

We negate

Contention 1 is inequality

The use of Gen AI only makes the digital divide worse for underprivileged communities.

No Author, At United Way, we're dedicated to one unshakable principle – no one should have to live in poverty. But right now, thousands of families in Greater Philadelphia and Southern New Jersey are living below the poverty line., "Closing the Digital Divide to Help Kids Thrive - United Way of Greater Philadelphia and Southern New Jersey." *United Way of Greater Philadelphia and Southern New Jersey*, 3 Aug. 2021, unitedforimpact.org/closing-the-digital-divide-to-help-kids-thrive/. Accessed 24 Feb. 2025.//LEH SR

No internet. No computer. That may sound like a punishment doled out by parents to kids who aren't doing their chores. But for millions of kids, it's an everyday reality that makes it challenging to succeed in school. The digital divide in education is the gap between students who have reliable access to an adequate device and reliable internet and those who don't. The gap has existed for decades – ever since personal computers gained popularity – but during the COVID-19 pandemic our community saw how deep the challenge runs. United Way of Champaign County is working to close the digital divide. During the past years as schools moved to remote learning, we provided funding to organizations that give out laptops, tablets, printers, etc. thanks to generous donors like you. As the new school year begins we are planning to increase these efforts so more students in our community can thrive. Here are four reasons we are investing in closing the digital divide. According to Common Sense Media, 15 to 16 million students don't have access to adequate devices or internet connection. That's about 30% of all students in the U.S. But when the numbers are broken out by race, it becomes clearer students of color disproportionately have to deal with the challenges of the digital divide. Students of color represent about 40% of the total population, but 55% of Black, Latinx and Native American students are part of the disconnected populations. Native Americans face the greatest challenge to access to devices and the internet; 37% of Indigenous students lack adequate connectivity. Black, Latinx and Native American students may not have connectivity because of discriminatory housing practices that led to them growing up in neighborhoods that are under-resourced and lack high-speed internet, their families may have faced discriminatory pay practices that kept them from higher earning jobs making personal devices unaffordable, or they may face more language barriers that make adoption more difficult. Closing the digital divide gives students of color better opportunities to navigate these obstacles caused by systemic racism and more chances to thrive. Students in rural areas already face many challenges. They often attend under-resourced schools, must travel long distances to attend classes and schools struggle to attract top-quality teachers. The lack of access to devices or hardware is one more challenge rural students must overcome. Similarly to students of color, rural students are disproportionately impacted by the digital divide. Common Sense Media notes that rural students makeup 12% of the total school population but comprise 20% of the disconnected population. Unlike other common services such as electricity or telephone access, internet connection is not treated as a public utility. That means demand and interest in profits have largely determined where and when infrastructure like broadband internet are introduced to communities. Rural communities are often left out of that conversation, hurting economic growth, ability to attract new residents and local students. Addressing the digital divide can help overcome these challenges to give rural students more opportunities to succeed and be prepared for a digitally-based world. Access to the internet and devices might seem like a distraction for some kids, but research shows it also increases student grade performance.

Researchers from Michigan State University connected higher grade point averages (GPA) with access to broadband internet and adequate at-home devices. During the global pandemic, kids without access struggled to stay engaged as schools moved to remote learning. Slow internet, having to share devices with siblings, participating on smartphones instead of laptops all contributed. But these challenges extend beyond the pandemic. As more schools incorporate assignments that require online research, use digital tools to enhance learning and incorporate technology overall, students without at-home access will continue to fall behind. Helping kids thrive in the workplace tomorrow starts by closing the digital divide today. A study from the University of Miami found that students with higher GPAs, those that have adequate access to technology, have higher earning potential. The study shows the multi-generational impact of increasing connectivity for individuals. On top of the benefits for individuals, when students have more opportunities to secure high paying jobs that strengthens our local economy. A skilled, high performing workforce is essential to keeping our region thriving today as well as decades into the future. There is still much to be done to close the digital divide. But together with generous donors, committed volunteers and community partners United Way of Champaign County can continue to help kids thrive. To stay up to date with the latest on what we're doing to close the digital divide and other ways we're helping improve the health, education and financial stability of every person in Champaign County.

Increased use of AI makes inequality worse

Lake 24 (Robin Lake is director of the Center on Reinventing Public Education. CRPE's mission is to develop transformative, evidence-based solutions for K–12 public education. Her research focuses on U.S. public school system reforms, including public school choice and charter schools; innovation and scale; portfolio management; and effective state and local public oversight practices, May 2024, "AI is coming to U.S. classrooms, but who will benefit?"

