

AI Can't Take Over Everyone's Jobs Soon (If Ever) › Models are still expensive to run, hard to use, and frequently wrong

BY MATTHEW S. SMITH 10 APR 2023

Pactum AI for supplier negotiation

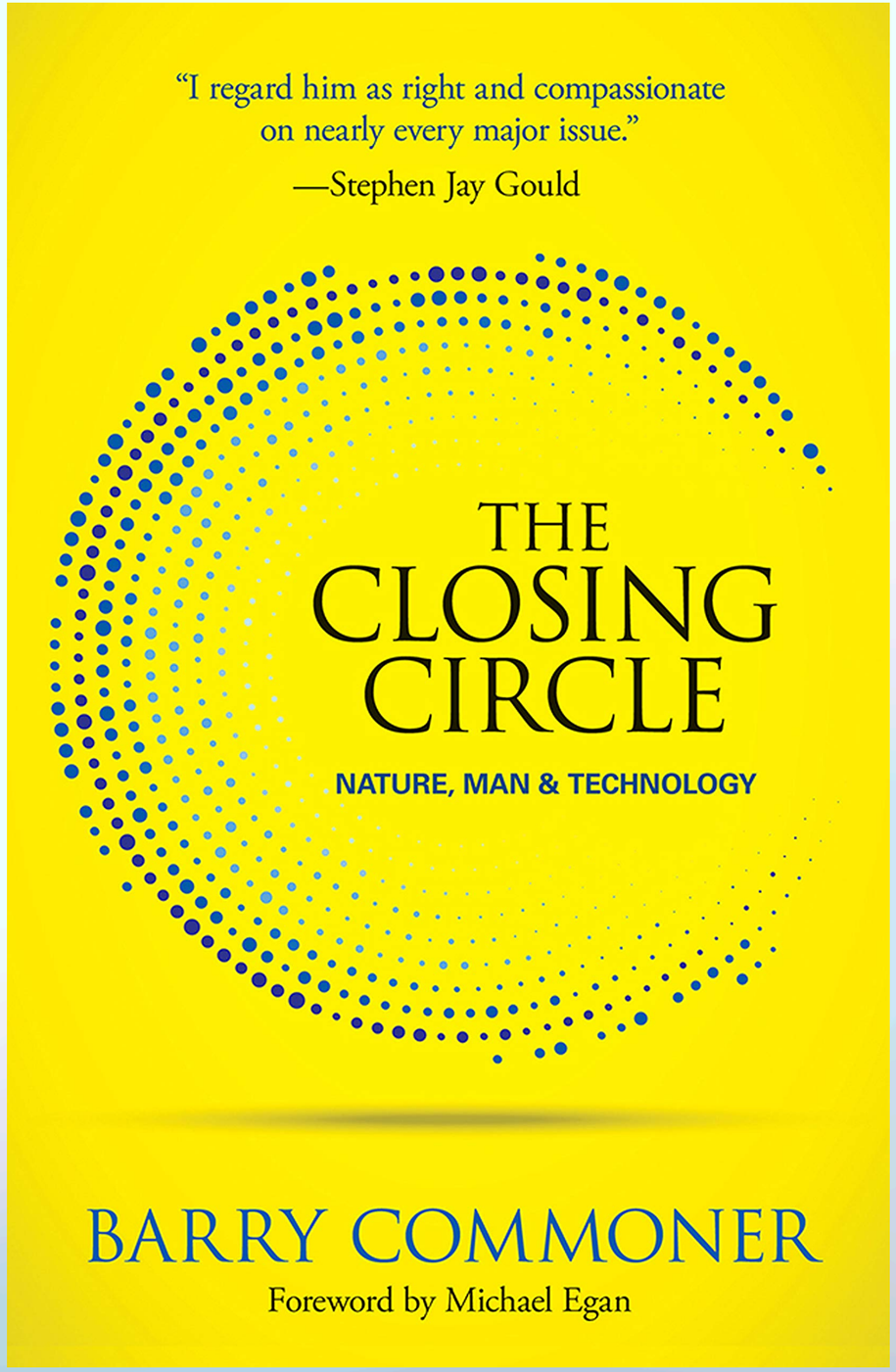
First trial with 89 suppliers: 64% of deals (target was 20%) with 1.5% saving over human negotiators

