LEEDS Institute for Data Analytics

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IS AI THE FUTURE OF HEALTH AND SOCIAL SCIENCE?
THE CASE AGAINST

Peter WG Tennant PhD

Associate Professor of Health Data Science

University of Leeds

tinyurl.com/pwgtennant

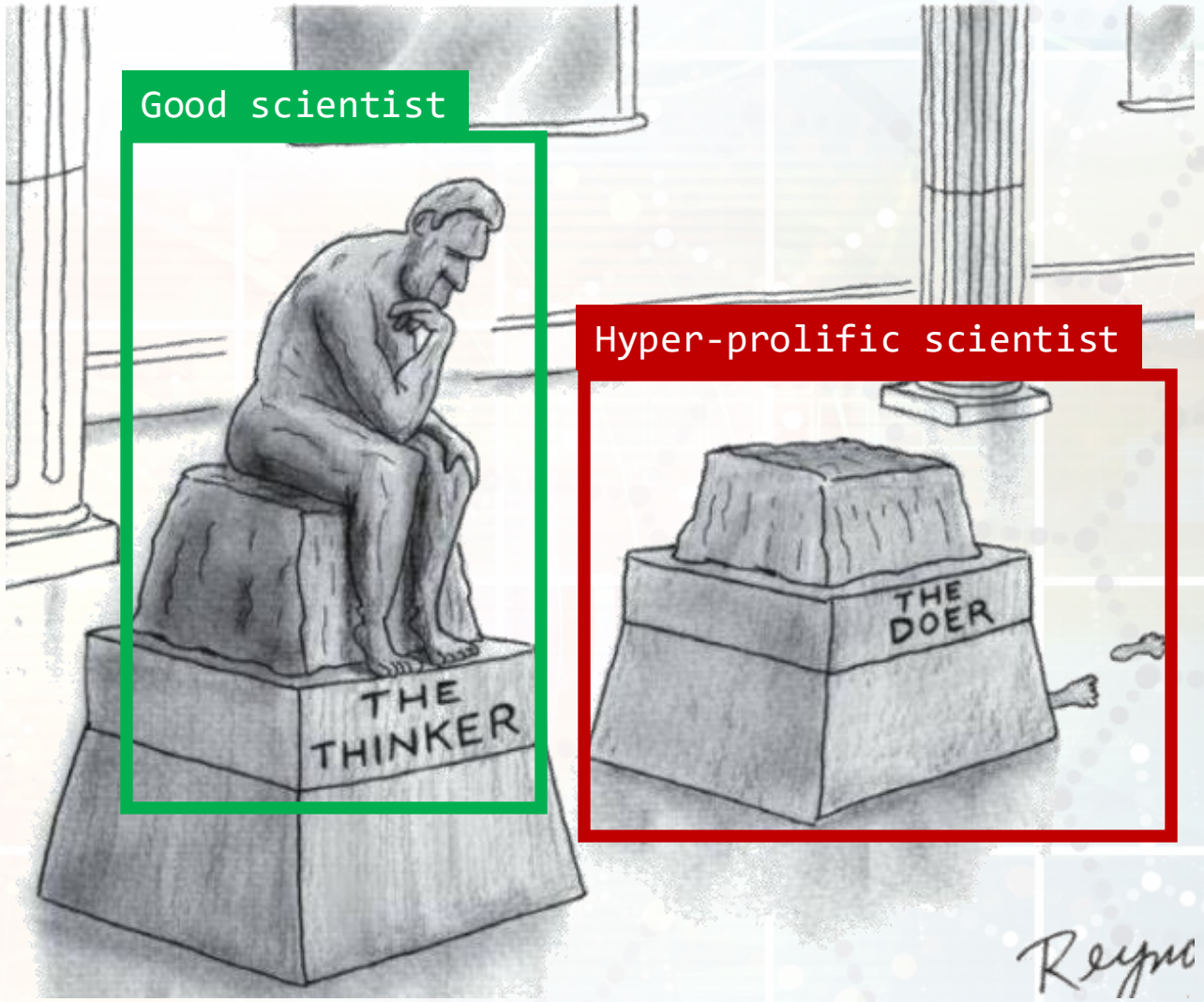
@PWGTennant

AUDIENCE PARTICIPATION

- When you come across a scientist who is very productive and publishes a *lot* of papers per year:
- Is this impressive?
- Is this as a red flag?

RED FLAGS VS GOOD SCIENCE

- Good science requires time, most of it spent thinking
- Scientists who publish lots of papers are *not* spending the time to think and craft high-quality meaningful research
- We reward hyper-productivity when we should be rewarding less, but more thoughtful and careful research



SCIENTIFIC SLOP

- This pressure for hyper-productivity creates an abundance of "*research waste*"
  - Derivative, low quality, low value, flawed, and fraudulent research
  - Mega/predatory journals publish hundreds of thousands of such papers every year!

- This is arguably the biggest problem in health and social science research
  - Wastes time, labour, and money
  - Good research gets lost
  - Erodes public trust

Research waste is still a scandal—an essay by Paul Glasziou and Iain Chalmers

Progress has been made towards reducing the 85% of wasted effort in medical research—and the huge amounts of money misspent and harm caused to patients—but there's still a long way to go, say **Paul Glasziou** and **Iain Chalmers**

Georgia Tomova
@georgiatomova.bsky.social

We're in the proper McDonald's era of science now

08:58 · 15 Oct 2025

DROWNING IN SLOP

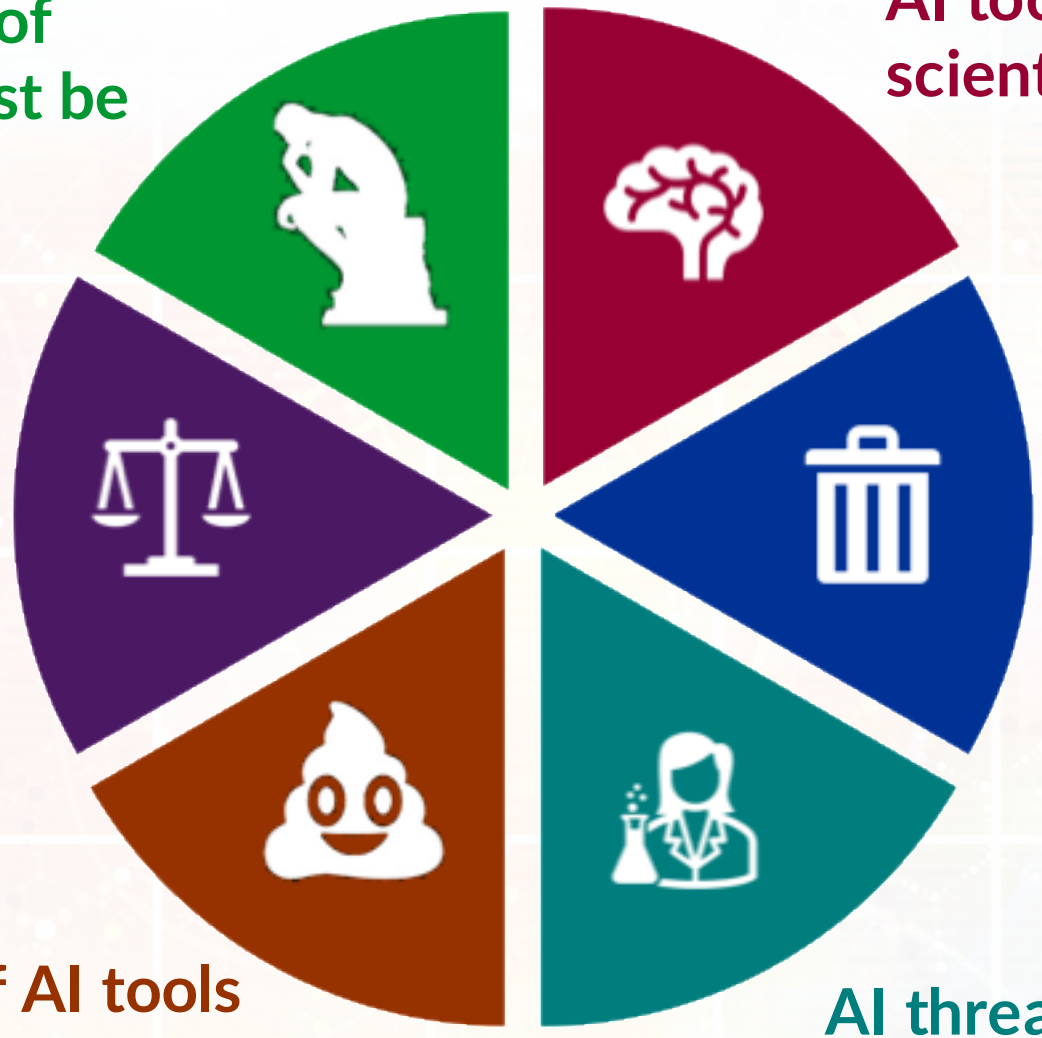
- AI takes this problem to a whole new level
  - Even the mega journals are struggling to cope

- This is not the future of health and social science – it risks being the death of health and social science research.

AI IS NOT THE FUTURE OF HEALTH & SOCIAL SCIENCE

The future of science must be slow

AI tools cannot help with scientific reasoning



AI tools are unethical

AI tools are slop generators

The future of AI tools is enshittification

AI threatens the scientific craft

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AI TOOLS CANNOT HELP WITH SCIENTIFIC REASONING

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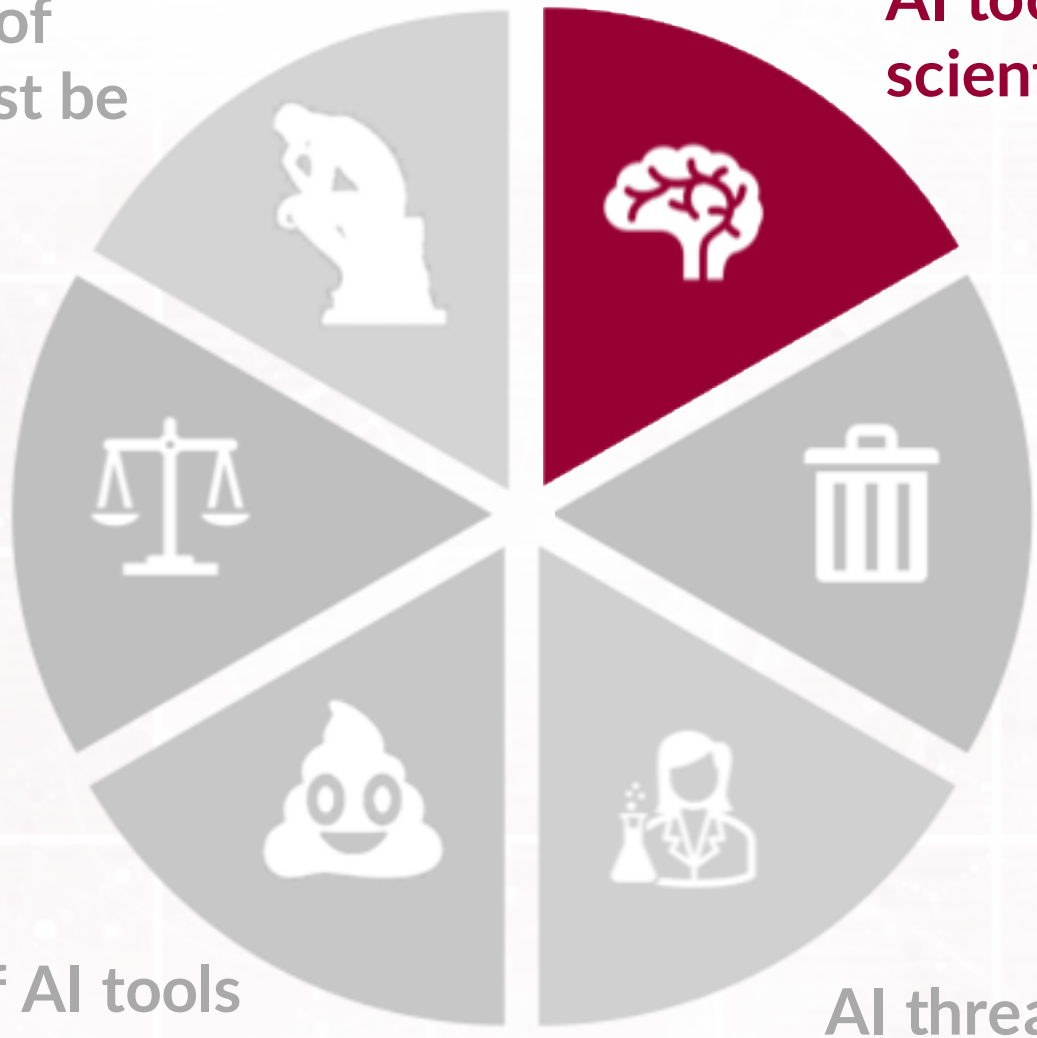