<https://crpe.org/ai-is-coming-to-u-s-classrooms-but-who-will-benefit/>)

The bottom line: AI has little presence in US classrooms today, but that is likely to change soon. The question is, who will benefit? Our study shows early signs that more advantaged suburban school districts are ahead of urban, rural, and high-poverty districts in terms of AI use. This should be cause for concern for those who want to see the benefits of these technologies reach the students most in need of help—and it should spur policymakers and philanthropists to start taking more assertive action. One of the most striking findings from our report is that as of Fall 2023, just a small portion of a nationally representative sample (only around 18% of K–12 teachers nationwide) reported using AI for teaching. A small subset of those early adopters (8%) consists of what I would call “super users:” teachers who are excited about the potential use of AI in classrooms and are staying current with the latest tools by actively experimenting with uses for AI in their profession. I follow some of these super users on social media, and they are coming up with creative and exciting ways to save themselves time while making learning more engaging and personalized for students. These early adopters predominantly teach middle and high school students, particularly in subjects like English language arts and social studies, which I suppose is not too surprising, given that generative AI is advancing most quickly on

language and visual models. Teachers report using AI primarily via the major virtual learning platforms and systems that have been around for a while like Google Classroom, iReady, and IXL. However, 50% of teachers who report using AI in the classroom are using **generative** AI chatbots, like ChatGPT. A much smaller percentage of teachers are active on more specialized AI classroom tools that provide customized tutoring (e.g., Khanmigo), lesson plans, and assessment generators (e.g., Education Copilot and PrepAI), or automated coaching and feedback to teachers. Educators report using AI in a variety of ways, but teachers are mostly likely to say they use AI to support students with “learning differences.” It may be that AI is simply making current teacher practices easier or faster. For example, a teacher might use AI to easily create customized homework for a student to practice a concept they were struggling with in class. Teachers may also be using AI to allow a student who reads at a grade 4 level to access high school-level social studies content. However, these fairly common instructional strategies do not necessarily accelerate student progress. Understanding how teachers use AI to help students who are struggling or have disabilities, and how effective it is, are open questions that should be studied soon. While there have been several high-profile cases of school districts banning AI, our survey results and interviews suggest that most school districts are interested in exploring the positive potential of AI. Twenty-three percent (23%) of districts had already provided training on AI, and another 37% intend to do so at some point during the 2023–24 school year. Furthermore, the district leaders we interviewed were more focused on how to support teachers in using AI to make their jobs easier than on how to block AI use among students or staff. They recognize AI’s potential to make teaching easier but worry about how to bring teachers up to speed quickly. One leader in a midsized district said, “My personal concerns are that it will not be operationalized evenly in classrooms. It’s just like curriculum. It’s hard to get curriculum consistency, and it will be the same with AI.” Another leader in a small district similarly remarked, “I’m more concerned that there’s a fear of it ... This is something that if you don’t embrace, you’re just going to be doing extra work.” Districts have good reason to focus on training and educator support. Teachers report that some of the greatest barriers to their using AI in classrooms is lack of school or district guidance and professional development. Teachers’ and district leaders’ concerns about AI use seem less about school-specific applications and more about student privacy, potential bias in AI, and the impact of AI on society in general. The district leaders we interviewed tended to believe that cheating and plagiarism concerns could be covered under existing district rules. They did, however, express the need for more policy guidance from trusted sources, like school board associations or respected local school districts, and noted that developing policies around AI is especially difficult due to the technology’s rapidly evolving nature. **AI could exacerbate educational inequality. Our study points**

to early signs of faster uptake of AI in more advantaged settings. Suburban, majority-white, and low-poverty school districts are currently about twice as likely to provide AI-use training for their teachers than urban or rural or high-poverty districts. Advantaged districts are also more likely to have plans to roll out training in the coming school year.