Sustainability

Nature, Man & Technology

1971

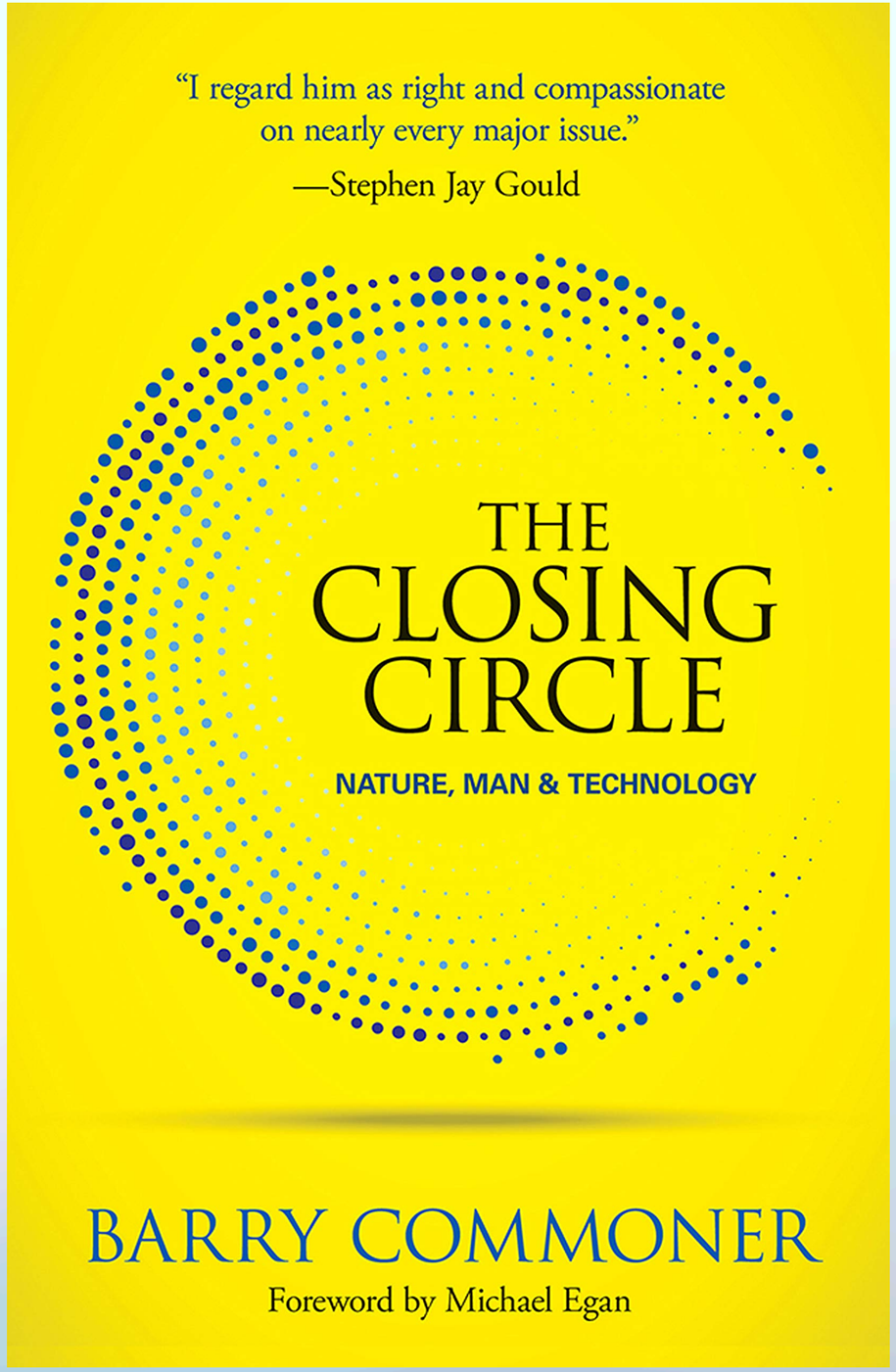
"Because the global ecosystem is a connected whole, in which nothing can be gained or lost and which is not subject to over-all improvement, anything extracted from it by human effort must be replaced. Payment of the price cannot be avoided; it can only delayed."