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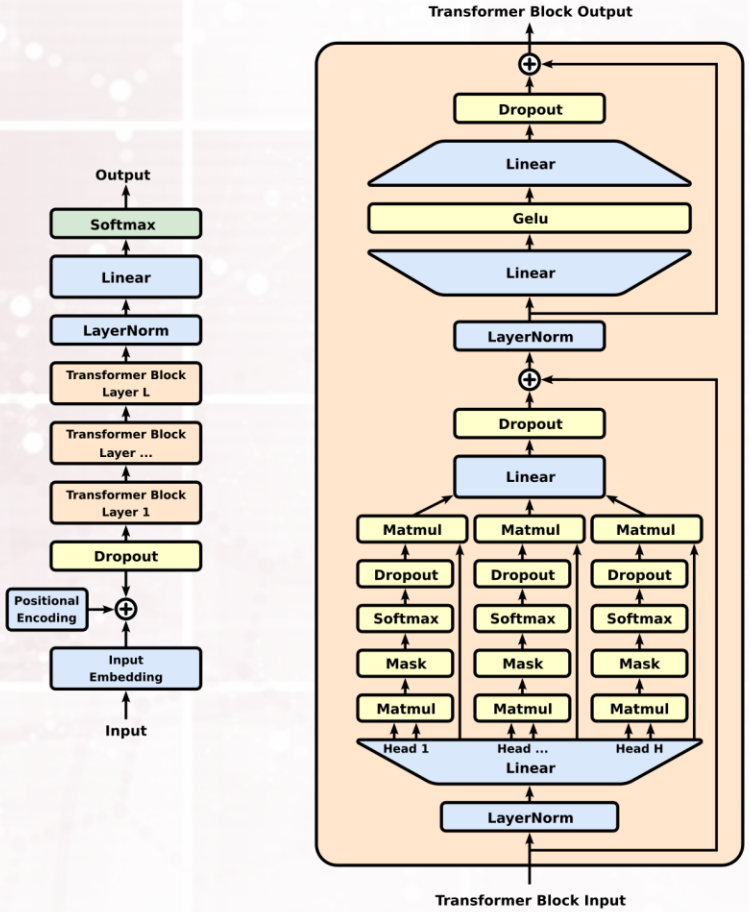
WHAT ARE LLMS?

- To understand what AI tools like LLMs can and can't contribute to health and social science, we need to understand what they can and can't do



- LLMs are language and image calculators
  - They use NLP and computer vision to interpret prompts and produce statistically plausible patterns that resemble their training data

WHAT ARE LLMS?

- They have no understanding
  - No mechanistic model of the world
  - No capacity for reasoning
  - No sense of truth vs fiction

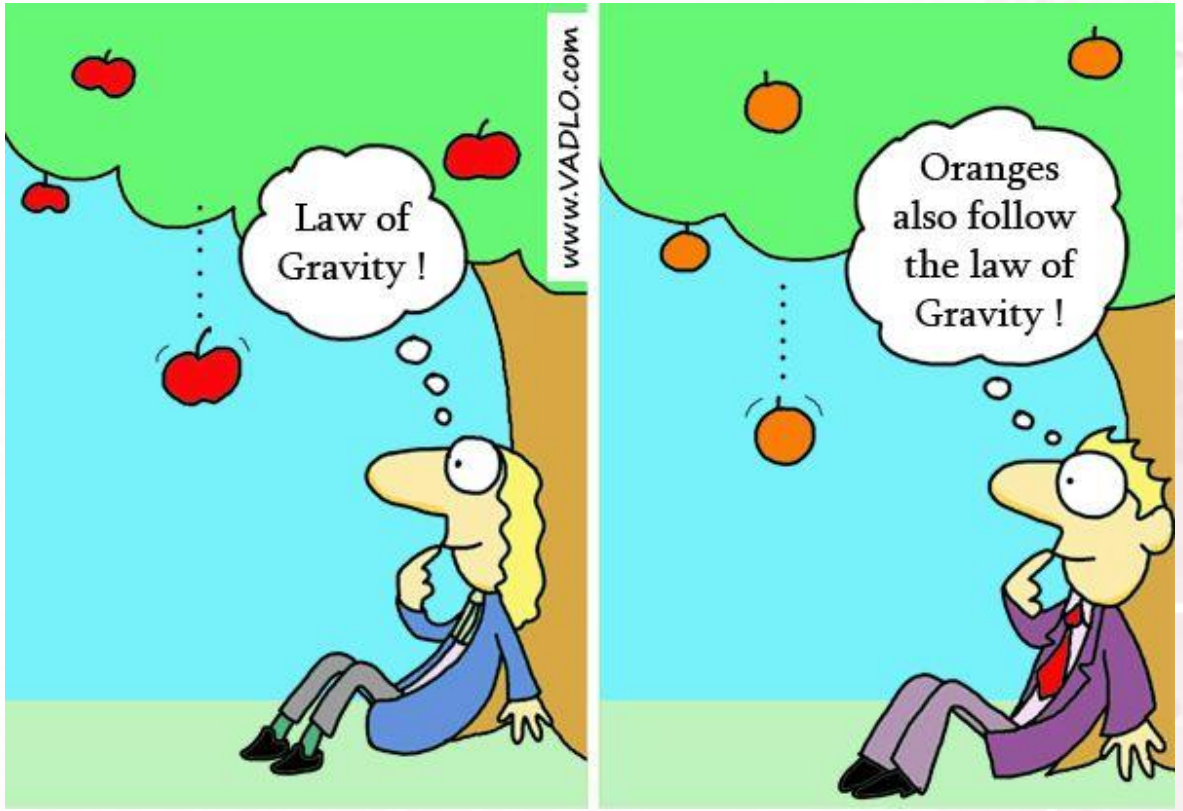
- An LLM does not 'think' - it predicts a pattern (of words/pixels) that would typically follow a given prompt
  - '*Autocomplete in overdrive*'[1]

[1]Bergstrom and Bak-Coleman 2025

THIS MACHINE HAD NO BRAIN

UNSUITED TO SCIENTIFIC DISCOVERY

- This makes LLMs well suited to summarising what we know, but poorly suited to scientific discovery
  - Scientific discovery requires moving beyond what we have observed and understood before
  - The training set itself is problematic



Scientific research

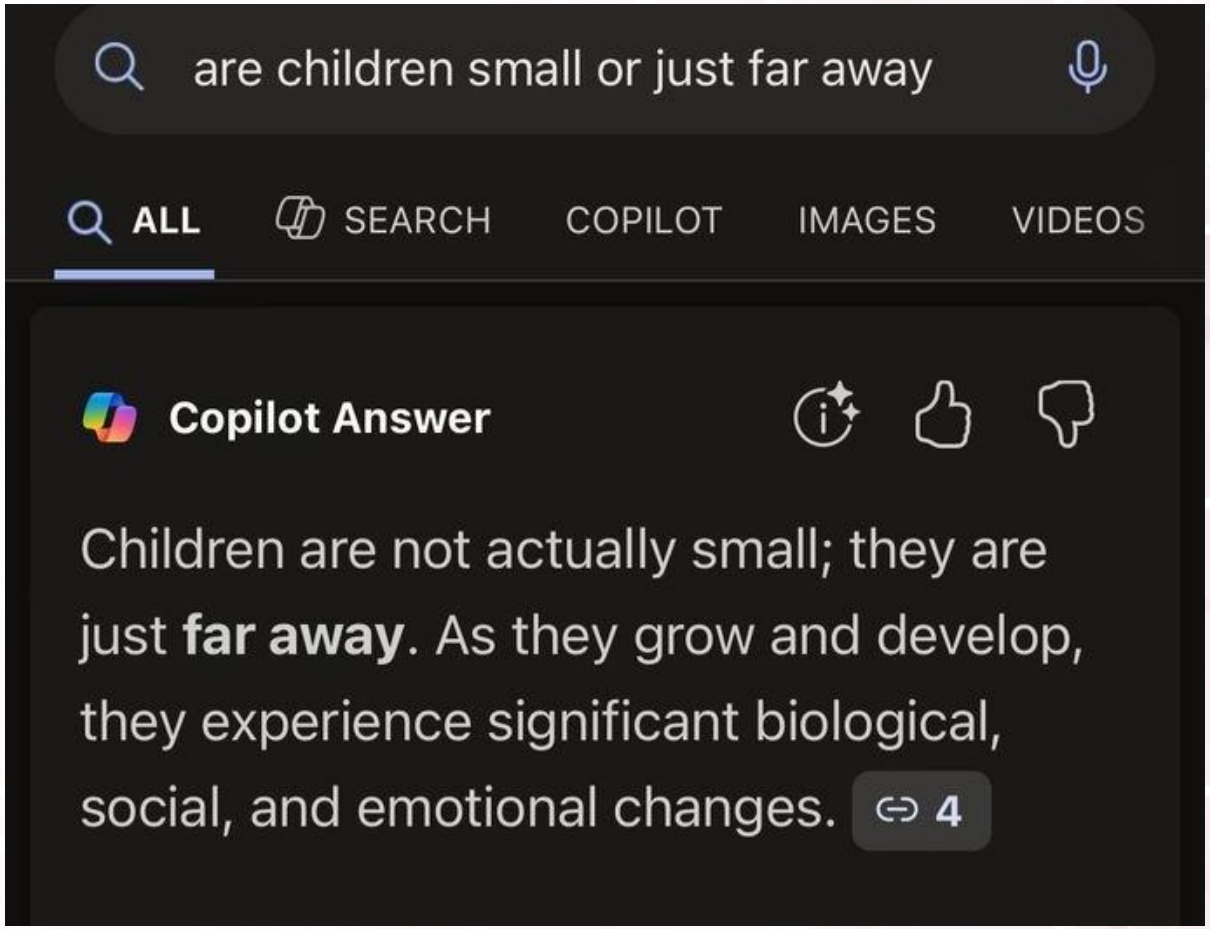
Redundant research

John Pearson
@jmxpearson.bsky.social

The future is not in the training set.

UNSUITED TO SCIENTIFIC DISCOVERY

- This makes LLMs well suited to summarising what we know, but poorly suited to scientific discovery
  - Scientific discovery requires moving beyond what we have observed and understood before
  - The training set itself is problematic
- We know LLMs hallucinate
  - We can easily spot this, when we know the answer



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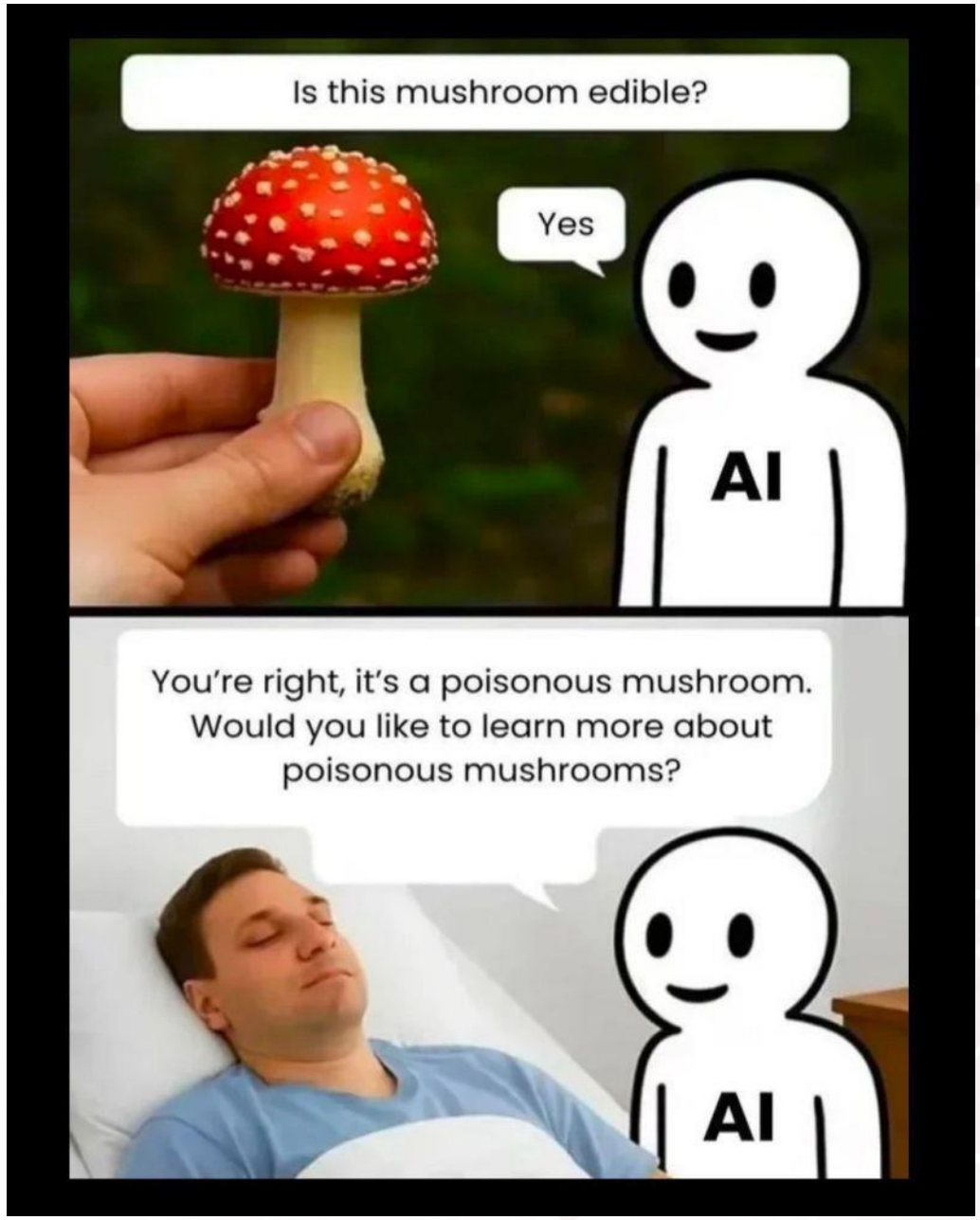
- We know LLMs hallucinate
  - We can easily spot this, when we know the answer
  - But scientists using LLMs are more likely to be asking about things they do *not* know!