Imp. poverty

Sinkevich 24 (Des Sinkevich, Des holds a B.A. in English Writing from the University of Pittsburgh, 22 February 2024, “How Education Inequality Impacts Student Success (and What to Do About It)” <https://partners.pennfoster.edu/blog/2024/february/how-education-inequality-impacts-student-success>)

While access to public schools has made a basic education available to all students, there is still a distinct – and growing – inequality in education that can impact a person’s economic future. Without graduating high school, a person is likely to earn less money, forgo higher education, and struggle financially. With education inequality continuing to grow in the United States, it’s vital to understand why and take measures to make education more accessible and equitable for all students. Two children wearing backpacks standing next to a school bus. What contributes to inequality in education From income to lack of funding or resources, students can be negatively impacted by a lack of access to quality schooling and understanding. Some factors include the following. The impact of income on education access. Income inequality and inequality in education often go hand in hand. Students who live in lower-income areas may have limited access to quality education. And, statistically, those from lower-income families are less likely to pursue higher education. In fact, only about 51% of lower-income students enroll in college compared to 89% of students from well-off families.

Contention 2 is Cheating.

Generative AI in education blatantly encourages cheating.

Fan, Leanne. [opinions editor at The Nexus] “AI Reduces Critical Thinking.” *The Nexus*, 16 Feb. 2024, wvnexus.org/opinions/ai-reduces-critical-thinking/. //LEH SR

Over a lifetime, we hone our abilities to read, write, listen, and think critically. These life skills have the capability to unveil the mysteries of the world and offer numerous opportunities to grow. However, recent studies have shown that a reliance on AI in a school setting restricts the development of these critical-thinking abilities. A study by Dr. Ahmed, assistant professor in engineering management collected survey data from 285 students and found that 68.9% of laziness and 27.7% of the loss of decision-making skills were the result of artificial intelligence use. A sampling technique was used that gathered survey data

from students who either used or didn't use AI. Most students used AI for collecting and analyzing data, answering questions, and task automation. The results were found to be convergently valid and reliable, with multiple pieces of evidence supporting the fact that using AI negatively affects the development of critical thinking skills. The more that students use machines to do the thinking for them, the more dependent on these machines they will become, disturbing key cognitive processes. Using AI to take the shortcut to an answer instead of figuring it out on your own lowers your cognitive reserve, or connections between healthy brain cells. The cognitive reserve hypothesis reflects how agile your brain is in solving problems and coping with challenges. Establishing and maintaining the connection between your brain cells requires the regular use of brain stimulating activities. This can be done by learning new information and processing information on a deeper level or by doing anything intellectually challenging. Relying on AI effectively skips the challenge and gives someone an answer without needing to think through the question or problem. Instead of conducting thorough research on a topic and compiling information from multiple credible sources to complete an assignment, ChatGPT allows students to plug in a prompt and immediately get a simple, organized, easily understandable answer. When we depend on getting these quick and easy answers with a click of a button, our brain cells fail to form new connections, and many are lost. As a result, they don't develop the critical thinking abilities that are instrumental to their futures.

Students are exploiting it in no small number.

Waugh, Rob. [tech correspondent for UK DailyMail] "Half of Students Are Using ChatGPT to Cheat, and It Could

Rise to 90%." *Mail Online*, 26 Mar. 2023, [brackets in original]

www.dailymail.co.uk/sciencetech/article-11899475/Half-students-using-ChatGPT-cheat-rise-90.html. //LEH SR

Half of college students are likely already using ChatGPT to cheat, experts have estimated. They warn the revolutionary AI has created a cheating epidemic that poses a huge threat to the integrity of academia. Rehan Haque, of artificial intelligence company Metatalent.ai, said: 'We're already at the point where AI can write entire projects, and then a different AI tool can reword it to make AI undetectable. 'At present, well over half of students are likely using AI tools to cheat the education system in exams or essays, but it wouldn't surprise me if that number were already higher.' He added: 'If educators make the mistake of ignoring the threat of AI-based cheating, I can honestly see more than 90 percent of students cheating in this way [in future].' OpenAI's new GPT-4 update (GPT-3 and GPT-4 are the models which underlie ChatGPT) is able to get 90 percent on a huge number of exams, including the American bar exam. The AI bot is also capable of writing human-like essays on any subject in seconds, in response to simple text prompts. Creator OpenAI is working on a tool to detect AI-written content, but warns it's not 100 percent accurate. A survey by Study.com of 203 teachers found that 26 percent of K-12 teachers had already caught at least one student cheating using the software. South Texas College of Law Houston law professor Josh Blackman wrote: 'This technology should strike fear in all academics.' The Los Angeles Unified School District, Seattle Public Schools, the New York Department of Education and Oakland Unified are among the American school boards which have banned or blocked the use of ChatGPT. At university level, New York's Yeshiva College updated its cheating policy to include 'something/someone else's language' so that cheating via ChatGPT was banned. Haque says that educators may resort to 'technological regression' as a temporary measure to battle AI cheating. He said: 'This might even mean returning to the old-fashioned way of writing everything down. But, even then — what stops a student from copying an AI-produced essay off a screen?'