Nature, Man & Technology

1971

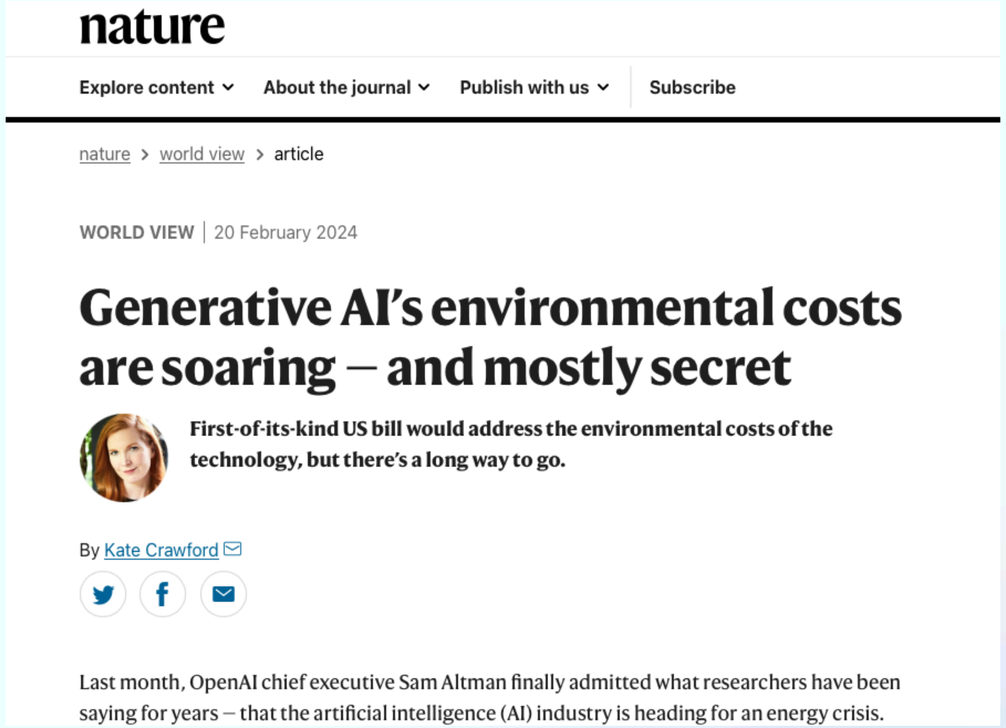
"There is evidence that a high rate of profit is associated with practices hat are particularly stressful toward the environment and that when these practices are restricted, profits decline."



ICT is Power Hungry

Time to think of a diet

- Data centers are estimated to be responsible for up to 3% of global electricity consumption
- Electric Power Research Institute (2024): Data centers could use up to 9% of total electricity generated in the United States by the end of the decade
- China Water Risk (CWR) estimates that water demand could **double** over the next *six years*