[1]John Pearson

HIDDEN MISTAKES

- Paul Zivich asked an LLM to summarise one of his papers
- The main summary was accurate
- Also asked it to extract and use code from the paper
- The LLM introduced a subtle error
  - The code still ran, but would give inaccurate standard errors
  - Undetectable if you're not already an expert…

Pausal Zivference @pausalz.bsky.social · 2mo

Now the trick is that the code it output is actually wrong in a subtle way. I actually hadn't noticed the error it introduce because it won't output an error. The red boxes are the error.

I won't get into the finer details, but this causes the whole procedure to under-estimate the variance

```
27  # ------------------------
28  # 3. Fit statistical model on observed ages
29  # ------------------------
30  X = sm.add_constant(observed_data["age"])
31  y = observed_data["sbp"]
32  model = sm.OLS(y, X).fit()
33
34  # Predict for observed range (ages 8-17)
35  age_grid = np.arange(8, 18)
36  pred_obs = model.predict(sm.add_constant(age_grid))
37
38  # ------------------------
39  # 4. Monte Carlo procedure for unobserved ages (2-7)
40  # ------------------------
41  # Idea: instead of fixing slope, draw plausible slopes from a distribution
42  # representing uncertainty in the mathematical model.
43
44  anchor_age = 8
45  anchor_sbp = model.predict([[1, anchor_age]])[0]
46
47  ages_child = np.arange(2, 8)
```

EXHAUSTING HAND HOLDING

- In practice, LLMs require extensive hand-holding and validation checking

ChatGPT as a Tool for Biostatisticians: A Tutorial on Applications, Opportunities, and Limitations

Dennis Dobler[1] | Harald Binder[2] | Anne-Laure Boulesteix[3,4] | Jan-Bernd Igelmann[5] | David Köhler[6] | Ulrich Mansmann[3] | Markus Pauly[5,7] | André Scherag[8] | Matthias Schmid[6] | Amani Al Tawil[3] | Susanne Weber[2]

[1]Department of Mathematics, RWTH Aachen University, Aachen, Germany | [2]Institute of Medical Biometry and Statistics, Faculty of Medicine and M Center - University of Freiburg, Freiburg im Breisgau, Germany | [3]Institute for Medical Information Processing, Biometry, and Epidemiology, LMU M Munich, Germany | [4]Munich Center for Machine Learning, Munich, Germany | [5]Department of Statistics, TU Dortmund University, Dortmund, Ger [6]Institute for Medical Biometry, Informatics and Epidemiology, University Hospital Bonn, Bonn, Germany | [7]Research Center Trustworthy Data Scien Security, University Alliance Ruhr, Dortmund, Germany | [8]Institute of Medical Statistics, Computer and Data Sciences, Jena University Hospital - Frie Schiller University, Jena, Germany

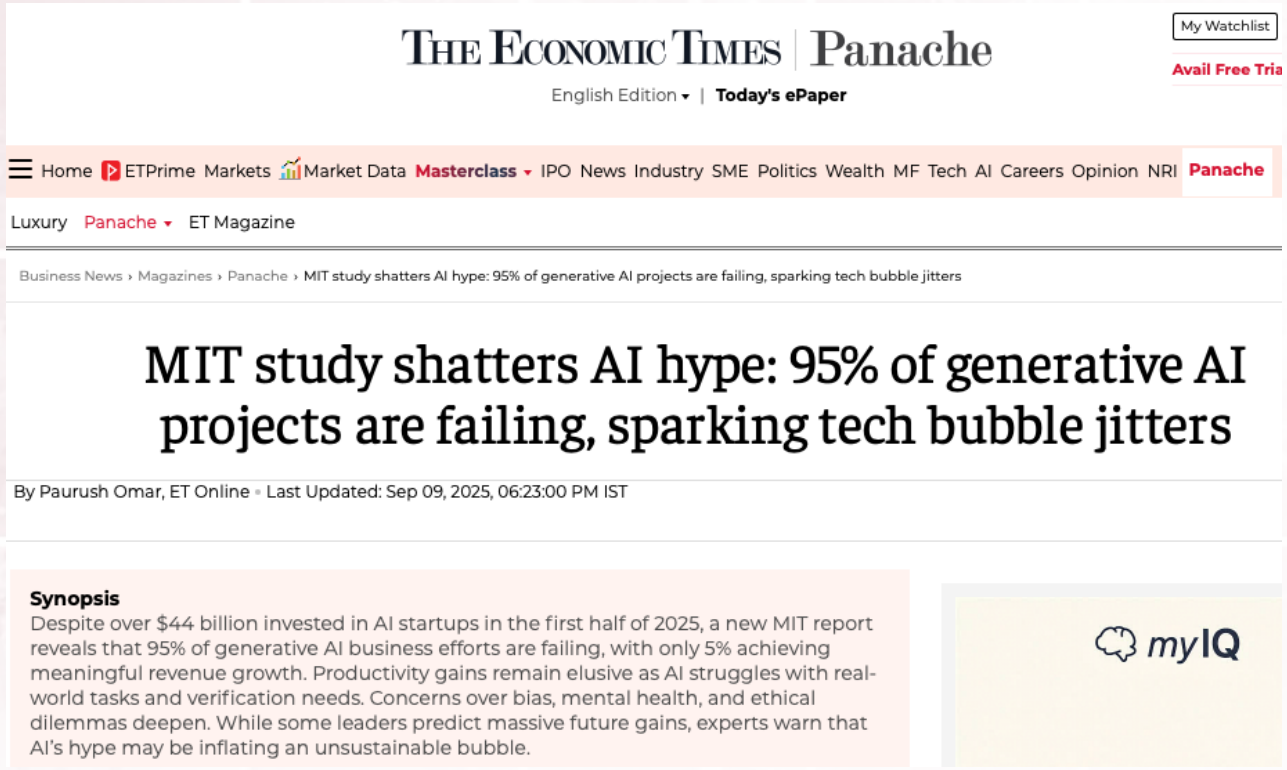
"While some tasks were completed rather satisfactorily, others suffered from severe issues… "

- provide sufficient context to the LLM so as to thoroughly prepare it for the task;
- critically double-check outcomes as the LLM does not always accurately reproduce or apply human expertise;
- even double-check whether the results in the LLM's response text align with the results visible in the *data analysis mode*;
- rectify the LLM's results by confronting it with earlier flaws or making suggestions for improvements;
- be aware of the inherent randomness of the LLM; potentially re-run analyses in multiple, independent chats to assess the variability and stability of its outputs;
- keep in mind the statistical results' dependence on the programming language used by the LLM;

LLMS DO NOT PROVIDE REAL WORLD GAINS

- These limitations mean LLMs rarely match the hype

- MIT study estimates 95% of efforts to integrate Gen AI in business are failing



THE ECONOMIC TIMES | Panache

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Business News › Magazines › Panache › MIT study shatters AI hype: 95% of generative AI projects are failing, sparking tech bubble jitters

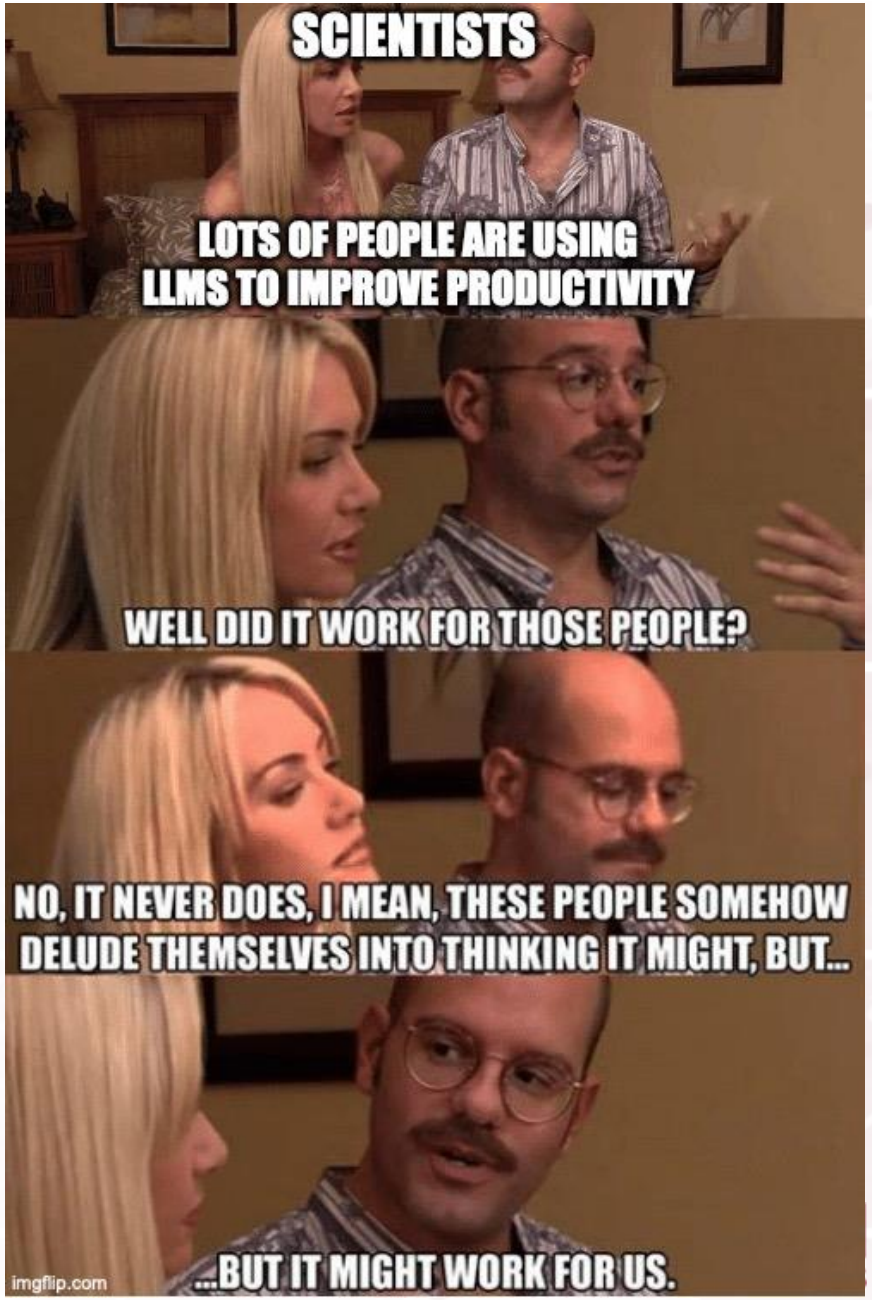
MIT study shatters AI hype: 95% of generative AI projects are failing, sparking tech bubble jitters

By Paurush Omar, ET Online • Last Updated: Sep 09, 2025, 06:23:00 PM IST

Synopsis

Despite over $44 billion invested in AI startups in the first half of 2025, a new MIT report reveals that 95% of generative AI business efforts are failing, with only 5% achieving meaningful revenue growth. Productivity gains remain elusive as AI struggles with real-world tasks and verification needs. Concerns over bias, mental health, and ethical dilemmas deepen. While some leaders predict massive future gains, experts warn that AI's hype may be inflating an unsustainable bubble.