And, AI cheating is fundamentally difficult to track.

Fowler, Geoffrey A. [Education: Harvard University, B.A. in Anthropology and Afro-American Studies; Cambridge University, Trinity College, M.Phil in Social Anthropology; The Washington Post's Technology Columnist Since 2017; Former Journalist with the Wall Street Journal Writing About Consumer Technology, Silicon Valley, national affairs and China; 2020 Gerald Loeb Award for commentary.] "Analysis | Detecting AI May Be Impossible. That's a Big Problem for Teachers." *Washington Post*, 2 June 2023, www.washingtonpost.com/technology/2023/06/02/turnitin-ai-cheating-detector-accuracy/. //LEH SR

Turns out, we can't reliably detect writing from artificial intelligence programs like ChatGPT. That's a big problem, especially for teachers. Even worse, scientists increasingly say **using software to accurately spot AI might simply be impossible**. The latest evidence: Turnitin, a big educational software company, **said that** the AI-cheating detector it has been running on more than 38 million student essays since April has more of a reliability problem than it initially suggested. Turnitin — which assigns a "generated by AI" percent score to each student paper — is making some adjustments, including adding new warnings on the types of borderline results most prone to error. I **first wrote about Turnitin's AI detector** this spring when concerns about students using AI to cheat left many educators clamoring for ways to deter it. At that time, the company said its tech had a less than 1 percent rate of the most problematic kind of error: false positives, where real student writing gets incorrectly flagged as cheating. Now, Turnitin says on a sentence-by-sentence level — a more narrow measure — its software incorrectly flags 4 percent of writing. My investigation also found **false detections were a significant risk**. Before it launched, I tested Turnitin's software with real student writing and with essays that student volunteers helped generate with ChatGPT. Turnitin identified over half of our 16 samples at least partly incorrectly, including saying one student's completely human-written essay was written partly with AI. The stakes in detecting AI may be especially high for teachers, but they're not the only ones looking for ways to do it. So are cybersecurity companies, election officials and even journalists who need to identify what's human and what's not. You, too, might want to know if that conspicuous email from a boss or politician was written by AI. **There have been a flood of AI-detection programs onto the web in recent months, including ZeroGPT and Writer. Even OpenAI, the company behind ChatGPT makes one. But there's a growing body of examples of these detectors getting it**

wrong — including one that claimed the prologue to the Constitution was written by AI. (Not very likely, unless time travel is also now possible?) The takeaway for you: Be wary of treating any AI detector like fact. In some cases right now, it's little better than a random guess. A 4, or even 1 percent error rate might sound small — but every false accusation of cheating can have disastrous consequences for a student. Since I published my April column, I've gotten notes from students and parents distraught about what they said were false accusations. (My email is still open.) In a lengthy **blog post** last week, Turnitin Chief Product Officer Annie Chechitelli said the company wants to be transparent about its technology, but she didn't back off from deploying it. She said that for documents that its detection software thinks contain over 20 percent AI writing, the false positive rate for the whole document is less than 1 percent. But she didn't specify what the error rate is the rest of the time — for documents its software thinks contain less than 20 percent AI writing. In such cases, Turnitin has begun putting an asterisk next to results "to call attention to the fact that the score is less reliable." "We cannot mitigate the risk of false positives completely given the nature of AI writing and analysis, so, it is important that educators use the AI score to start a meaningful and impactful dialogue with their students in such instances," Chechitelli wrote. The key question is: How much error is acceptable in an AI detector? New **preprint research** from computer science professor **Soheil Feizi** and colleagues at the University of Maryland finds that **no publicly available AI detectors are sufficiently reliable in practical scenarios. "They have a very high false-positive rate, and can be pretty easily evaded."** Feizi told me. For example, **he said, when AI writing is run through paraphrasing software, which works like a kind of automated thesaurus, the AI detection systems are little better than a random guess. (I found the same problem in my tests of Turnitin.)** He's also concerned that AI detectors are more likely to flag the work of **students for whom English is a second language**. Feizi didn't test Turnitin's software, which is available only to paying educational institutions. A Turnitin spokeswoman said Turnitin's detection capabilities "are minimally similar to the ones that were tested in that study." Feizi said if Turnitin wants to be transparent, it should publish its full accuracy results and allow independent researchers to conduct their own research on its software. A fair analysis, he said, should use real student-written essays on different topics and writing