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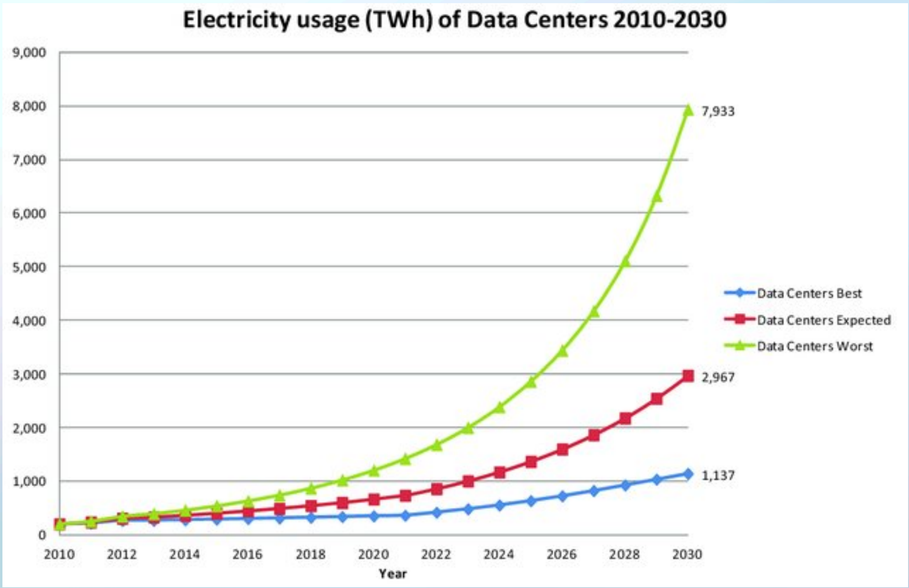
WORLD VIEW | 20 February 2024

Generative AI's environmental costs are soaring — and mostly secret

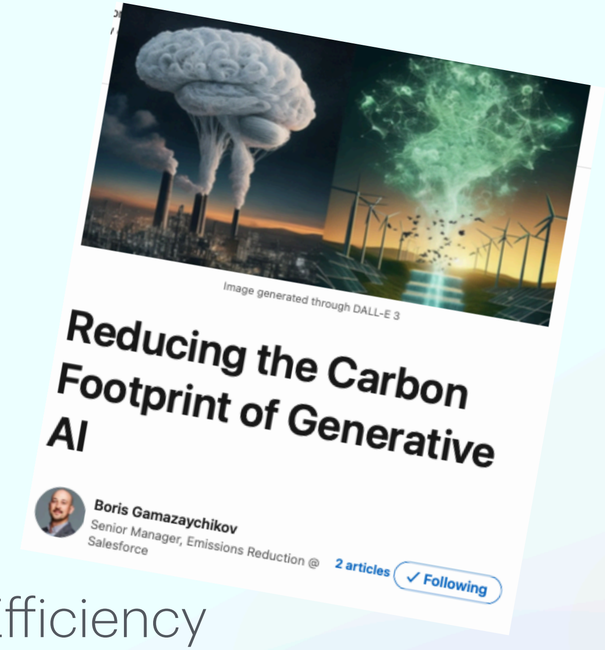
First-of-its-kind US bill would address the environmental costs of the technology, but there's a long way to go.

By Kate Crawford

Last month, OpenAI chief executive Sam Altman finally admitted what researchers have been saying for years — that the artificial intelligence (AI) industry is heading for an energy crisis.



LLM training emissions

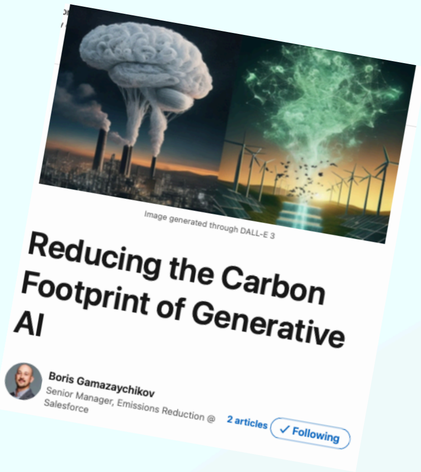


- Influenced by Computing, Datacenter Location, Hardware, Data Center Efficiency
- Consumption during **pre-training**, supervised fine-tuning, reward modeling, reinforcement learning from human feedback, and *inference*
- *"Right-sizing models, choosing clean data center locations, and utilizing efficient hardware are all tangible and important steps that should be considered by every organization working in this space. Transparency in disclosing carbon data is essential for progress."*