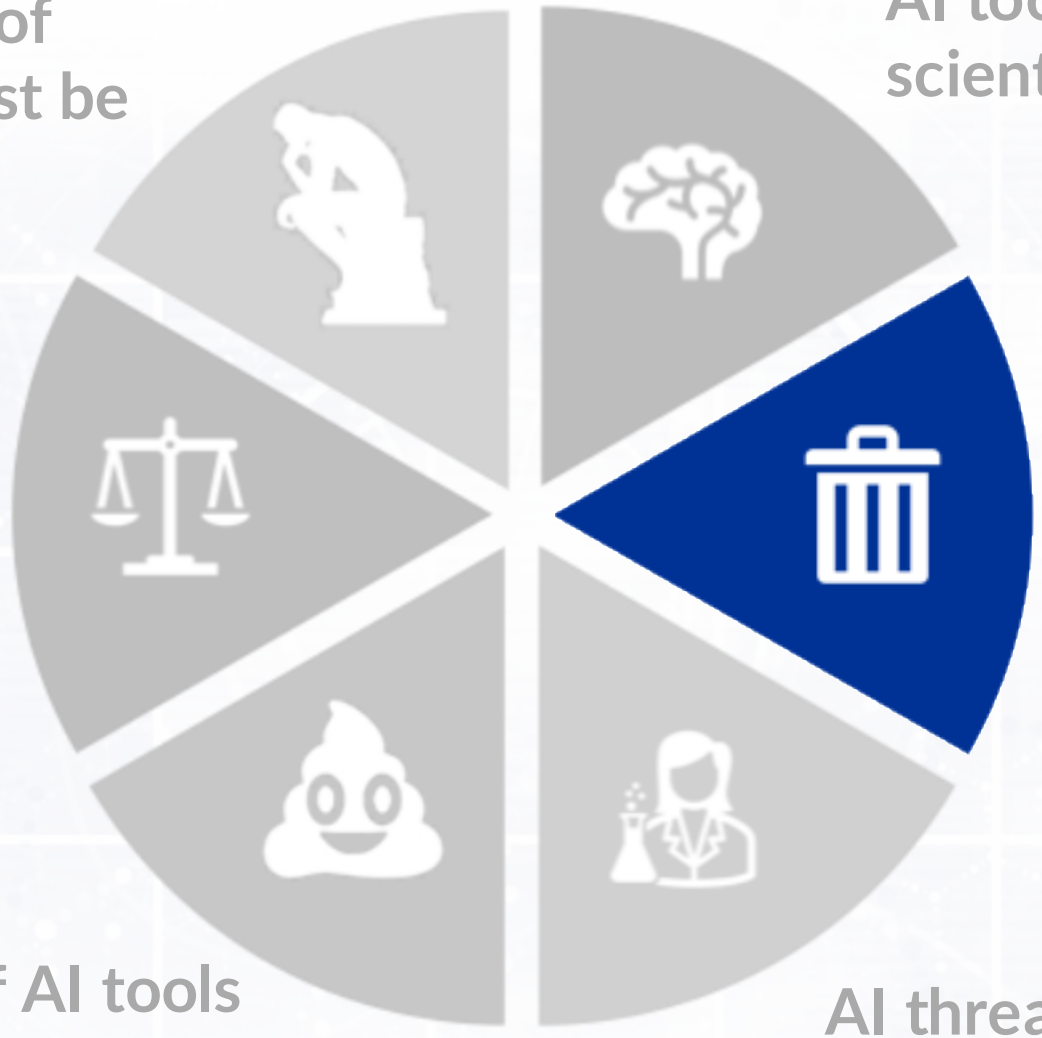
myIQ



AI TOOLS ARE SLOP GENERATORS

The future of science must be slow

AI tools cannot help with scientific reasoning



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LLMS ARE SLOP GENERATORS

Why can't Epidemiology be automated (yet)?

David Bann[1]*, Ed Lowther[2], Liam Wright[1], Yevgeniya Kovalchuk[2]

[1]Centre for Longitudinal Studies, University College London, London, UK
[2]Centre for Advanced Research Computing, University College London, London, UK
*Corresponding author: david.bann@ucl.ac.uk

Recent advances in artificial intelligence (AI)—particularly generative AI—present new opportunities to accelerate, or even automate, epidemiological research. Unlike disciplines based on physical experimentation, a sizable fraction of Epidemiology relies on secondary data analysis and thus is well-suited for such augmentation. Yet, it remains unclear which specific tasks can benefit from AI interventions or where roadblocks exist. Awareness of current AI capabilities is also mixed. Here, we map the landscape of epidemiological tasks using existing datasets—from literature review to data access, analysis, writing up, and dissemination—and identify where existing AI tools offer efficiency gains. While AI can increase productivity in some areas such as coding and administrative tasks, its utility is constrained by limitations of existing AI models (e.g. hallucinations in literature reviews) and human systems (e.g. barriers to accessing datasets). Through examples of AI-generated epidemiological outputs, including fully AI-generated papers, we demonstrate that recently developed agentic systems can now design and execute epidemiological analysis, albeit to varied quality (see https://github.com/edlowther/automated-epidemiology). Epidemiologists have new opportunities to empirically test and benchmark AI systems; realising the potential of AI will require two-way engagement between epidemiologists and engineers.

Key words: Artificial intelligence, epidemiology, automation, large language models

"We live in an era that incentivises scientists to produce masses of papers of questionable quality…this is a human, not an AI problem"

False dichotomy:

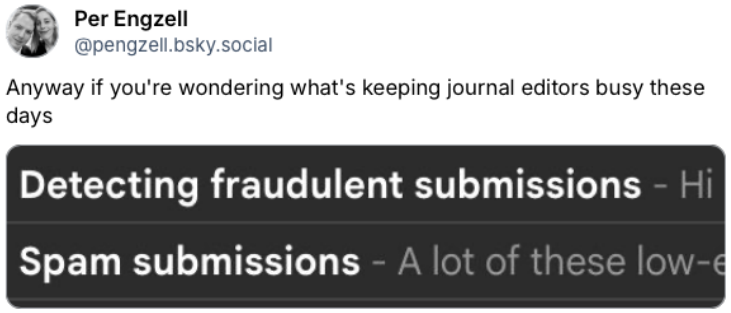
"Guns don't kill people, people kill people"

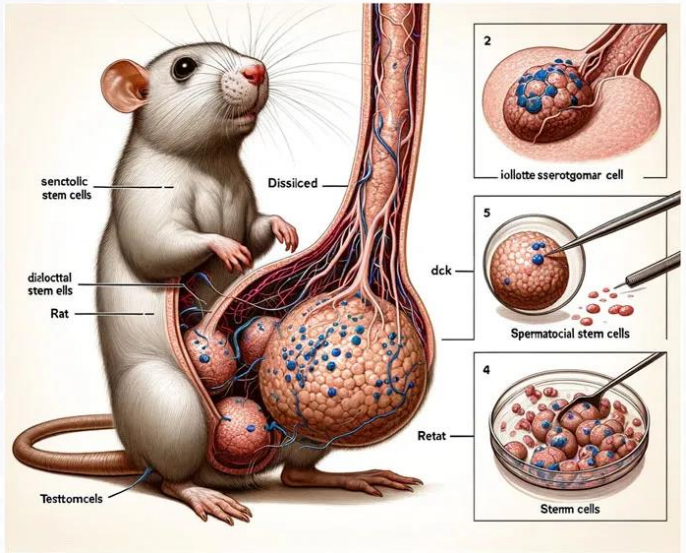
LLMS ARE SLOP GENERATORS

- LLMs are catalyzing scientific slop on an unimaginable scale

Artificial intelligence research has a slop problem, academics say: 'It's a mess'

AI research in question as author claims to have written over 100 papers on AI that one expert calls a 'disaster'





Journals and publishers crack down on research from open health data sets

PLOS, Frontiers, and others announce policies trying to stem the tide of suspect research

8 OCT 2025 · 11:20 AM ET · BY CATHLEEN O'GRADY

SocArXiv @socarxiv.bsky.social · 4h

1. Pausing new submissions about AI topics for 90 days. That is, papers about AI models, testing AI models, proposing AI models, theories about the future of AI, etc. We will make exceptions for papers that are already accepted for publication (or published) in peer-reviewed scholarly journals
/2

LLMS ARE AN EXISTENTIAL THREAT TO SCIENCE

"Important work risks being lost or drowned out by a surge of low-quality or AI-generated content"

For Researchers

Data science – are we chatting away scientific integrity?

by Cancer Research UK | Analysis
11 November 2025

"We are being swamped by AI-generated content that is endangering the very foundations of objectivity and empirically derived facts"

AI THREATENS THE SCIENTIFIC CRAFT

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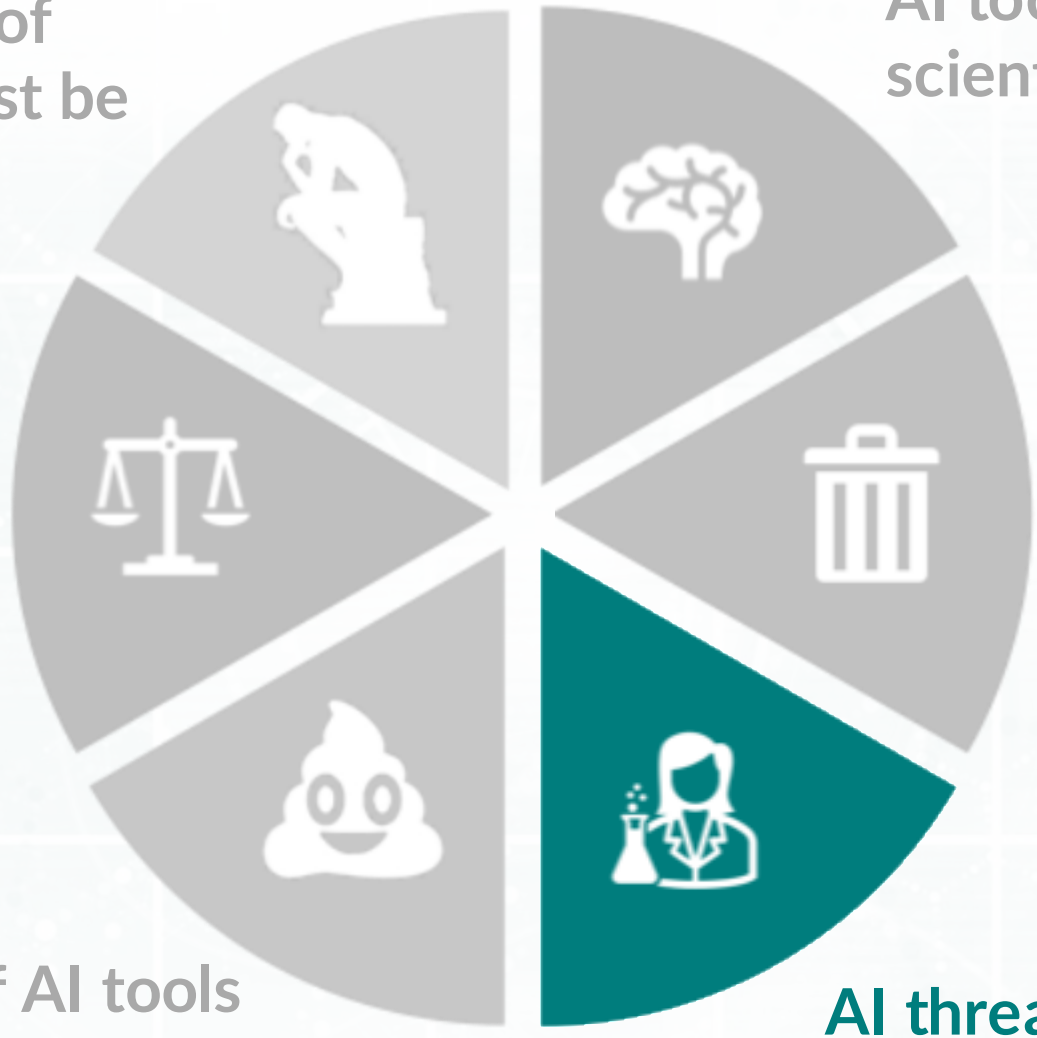

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LLM THREATEN THE SCIENTIFIC CRAFT