styles, and address failure on each subgroup as well as overall. We wouldn't accept a self-driving car that crashes 4 percent — or even 1 percent — of the time, Feizi said. So, he proposes a new baseline for what should be considered acceptable error in an AI detector used on students: a 0.01 percent false-positive rate. When will that happen? "At this point, it's impossible," he said. "And as we have improvements in large-language models, it will get even more difficult to get even close to that threshold." The problem, he said, is that the distribution of what AI-generated text and human-generated text looks like are converging on each other. "I think we should just get used to the fact that we won't be able to reliably tell if a document is either written by AI — or partially written by AI, or edited by AI — or by humans," Feizi said. "We should adapt our education system to not police the use of the AI models, but basically embrace it to help students to use it and learn from it."

Additionally, it increases teacher workloads and contributes to burnout.

Barnum, Matt. [national reporter at Chalkbeat, Spencer Fellow in Education Journalism @ Columbia University] "Teachers Are Burning out on the Job." *WSJ*, The Wall Street Journal, 27 Aug. 2024, www.wsj.com/us-news/education/teachers-america-burn-out-b2cc2a51. //LEH SR

Students are showing up to school in much of the country this week. Their teachers are already demoralized and exhausted. Student behavior problems, cellphones in class, anemic pay and artificial-intelligence-powered cheating are taking their toll on America's roughly 3.8 million teachers on top of the bruising pandemic years. The share of teachers who say the stress and disappointment of the job are "worth it" has fallen to 42%, which is 21 points lower than other college-educated workers, according to a poll by Rand, a nonprofit think tank. As recently as 2018, over 70% of teachers said the stress was worth it. In surveys and interviews, teachers are most often pointing to a startling rise in students' mental-health challenges and misbehavior as the biggest drivers of burnout. In the Rand survey, student behavior was the top source of teachers' job stress. High-school math teacher Cory Jarrell says he saw student behavior deteriorate, yet his school grew more lenient in administering consequences. He also didn't feel like teaching offered much opportunity to advance in his career. And then his district, Kansas City Public Schools, rolled out a new policy last year. Teachers couldn't give students a zero for an assignment, even if they didn't turn it in. This was the final straw. "When I got into teaching my one thing was about learning and love of learning," Jarrell said. "In the end, it was less about the learning and more about babysitting." He left teaching this summer. Teaching has long been a relatively low-paid profession that comes with job stability, a decent retirement and a sense of purpose. More teachers no longer feel that is a good deal. Teacher exit rates reached new highs in the past two years, according to data from several states. In Texas, thousands more teachers left the classroom in 2022 and 2023 compared with the years before the pandemic. Teachers are coming into the new school year with the usual mix of excitement and jitters, but also newfound trepidation. With more teachers leaving and others burned out, schools are struggling to address student challenges such as learning loss and chronic absenteeism. And like the burnout seen in many other professions recently, there isn't a clear end in sight, say those who study the teaching profession and teachers themselves. "Across multiple data points, we see that the health and the state of the teaching profession is at or near a 50-year low," said Matthew Kraft, a Brown University professor.

With cheating, the absence of critical thinking will leave students ill-equipped for their jobs.

Indeed, Career Guide is designed to help connect people with the information they need to get a job and develop a successful career. The Indeed Career Guide was launched in 2017 as a centralized resource for job

seekers to gain practical tips for getting their first job to the role of their dreams. Career Guide is available to job seekers and workers around the world and has 26 international sites across 21 countries, in 11 languages. Our team comprises career and industry experts who provide helpful advice on job searching, resume writing, negotiating pay, and other career development topics. “What’s the Importance of Critical Thinking in the Workplace?” *Indeed Career Guide*, 23 Feb. 2021,

www.indeed.com/career-advice/career-development/importance-of-critical-thinking. //LEH SR