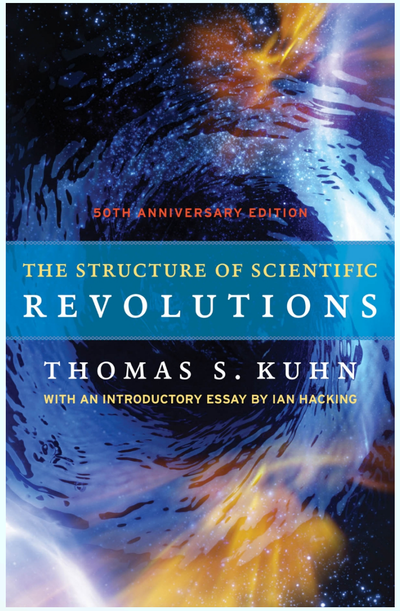
Model		GPT-3	BLOOM	LLaMA	LLaMA-2	T5	PaLM
Developer		OpenAI	BigScience	Meta		Google	
Model Size (# parameters)		175B	175B	7B, 13B, 33B, 65B	7B, 13B, 34B, 70B	11B	540B
Training Data (# tokens)		300B	350B	1.4T	2T	34B	795B
Training Compute (FLOPs)		3.2E+23	3.7E+23	9.9E+23	1.5E+24	2.2E+21	2.6E+24
Processor	Manufacturer	Nvidia	Nvidia	Nvidia	Nvidia	Google	Google
	Type	GPU	GPU	GPU	GPU	TPU	TPU
	Model	V100	A100	A100	A100	TPU v3	TPU v4
Processor Hours		3,552,000	1,082,990	1,770,394	3,311,616	245,760	8,404,992
Grid Carbon Intensity (kgCO2e/KWh)		0.429	0.057	0.385	0.423	0.545	0.079
Data Center Efficiency (PUE)		1.1	1.2	1.1	1.1	1.12	1.08
Energy Consumption (MWh)		1,287	520	779	1,400	86	3,436
Carbon Emissions (tCO2e)		552	30	300	593	47	271

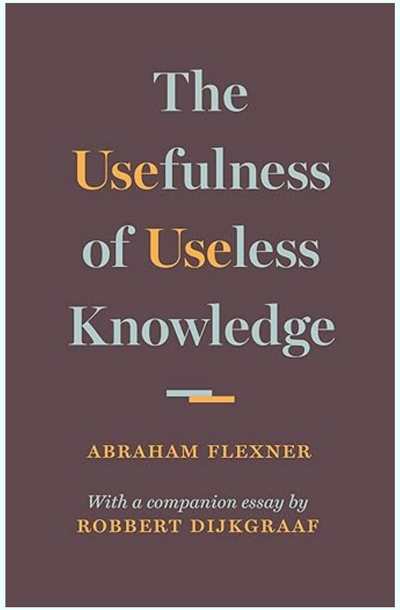
$$KWh = Hours\ to\ train \times Number\ of\ Processors \times Average\ Power\ per\ Processor \times PUE \div 1000$$

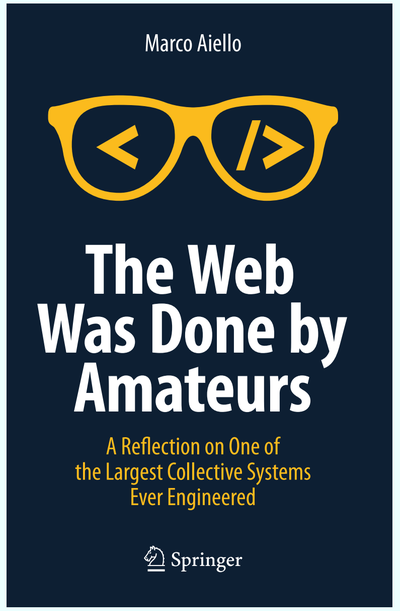
$$tCO2e = KWh \times kg\ CO2e\ per\ KWh \div 1000$$