The AI Scientist: Towards Fully Automated Open-Ended Scientific Discovery

Chris Lu[1,2,*], Cong Lu[3,4,*], Robert Tjarko Lange[1,*], Jakob Foerster[2,†], Jeff Clune[3,4,5,†] and David Ha[1,†]
[*]Equal Contribution, [1]Sakana AI, [2]FLAIR, University of Oxford, [3]University of British Columbia, [4]Vector Institute, [5]Canada CIFAR AI Chair, [†]Equal Advising

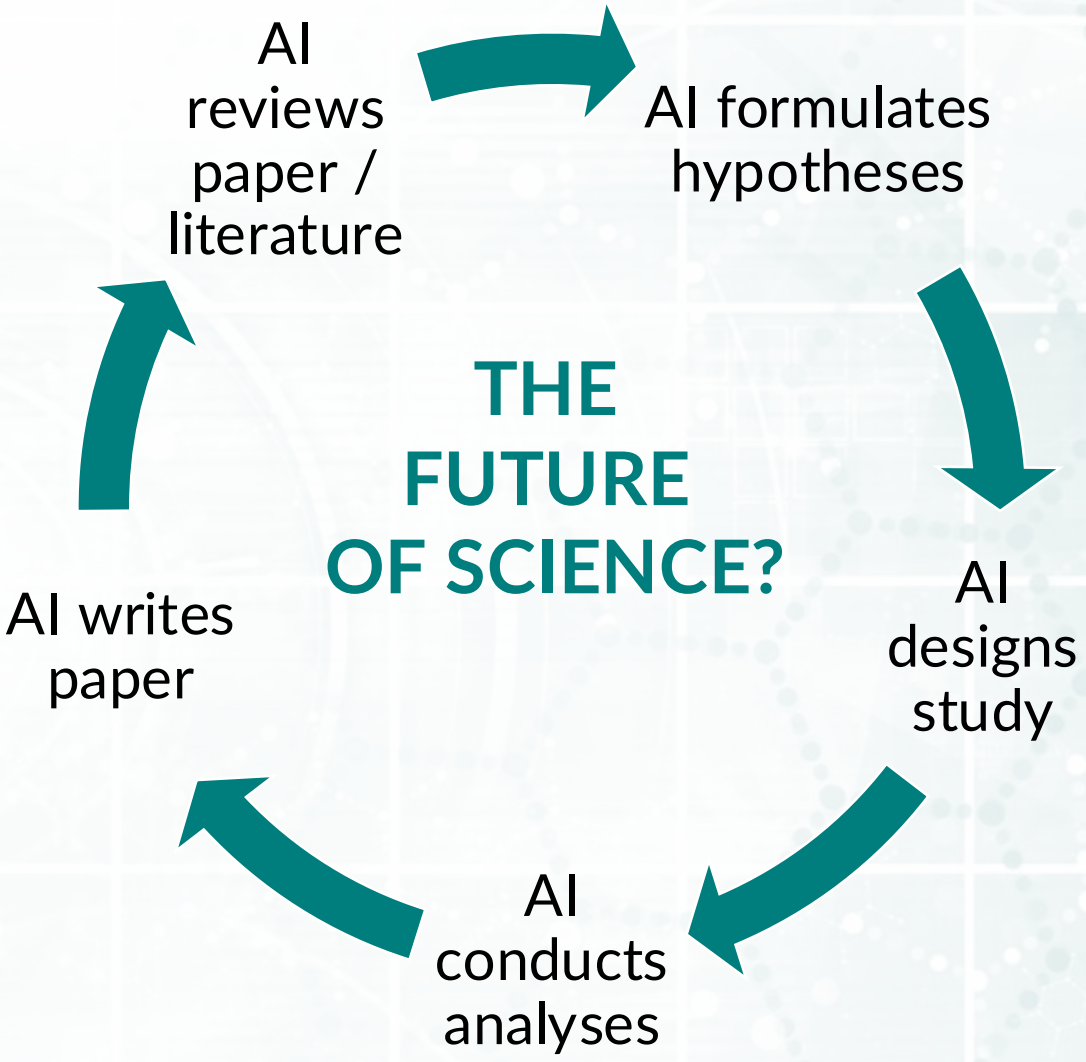
One of the grand challenges of artificial general intelligence is developing agents capable of conducting scientific research and discovering new knowledge. While frontier models have already been used as aides to human scientists, e.g. for brainstorming ideas, writing code, or prediction tasks, they still conduct only a small part of the scientific process. This paper presents the first comprehensive framework for fully *automatic scientific discovery*, enabling frontier large language models (LLMs) to perform research independently and communicate their findings. We introduce THE AI SCIENTIST, which generates novel research ideas, writes code, executes experiments, visualizes results, describes its findings by writing a full scientific paper, and then runs a simulated review process for evaluation. In principle, this process can be repeated to iteratively develop ideas in an open-ended fashion and add them to a growing archive of knowledge, acting like the human scientific community. We demonstrate the versatility of this approach by applying it to three distinct subfields of machine learning: diffusion modeling, transformer-based language modeling, and learning dynamics. Each idea is implemented and developed into a full paper at a meager cost of less than $15 per paper, illustrating the potential for our framework to democratize research and significantly accelerate scientific progress. To evaluate the generated papers, we design and validate an automated reviewer, which we show achieves near-human performance in evaluating paper scores. THE AI SCIENTIST can produce papers that exceed the acceptance threshold at a top machine learning conference as judged by our automated reviewer. This approach signifies the beginning of a new era in scientific discovery in machine learning: bringing the transformative benefits of AI agents to the *entire* research process of AI itself, and taking us closer to a world where *endless affordable creativity and innovation* can be unleashed on the world's most challenging problems. Our code is open-sourced at https://github.com/SakanaAI/AI-Scientist.

"The AI Scientist… generates novel research ideas, writes code, executes experiments, visualizes results, describes its findings by writing a full scientific paper"

It is argued that such automation will liberate us to work on more creative matters

THE LIBERATING MACHINE FALLACY

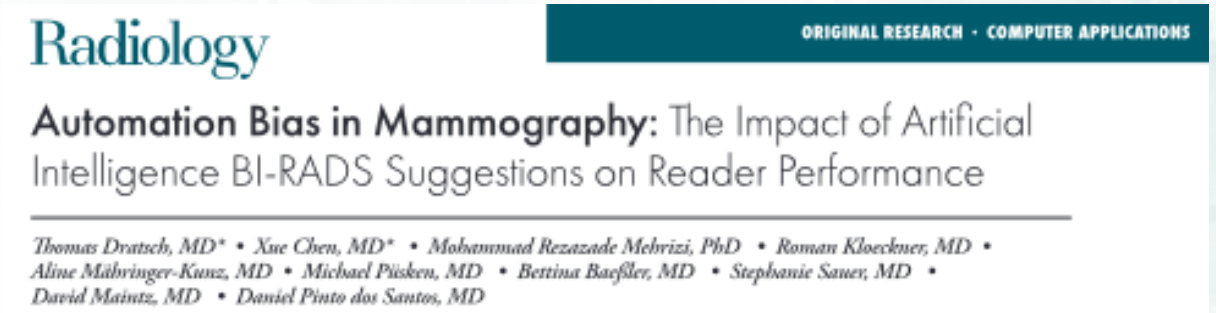
- But what tasks are we 'liberating' ourselves to do, if we hand over all the core stages of the scientific method?!
  - No labour-saving machine has ever 'freed' us to do more meaningful work!
- These are the tasks we are trained for, skilled at, and typically find most rewarding
- Would you not rather struggle with these tasks yourself, than be stuck inputting and validating output from a machine?



WE BECOME WORSE WHEN WE RELY ON AI

- There is growing evidence that we perform *worse* when we 'collaborate' with AI

- We become overly dependent on algorithms and lose our ability to make critical judgements
  - **Automation bias**



- Using LLMs appears to damage our critical thinking skills
  - **Cognitive offloading bias**

BREAKING THE TRAINING PIPELINE

- The more labour we give to LLMs, the fewer opportunities we have to learn and maintain our craft
  - Collective deskilling

- Creeping reliance on LLMs risks displacing human scientists
  - Fewer jobs
  - Fragmentation of the training pipeline
  - Potential workforce collapse

- Dark future:
  - Instead of postdocs, we're costing LLM subscriptions into our grants

The Age of De-Skilling

Will AI stretch our minds—or stunt them?

By Kwame Anthony Appiah

Illustration by Matteo Giuseppe Pani / The Atlantic

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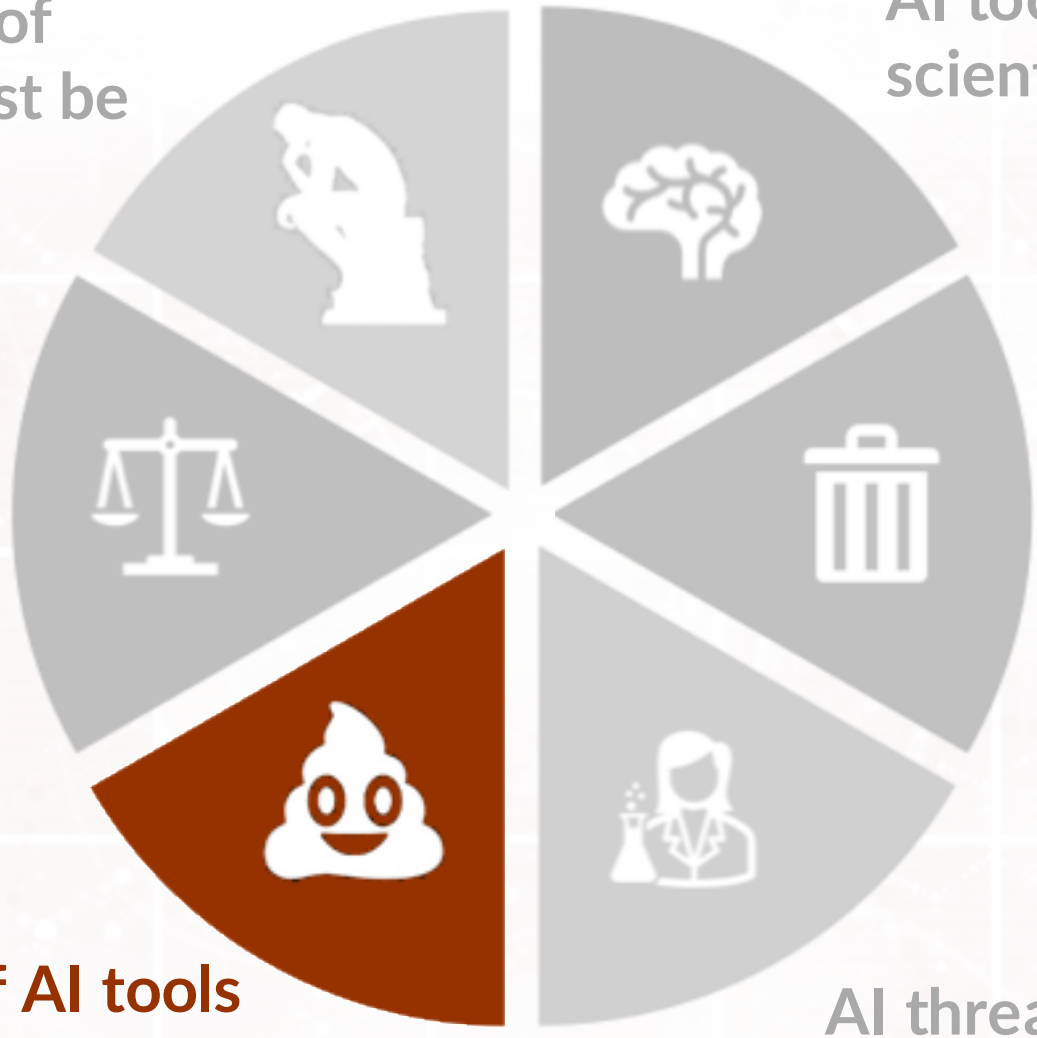

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THE FUTURE IS MODEL COLLAPSE

- It is often assumed that LLMs will get better and better

- This is not necessarily true
  - Existing LLMs have already been trained on the majority of publicly available data