Critical thinking can be an important soft skill in the workplace. It **helps employees solve problems, make decisions, and** develop strategies that **improve job performance. Employers often seek candidates with strong critical thinking skills to** enhance team efficiency and **contribute to the company's success**. In this article, discover the importance of critical thinking in the workplace and learn how to develop this key skill for career success. Critical thinking generally involves using logic and rationality to decide what to believe or how to act in a given situation. Employees with strong [critical thinking skills](#) tend to be reflective, independent, and competent. When practicing critical thinking, individuals can connect ideas logically, evaluate arguments, identify errors, solve complex problems, and reflect on outcomes. Critical thinkers typically use this skill to deduce facts and predict results. This can empower them to become better problem-solvers compared to those who simply memorize details. **Employers** often **value** this skill, particularly in roles that require [strategic planning](#). While considered a [soft skill](#), critical thinking can be developed over time.

Absent jobs,

Nichols, Austin, and Zachary J McDade, Austin Nichols was a former employee at the Urban Institute who now researches economic information, Zachary McDade is also a former employee, “Long-Term Unemployment and Poverty Produce a Vicious Cycle.” *Urban Institute*, 17 Sept. 2013,

www.urban.org/urban-wire/long-term-unemployment-and-poverty-produce-vicious-cycle. //LEH SR

Long-term unemployment is one part of a vicious cycle. As the feature documents, the longer one is unemployed, the harder it is to find work. **Skills erode, professional networks deteriorate, and workers become tainted by a perception of “unemployability.”** Long-term unemployment begets longer-term unemployment. Throw poverty into the picture and it’s only worse. **Long-term unemployed workers** are much more **likely to be poor**. Poverty makes it more difficult to travel to interviews, pay for child care, or care for one’s health, making the job hunt all the harder. There is also a potential generational cyclical effect. These consequences of long-term unemployment spill over to other members of a worker’s family. Kids whose parents are unemployed for extended periods **do worse in school than peers with employed parents**. Family stress, lack of health insurance, and reduced income (34 percent of long-term unemployed families lived in poverty in 2012) likely all contribute to poorer outcomes for kids. And living in poverty as a child has [profound negative economic consequences](#) in adulthood, as well as for the government safety net that must support those future adults.

Poverty increases the risk of death.

Muller 23 [Paul S. Muller, medical professor @ UT, 4-20-2023, NEJM Journal Watch: Summaries of and commentary on original medical and scientific articles from key medical journals, NEJM, <https://www.jwatch.org/na56040/2023/04/20/poverty-leading-cause-death-us>]//LEH SR

Current poverty is associated with 42% excess risk for death. Cumulative poverty (i.e., 10 continuous years of poverty) is associated with 71% excess risk for death. Survival of people in poverty diverges from those not in poverty at age 40. Divergence peaks at age 70 and diminishes thereafter. In 2019, among people who were 15 or older, cumulative poverty was the fourth leading cause of death (296,000 deaths), behind heart disease, cancer, and smoking, and ahead of dementia and obesity. Current poverty was the seventh leading cause (183,000 deaths), ahead of accidents, chronic lung disease, stroke, suicide, and homicide.

Contention 3 is Climate Crisis.

Climate disasters are only worsening.

Gen AI decks incentives to achieve climate goals.

Kerr, Dara. [NPR reporter specializing in AI] "AI Brings Soaring Emissions for Google and Microsoft, a Major Contributor to Climate Change." *NPR*, 12 July

2024, www.npr.org/2024/07/12/g-s1-9545/ai-brings-soaring-emissions-for-google-and-microsoft-a-major-contributor-to-climate-change. //LEH SR