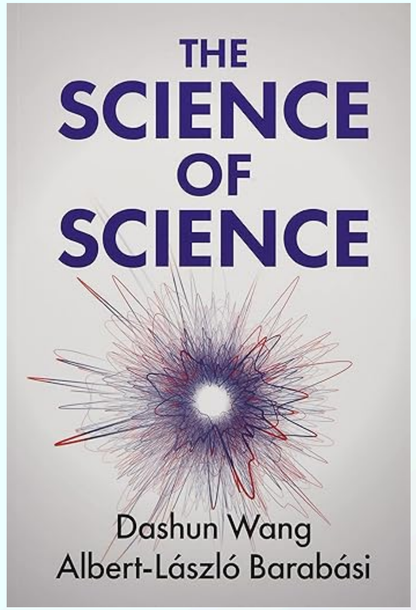


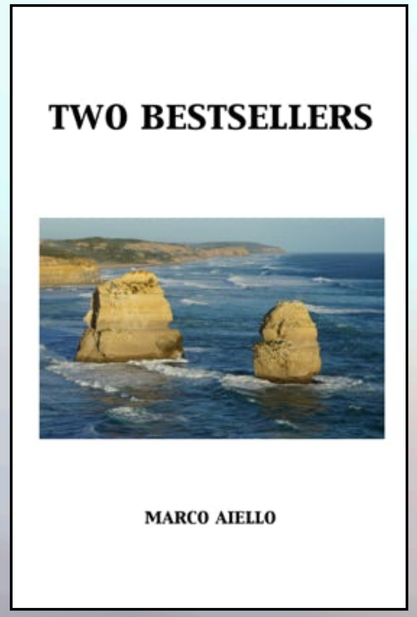
Concluding remarks

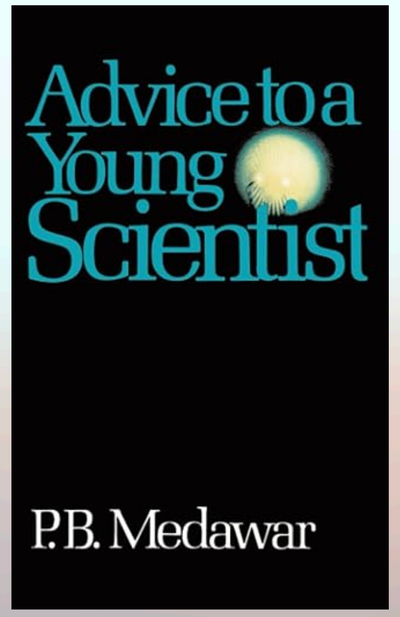













COVER FEATURE VENTURE SCIENTISTS AND TECHNOLOGY ENTREPRENEURSHIP

The AI Revolution and the Future of Work: Threats and Opportunities

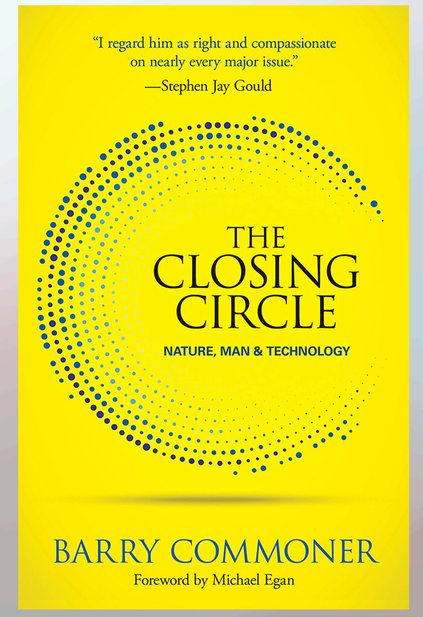
Marco Aiello, University of Stuttgart

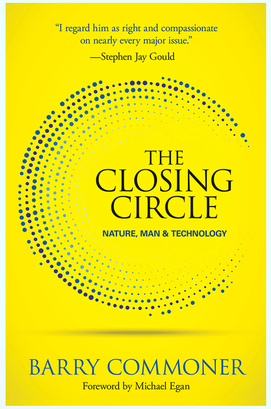
AI is transforming the global labor market, signaling a shift where jobs are both displaced and newly created. But is it really creating enough new jobs?