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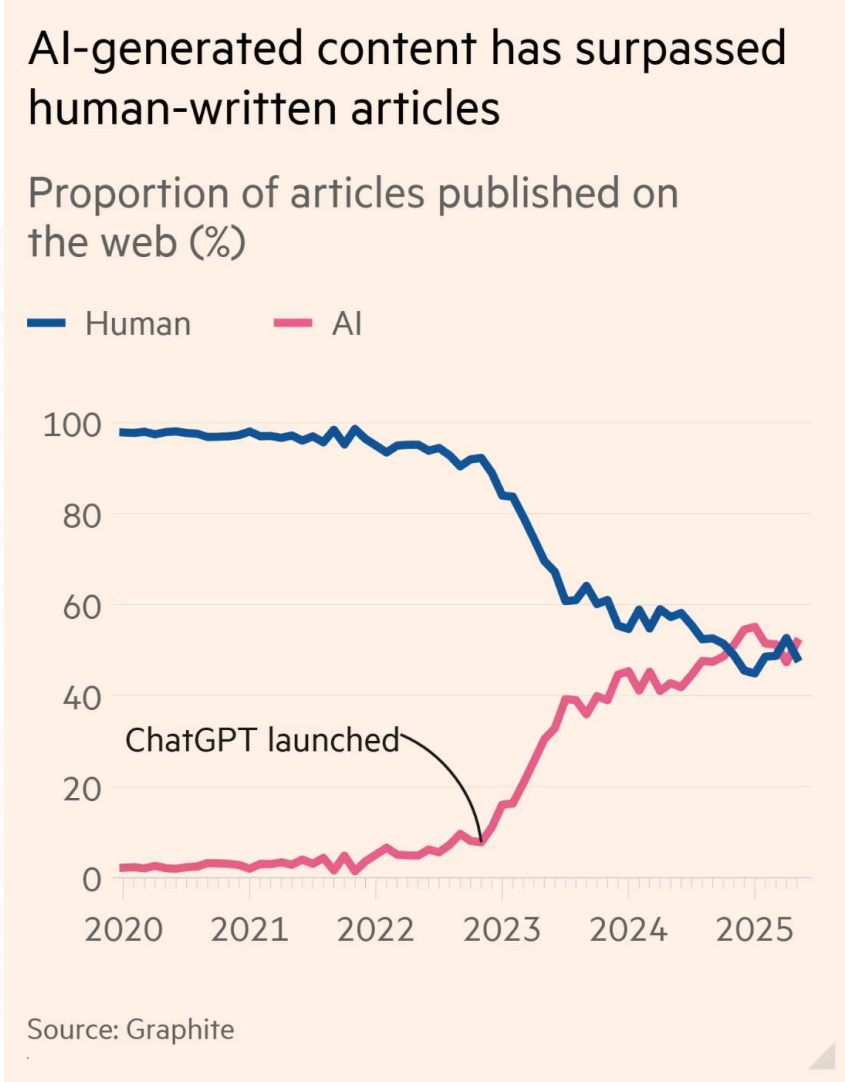

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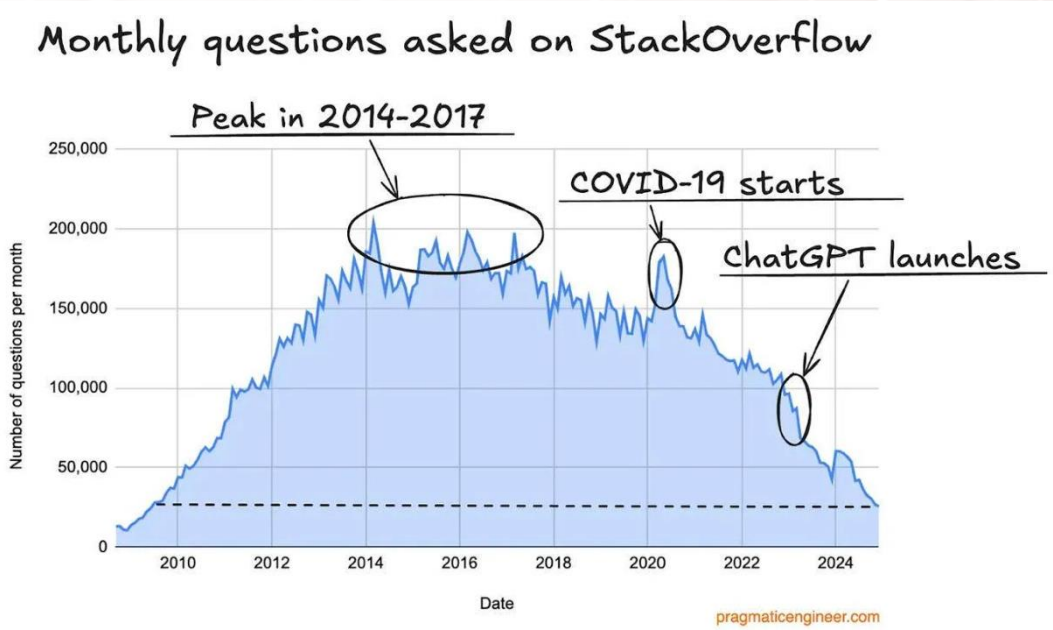
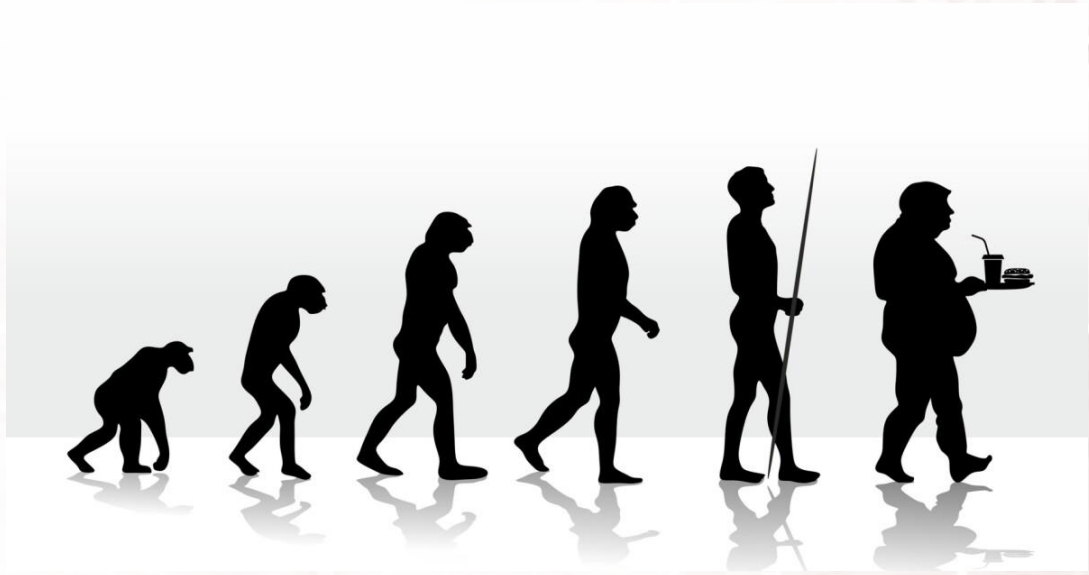
- This is not necessarily true
  - Existing LLMs have already been trained on the majority of publicly available data
  - The training data is degrading – over 50% of the internet is now written by AI
  - We are contributing less to human platforms like Wikipedia and Stack Overflow

- Future models may actually be worse!



ENSHITTIFICATION

- Regardless: what happens next, if we contract our skills and reasoning to LLMs?
  - What has happened where technology promised faster and cheaper products?
- Fast food
  - Cheap, low quality, with high human and environmental costs



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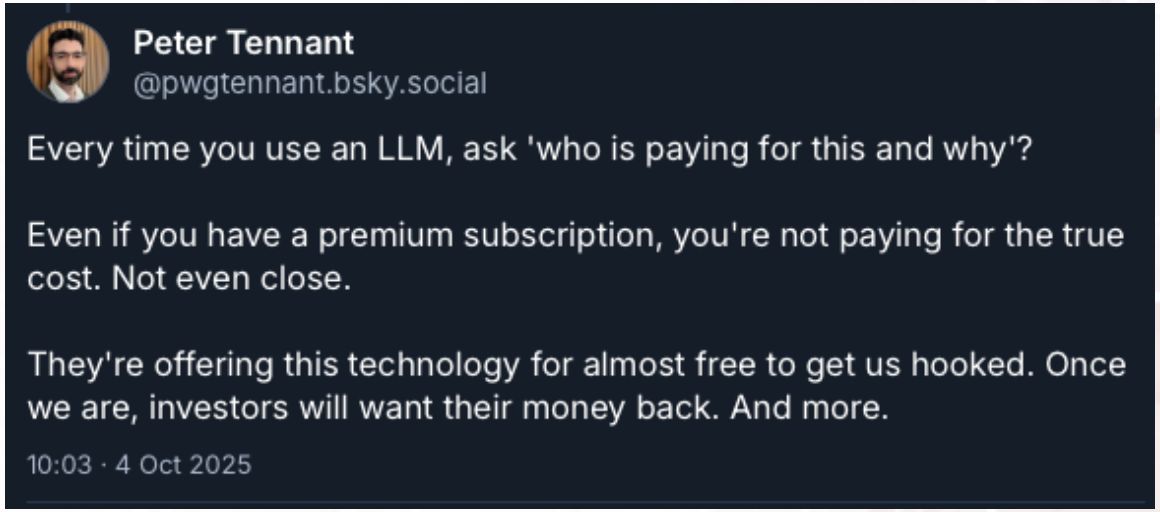
ENSHITTIFICATION

- Regardless: what happens next, if we contract our skills and reasoning to LLMs?
  - What else was made faster and cheaper with technology?
- Fast food
  - Cheap, low quality, with high human and environmental costs
- Fast fashion
  - Cheap, low quality, with high human and environmental costs
- Big tech
  - Ads, sponsored results, worsening user experience, increasing subscription costs

THE FUTURE IS ENSHITTIFICATION

- The same will happen with LLMs
- You are NOT paying the cost of LLMs
  - It's currently being supported by enterprise investment
  - They will want their billions back, with interest!
- LLMs will become *enshittified*
  - Ads, sponsored results, worse experience, higher subscription fees
- We risk being dependent
  - Funnelling grant money to subscriptions leaving less available for human scientists



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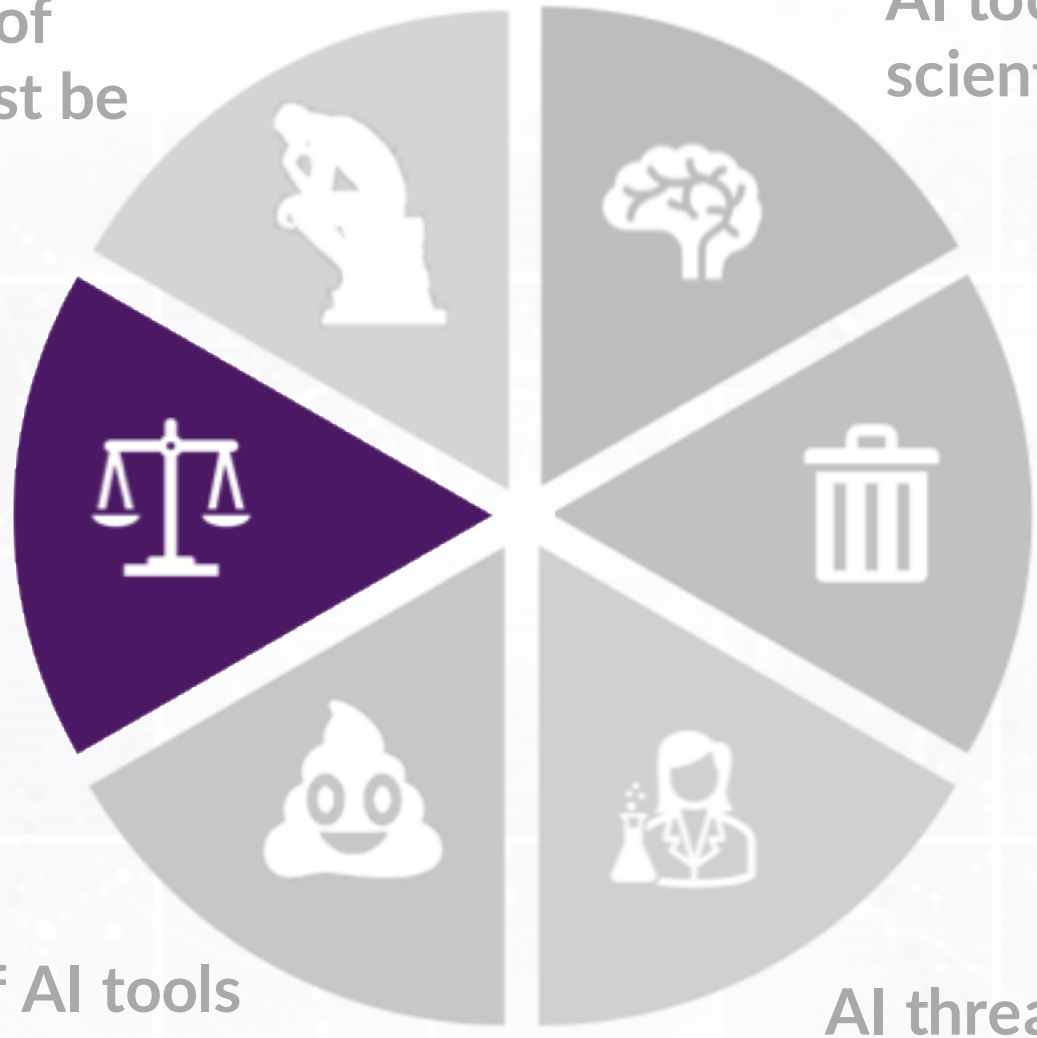