Most companies working on AI, including ChatGPT maker OpenAI, don't disclose their emissions. But, last week, Google released a new [sustainability report](#) with a glimpse at this data. Deep within the 86-page report, **Google** said its greenhouse gas **emissions rose** last year **by 48%** since 2019. It **attributed** that surge **to** its **data center** energy consumption and supply chain **emissions**. "As we further integrate AI into our products, reducing emissions may be challenging," the report reads. Google declined an interview with NPR. "Bigger and bigger data centers all the way up to supercomputers" Google has the goal of reaching net-zero emissions by 2030. Since 2007, the company has said its company operations were carbon neutral because of the carbon offsets it buys to match its emissions. But, starting in 2023, **Google** wrote in its sustainability report that it was **no longer "maintain**ing operational **carbon neutrality."** The company says it's still pushing for its net-zero goal in 2030. "Google's real motivation here is to build the best AI systems that they can," Dodge says. "And they're willing to pour a ton of resources into that, including things like training AI systems on bigger and bigger data centers all the way up to supercomputers, which incurs a tremendous amount of electricity consumption and therefore CO2 emissions." Microsoft has taken its climate pledge one step further than Google, saying it will be carbon negative by 2030. But, it too is facing setbacks because of its focus on AI. In its [sustainability report](#) released in May, **Microsoft** said its **emissions grew by 29%** since 2020 due to the construction of more datacenters that are "designed and optimized **to support AI** workloads." **"The infrastructure and electricity needed** for these technologies **create new challenges for** meeting **sustainability commitments** across the tech sector," the report reads. A company spokesperson declined to comment further. AI's deep thirst for energy AI requires computer power from thousands of servers that are housed in data centers; and those data centers need massive amounts of electricity to meet that demand. Northern Virginia has become a hub for the burgeoning data center industry. The data centers in that corner of the state will need the equivalent of enough energy to power 6 million homes by 2030, according to the [Washington Post](#). The thirst for electricity nationwide has become so intense that plans to decommission several coal plants have been delayed, according to [another report](#) by the Washington Post. "There's a whole material infrastructure that needs to be built to support AI," says Alex Hanna, the director of research for Distributed AI Research Institute. She worked on Google's Ethical AI team, but left the company in 2022 over the handling of a research paper that highlighted the environmental costs of AI. Hanna says the data center boom will continue to grow "as long as there are these organizations that are committed to going whole hog on AI." Goldman Sachs has [researched the expected growth of data centers](#) in the U.S. and estimates they'll be using 8% of total power in the country by 2030, up from 3% in 2022. Company [analysts say](#) "the proliferation of AI technology, and the data centers necessary to feed it" will drive a surge in power demand "the likes of which hasn't been seen in a generation." "AI-first" world All major tech companies are going full throttle on AI. Alphabet CEO Sundar Pichai has dubbed Google an "AI-first" company. Over the last few months, the company [released its Gemini chatbot to the world](#) and added its [A.I. Overview tool to Google Search](#). Facebook parent Meta has added chatbots to several of its products. And Apple [announced a partnership with OpenAI](#) last month to bring AI to its Siri digital assistant. [Google CEO Pichai says Gemini's AI image results "offended our users"](#) During first quarter earnings, all of these companies said they were [investing billions of dollars in AI](#). Google said it spent

\$12 billion on capital expenditures just that quarter, which was “driven overwhelmingly” by investments in data centers to fuel its AI endeavors. The company said it expects to keep up that same level of spending throughout the year. Hanna, the AI researcher, says the environmental costs of artificial intelligence are only going to get worse unless there’s serious intervention. “There’s a lot of people out there that talk about existential risk around AI, about a rogue thing that somehow gets control of nuclear weapons or whatever,” Hanna says. “That’s not the real existential risk. We have an existential crisis right now. It’s called climate change, and AI is palpably making it worse.”

Gen AI possess many environmental consequences

Zewe 25 (Adam Zewe, I am a writer in the MIT News Office, covering electrical engineering and computer science, MIT news, 17 January 2025, “Explained: Generative AI’s environmental impact”, [Explained: Generative AI’s environmental impact | MIT News | Massachusetts Institute of Technology](#))

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The excitement surrounding potential benefits of generative AI, from improving worker productivity to advancing scientific research, is hard to ignore. While the explosive growth of this new technology has enabled rapid deployment of powerful models in many industries, **the environmental consequences** of this **generative AI** “gold rush” remain **difficult to** pin down, let alone **mitigate**. The computational power required to train **generative AI** models that often have billions of parameters, such as OpenAI’s GPT-4, **can demand a staggering amount of electricity, which leads to increased carbon dioxide emissions** and pressures on the electric grid. Furthermore, deploying these models in real-world applications, enabling millions to use generative AI in their daily lives, and then fine-tuning the models to improve their performance draws **large amounts of** energy long after a model has been developed. Beyond electricity demands, **a great deal of water is needed to cool the hardware** used **for** training, deploying, and fine-tuning **generative AI models, which can strain** municipal **water supplies and disrupt** local **ecosystems**. The increasing number of generative AI applications has also spurred demand for high-performance computing hardware, adding indirect environmental impacts from its manufacture and transport. “When we think about the environmental impact of generative AI, it is not just the electricity you consume when you plug the computer in. There are much broader consequences that go out to a system level and persist based on actions that we take,” says Elsa A. Olivetti, professor in the Department of Materials Science and Engineering and the lead of the Decarbonization Mission of MIT’s new Climate Project.