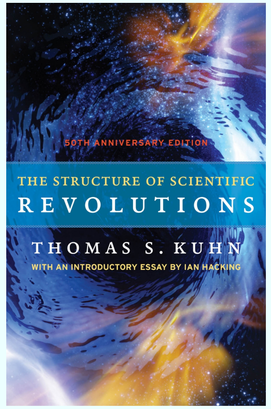
Technological advancement brings new entrepreneurial opportunities and has the power to revolutionize markets. In doing so, jobs can be swapped away, considerably downsized, or deeply changed. The neoclassical view on technological advancements postulates that whenever a certain type of job is made useless by technological innovation, new jobs appear on the market to compensate for the loss, possibly after a painful transition.[1] If the Second Agricultural Revolution finally resulted in workers moving from the fields to the factories, the end of the First Industrial Revolution marked the shift of work from being available in factories to being in offices. Usually, the number of office jobs created was greater than those lost. These revolutions brought economic growth in terms of average income per person and gross domestic product (GDP). Up until recently, economic growth has guaranteed that labor markets have many new opportunities and that unemployment rates are low during periods of growth. Now, though, things appear to be different, as pointed out by several economists (for example, Paul Krugman[2]) and computer scientists (see Moshe Vardi[3]). Such a view is often referred to as *Neo-Luddist*, as a reference to the movement of English textile workers who, in the early 1800s, started threatening mill owners and destroying machinery in a fight to keep their factory jobs.

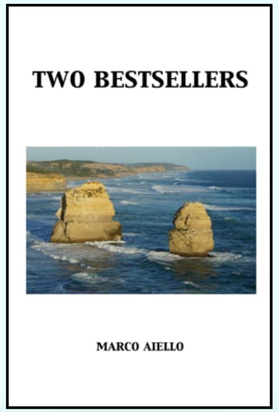
Starting from the assumption that we are currently experiencing the Fourth Industrial Revolution, which is fueled by the rapid advancements in AI, machine learning, robotics, and the Internet of Things, what are the current opportunities in terms of jobs and entrepreneurship, and also, what are the risks in terms of the global labor market? In the present article, I will explore these threats and

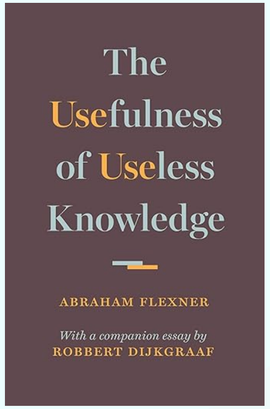
Digital Object Identifier 10.1109/MIC.2024.3376279
Date of current version: 6 May 2024

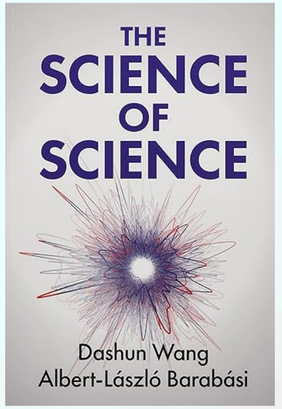












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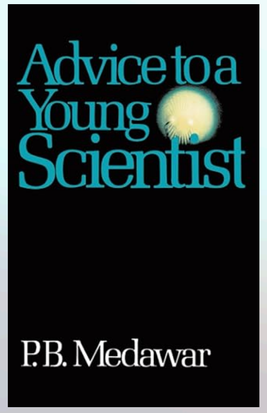

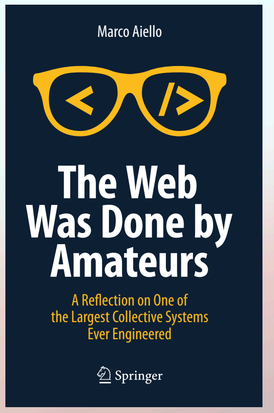

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Thank you! Vielen Dank! Grazie! Merci! Bedankt!

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