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UNETHICAL MACHINES

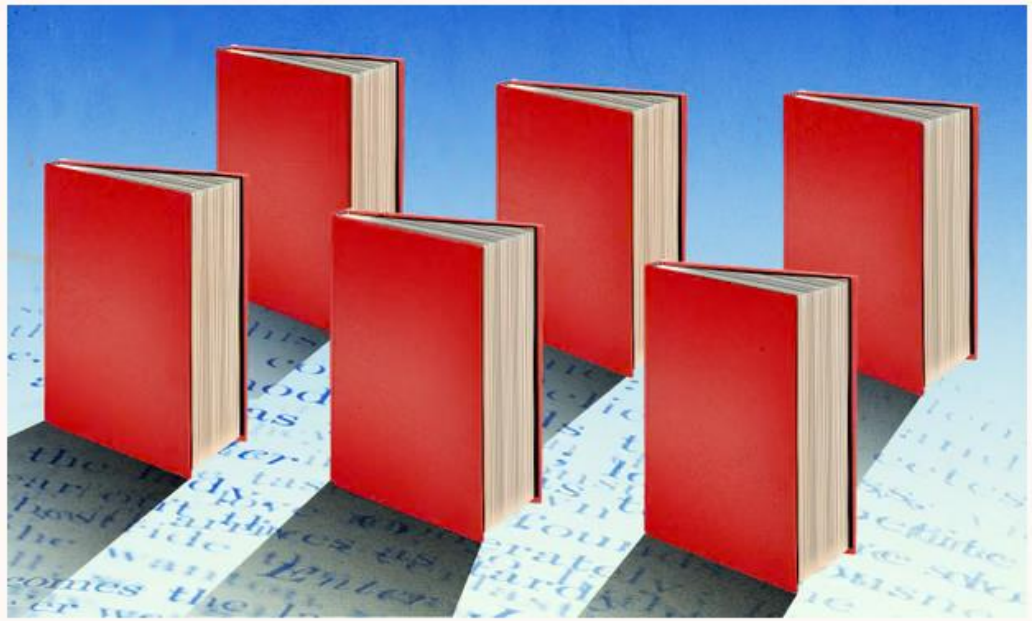
- We must consider the wider implications for health and society

- LLMs are built on mass intellectual theft
  - We produce the work, share it with they world, they scrape and sell back to us
  - This undermines our labour and livelihoods

Tech companies are stealing our books, music and films for AI. It's brazen theft and must be stopped

Anna Funder and Julia Powles

If we don't refuse and resist, not just our culture but our democracy will be irrevocably diminished



'What is categorically disallowed for humans is being seriously discussed as acceptable for the handful of humans behind AI companies and their (not yet profit-making) machines.' Illustration: Getty Images/Guardian Design

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- Behind the ‘magic’ of every LLM is an army of invisible and exploited workers moderating harmful content

‘It’s destroyed me completely’: Kenyan moderators decry toll of training of AI models

Employees describe the psychological trauma of reading and viewing graphic content, low pay and abrupt dismissals

Office premises of Sama in Nairobi, Kenya. Photograph: Tony Karumba/AFP/Getty Images

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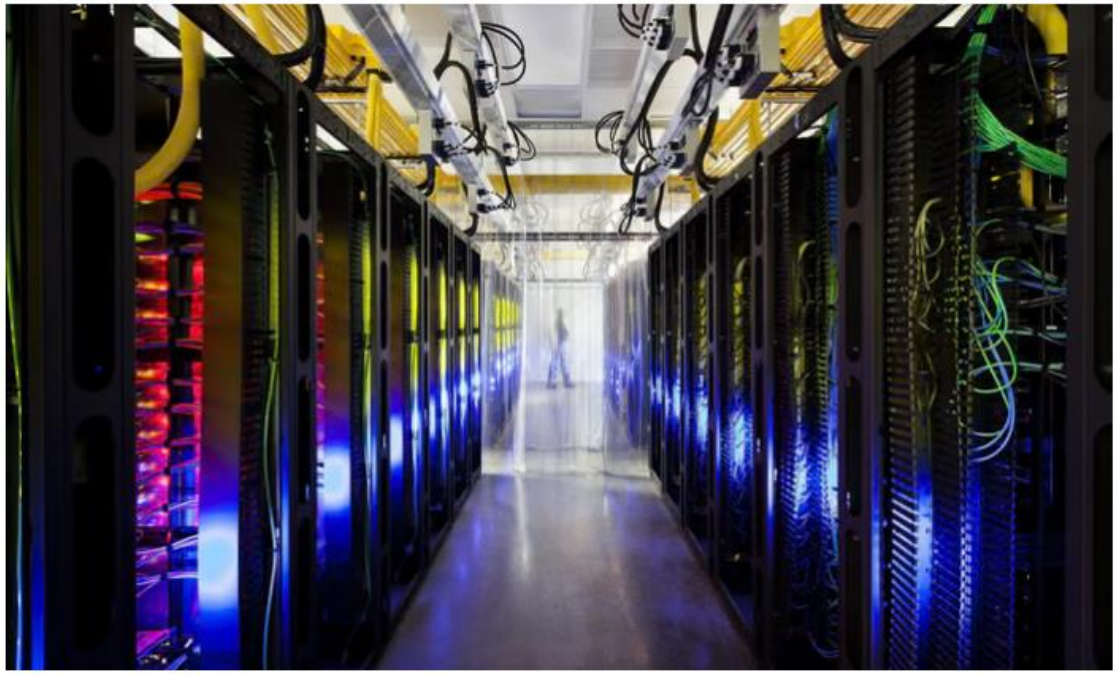
- LLMs are extremely power and water hungry
  - By 2030 they are expected to draw 5% of all global energy

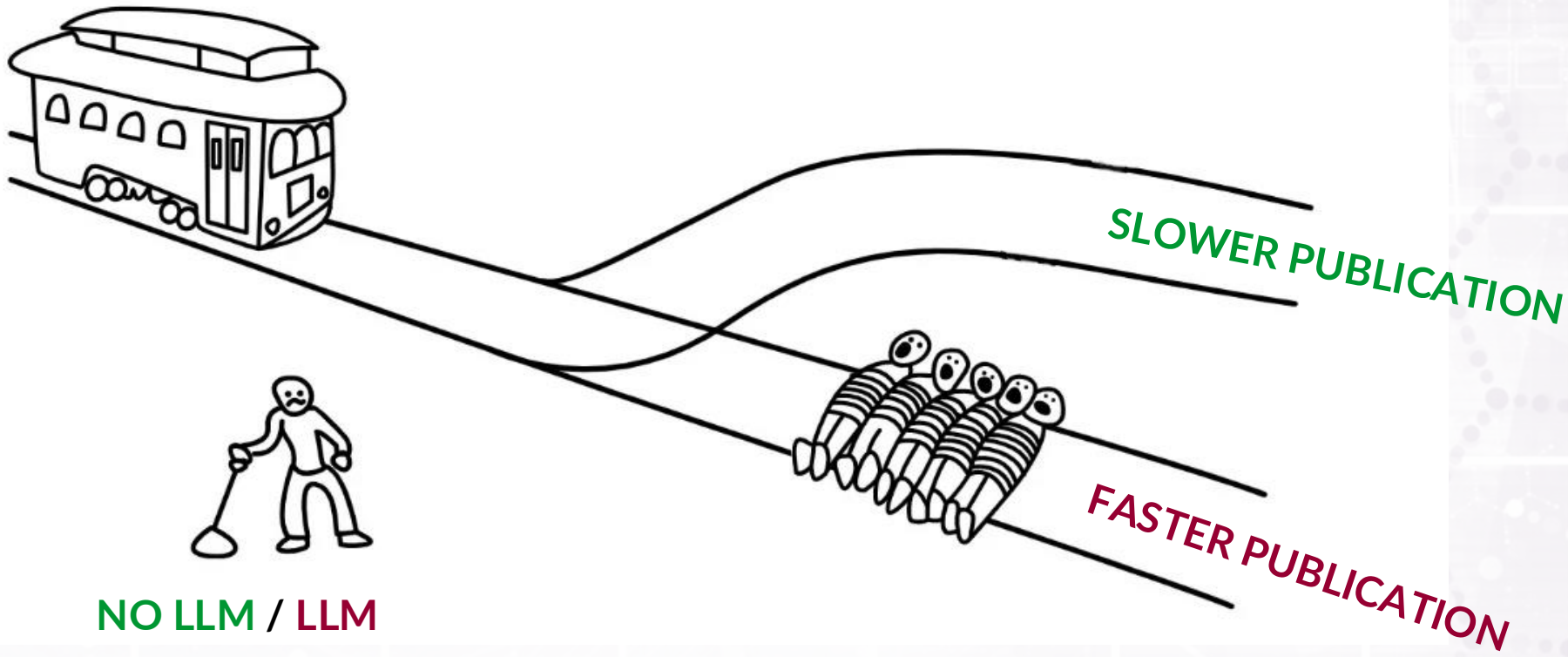
Can the climate survive the insatiable energy demands of the AI arms race?

New computing infrastructure means big tech is likely to miss emissions targets but they can’t afford to get left behind in a winner takes all market



MORAL QUESTION

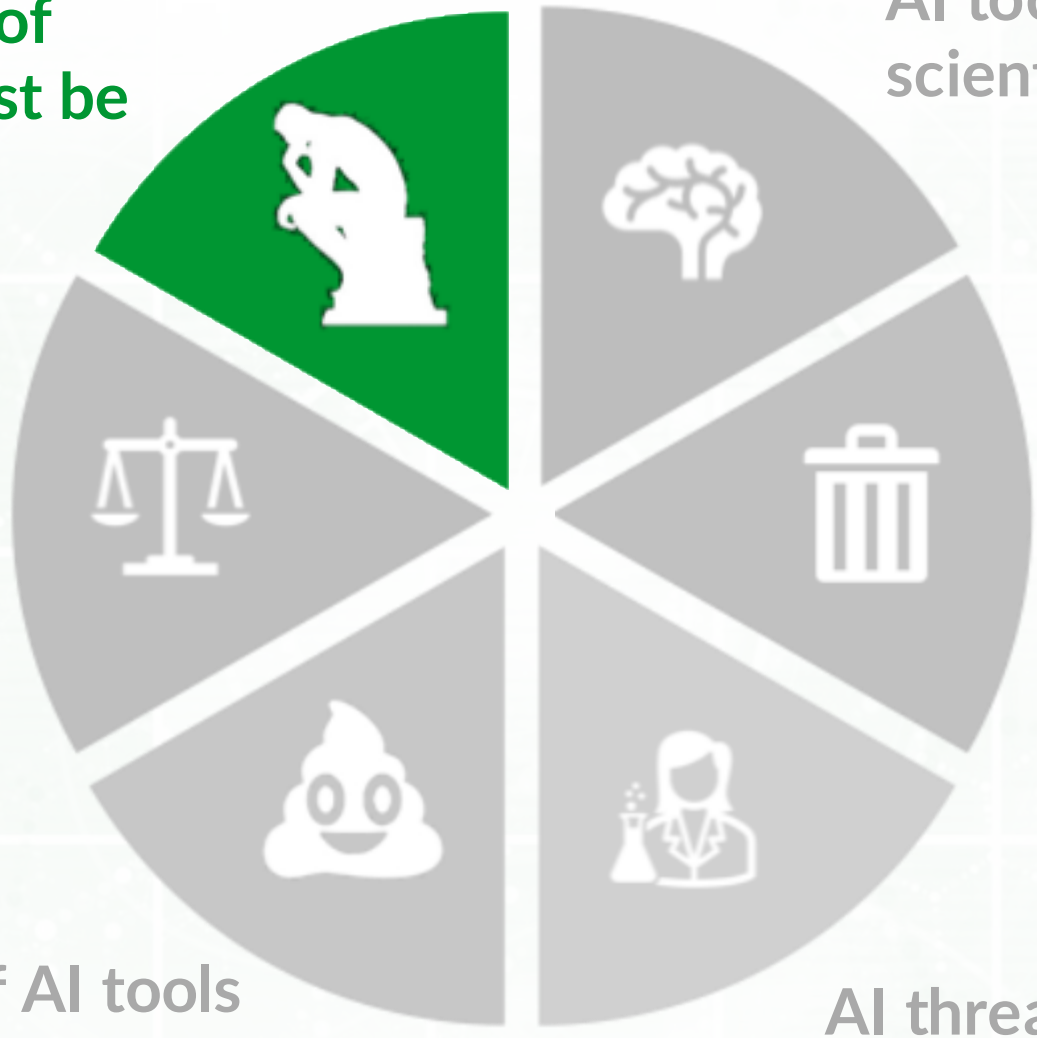
"What human, social, and environmental cost are you willing to accept to help prepare your next publication or alternative output?"



THE FUTURE OF SCIENCE MUST BE SLOW

The future of science must be slow

AI tools cannot help with scientific reasoning



AI tools are unethical

AI tools are slop generators

The future of AI tools is enshittification

AI threatens the scientific craft

WE NEED MORE THINKING TIME

The international journal of science / 25 July 2024

nature

Scientists need more time to think

E-mails and instant messaging are core to research — but also a distraction. Researchers should study their impact on science, and how they can claw back time to concentrate.

Video calls. Instant messaging. Voice calls. E-mails. Social media. Smartphones. Tablets. Laptops. Desktops. More digital devices equals less time to concentrate and to think. The negative effects of this on researchers are tackled by computer scientist Cal Newport in his latest book, *Slow Productivity*[1].

The book's title challenges the idea, common to many workplaces, that productivity must always increase. A study has shown that science is becoming less disruptive, even though there are now more papers being published and grants awarded than ever before[2]. Newport, who studies technology in the workplace at Georgetown University in Washington DC, says that researchers and other knowledge workers need to slow down and spend more time thinking, to focus on maintaining and improving quality in their work.

Newport does the research community a service by shining a spotlight on an overburdened workforce. Institutions should already be accessing the expertise that exists within their walls in the search for answers, but are not doing so. Newer communications technologies have enormous benefits, including speeding up research, as was necessary during the COVID-19 pandemic. But they are also squeezing out thinking time. Newport's book reminds us that there are researchers who will know how to help.

Stop, drop and think

Thinking time — the time needed to concentrate without interruptions has always been central to scholarly work. It is essential to designing experiments, compiling data, assessing results, reviewing literature and, of course, writing. Yet, thinking time is often undervalued; it is rarely, if ever, quantified in employment practices.

One way to think about the practice of juggling research with e-mail and instant messaging is to visualize someone working next to a physical letterbox. Imagine opening and reading every letter as soon as it arrives, and starting to compose a reply, even as more letters drop through the box — all the while trying to do your main job. Researchers say that their to-do lists tend to lengthen, in part because colleagues can contact them instantly, often for good reasons. Researchers also often have to choose what to prioritize, which can cause them to feel overwhelmed.

Newport gives suggestions on reclaiming thinking time, include limiting the number of items on to-do lists and project teams setting aside time to complete tasks that require all members, thus avoiding individual members sending e-mails to each other. For institutions, Newport recommends a transparent workload management system — a way for managers to see everything that a colleague is expected to do — and then to adjust the workload if there are more tasks than there is available time.

> **"Thinking time is often undervalued; it is rarely, if ever, quantified in employment practices."**

Undoubtedly good advice, this might be easier to implement in industrial settings than in academic ones. In many academic research laboratories, researchers report to a single principal investigator, with little management structure. This is partly because it is hard to justify to academic funders the budget for paying for management and administration roles.

But Felicity Mellor, a science-communication researcher at Imperial College London, is sceptical about giving managers a role in thinking time. In many cases, researchers are already feeling the weight of their institution's monitoring and evaluation systems. Mellor argues that including yet another box in an evaluation form might not go down well. She also thinks that institutions will not accept this. "Can you imagine the response if a scientist filled out a time sheet where it says 'eight hours spent thinking'?" Ultimately, she says, creating a more supportive research culture needs a much more fundamental change. That suggests an even more radical rethink of the current funding model for academic research, as we wrote last month (see *Nature* **630**, 793; 2024) , along with changes to other aspects of academic science.

Quality check

Newport's thesis raises a much more fundamental question: what is the impact of lost concentration time on science — not just on the structure and process of science, but also on the content and quality of research?

In 2014, Mellor co-led a research project, funded by the UK Arts and Humanities Research Council, called The Silences of Science, published as a book two years later[3]. Researchers discussed this question, and others in a series of workshops, but the work did not continue after the grant expired. Such explorations need to be revived, but they also need to incorporate the impact of artificial-intelligence technologies. These tools are being implemented at pace around the world to automate many routine administrative tasks. Researchers need to evaluate whether such tools can free up more thinking time for researchers; or whether they could have the opposite effect.

Communications technologies are sure to evolve further and to continue distracting researchers from their work. More studies investigating the effect of these technologies on science are needed urgently, as are studies on how thinking time can be protected in a world of instant communication. This knowledge will help researchers and institutional leaders to make better decisions about the technologies' deployment — and, hopefully, allow researchers to carve out that all-important space and time to think.

1. Newport, C. *Slow Productivity: The Lost Art of Accomplishment Without Burnout* (Portfolio, 2024).
2. Park, M *et al. Nature* **613**, 138–144 (2023).
3. Mellor, F. & Webster, S. *The Silences of Science: Gaps and Pauses in the Communication of Science* (Routledge, 2016).

Rosa Ritunnano
@rritunnano.bsky.social

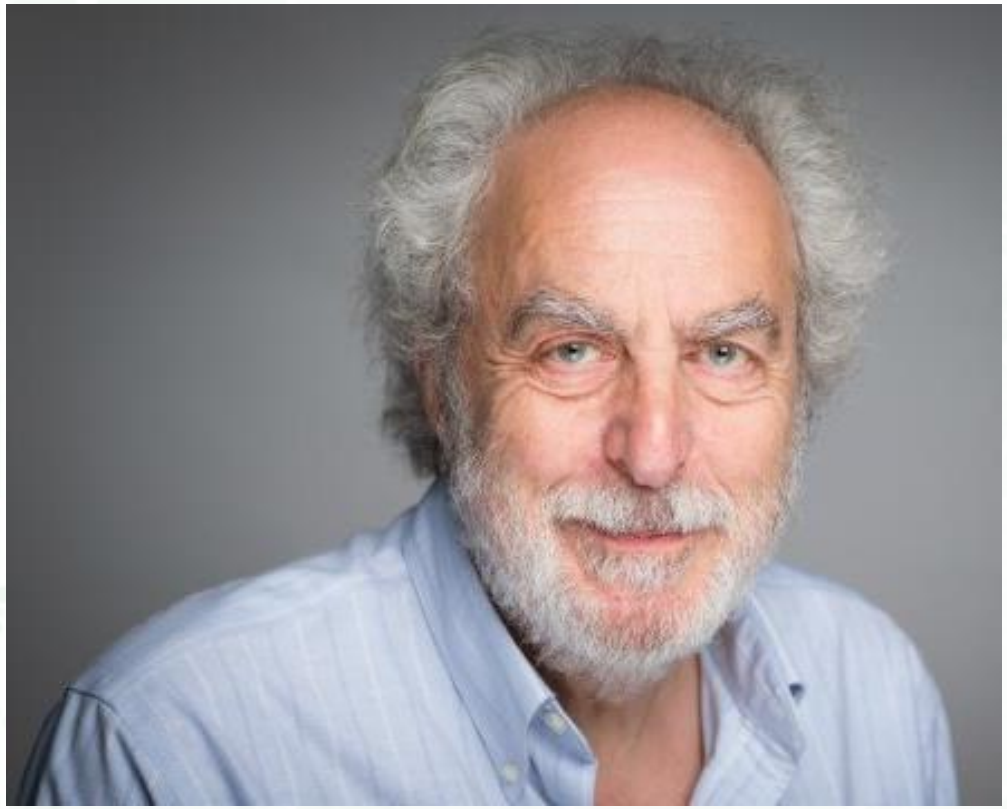
Follow

Instead of listing my publications, as the year draws to an end, I want to shine the spotlight on the commonplace assumption that productivity must always increase. Good research is disruptive and thinking time is central to high quality scholarship and necessary for disruptive research.

@PWGTennant

UNIVERSITY OF LEEDS

WE NEED LESS RESEARCH



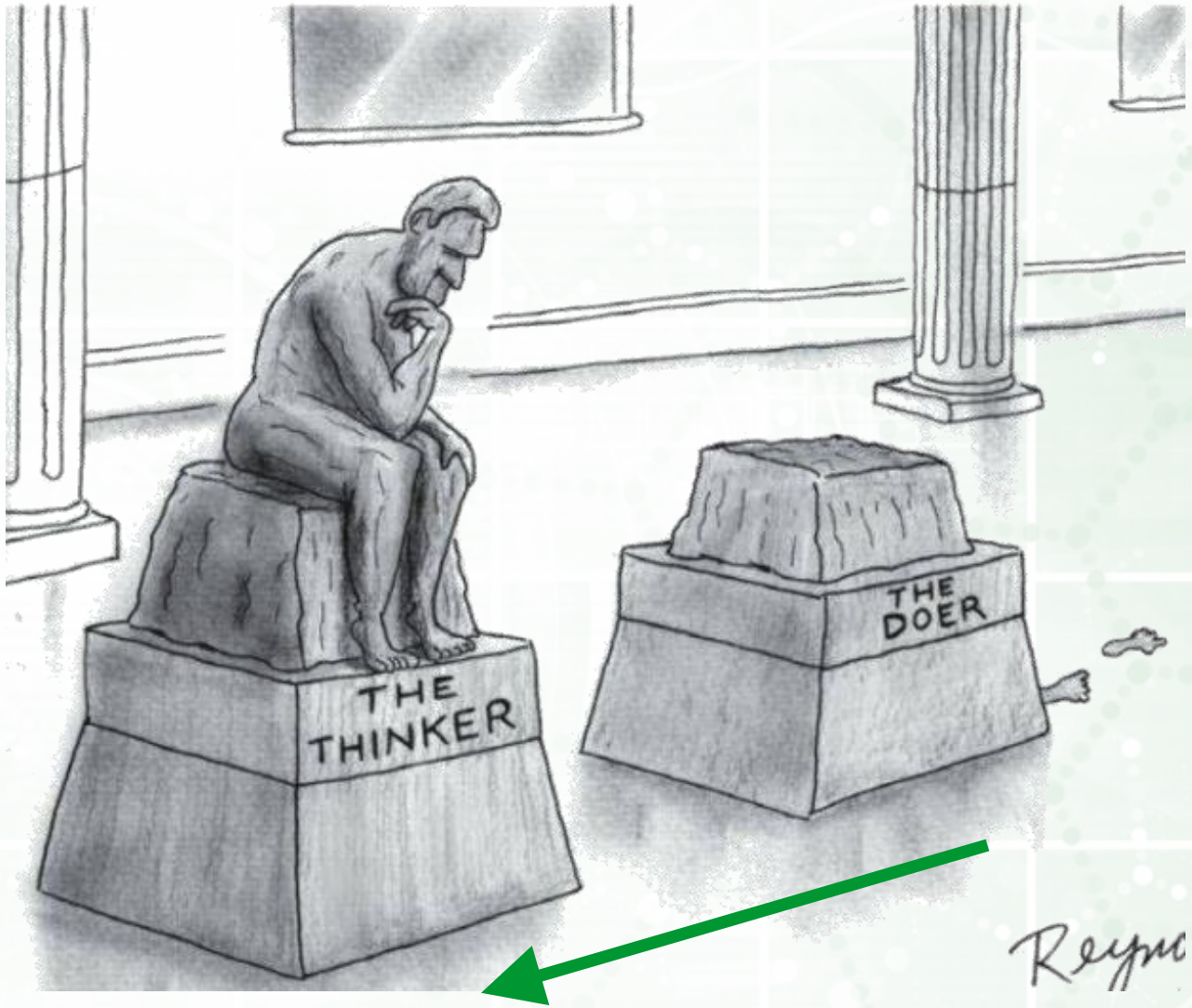
Doug Altman (1948-2018)

"We need less research, better research, and research done for the right reasons"

- The Scandal of Poor Medical Research, BMJ, 1994

THE FUTURE OF SCIENCE MUST BE SLOW

- Trust in and support for science is at an unprecedented low
- The flood of derivative, fraudulent AI research threatens us all
- Chasing 'greater productivity' will not save health and social science
- The only path is the slower path
  - Spending more time thinking and collaborating with our **human colleagues** to produce better more thoughtful research



WE MUST PRIORISE THINKING OVER DOING

TO ANSWER THE QUESTION:

Q) Is AI the future of health and social science research?

A) NO! It risks being the death of health and social science research!