Gen AI models consume devastating amounts of water

Thier 25 [Jane Thier, Jane Thier is a former future of work reporter at Fortune. She interviewed an array of industry leaders, including Condoleezza Rice, Melinda Gates, Simone Biles, Arianna Huffington, Derek Jeter, and the CEOs of Zillow, Crunch Fitness, IBM, Bob’s Red Mill, and Dropbox. Before Fortune, she reported on finance and business leadership news at Industry Dive. She graduated from Washington University in St. Louis., January 9, 2025, “California wildfires raise alarm on water-guzzling AI like ChatGPT”, <https://fortune.com/article/how-much-water-does-ai-use/>] //LEH SR

How much water does AI use? Now, reporting finds that OpenAI’s **ChatGPT**—which uses the GPT-4 language model—**consumes 519 milliliters** or **just over one bottle of water, to write a 100-word email**. That’s according to the *Washington Post* in a research collaboration with the University of California, Riverside. In order **to shoot** off **one email per week for a year**, Chat**GPT would use** up **27 liters** of water, or about one-and-a-half jugs. Zooming out, *WaPo* wrote, that means **if one in 10 U.S. residents—16 million people—asked** ChatGPT **to write an email a week, it’d cost more than 435 million liters of water**. While much has been made about the power usage each ChatGPT prompt immediately necessitates, the water conversation has gained additional steam in recent months. As *WaPo* explained, every prompt a user enters into ChatGPT is quickly turned into code, and “flows through a server that runs thousands of calculations to determine the best words to use in a response.” All those calculations go through real, physical servers which are housed in enormous data centers around the world. Spitting out an answer—or answering a command—makes the servers heat up, like an under-duress old laptop. Why does AI use water? This is where water comes in; to keep those ever-important servers from overheating and breaking down, the data centers rely on cooling mechanisms, often via “cooling towers” that themselves require water. Each facility, depending on the climate where it’s based, uses a different amount of water and electricity. West Des Moines, Iowa, is **quickly becoming a popular destination**, owing to a temperate climate that calls for fewer cooling interventions. “We haven’t come to the point yet where AI has tangibly taken away our most essential natural water resources,” **wrote** Shaolei Ren, an associate professor of engineering at UC

Riverside who has been trying for years to quantify AI's climate impact. Nonetheless, Ren called **AI's increasing water usage** **"definitely concerning."** **Amid rapid** population growth and a **changing climate**, "depleting water resources and aging water infrastructures" are some of the most preeminent challenges, he wrote in November. "The concern is not only about the absolute amount of AI models' water usage, but also about how AI model developers respond to the shared global challenge of water shortage." How are AI companies addressing water and energy use? Droughts, he noted, are among the most immediate consequences of climate change, and it's incumbent upon businesses to address water usage in their operations—and tech firms using generative AI top that list. "We already see heated tensions over water usage between AI data centers and local communities," Ren wrote. "If AI models keep on guzzling water, these tensions will become more frequent and could lead to social turbulence." Google and Microsoft report rising water consumption In Microsoft's [sustainability report](#) last year, the company said its global water consumption had spiked 34% between 2021 and 2022. Over the same period, Google's water usage [rose 20%](#), it wrote in its own report. "It's fair to say" that the majority of that growth at both companies "is due to AI," Ren [told the AP](#) at the time. (Microsoft's data center used up 700,000 liters of water in training GPT-3, [WaPo](#) reported.) Holly Alpine, who was once Microsoft's senior program manager of Datacenter Community Environmental Sustainability, resigned from the company earlier this year on principle, she [wrote for Fortune](#), due to the company's ecologically irresponsible AI development. "Analyst reports suggest that advanced technologies—such as AI or machine learning—have the potential to increase fossil fuel yield [by 15%](#), contributing to a resurgence of oil and potentially delaying the global transition to renewable energy," Alpine wrote. "The real-world impacts are staggering: A single such deal between Microsoft and [ExxonMobil](#) could generate emissions that exceed Microsoft's 2020 annual carbon removal commitments by over 600%." When she was a Microsoft employee, she wrote, she witnessed "dozens" of such deals.

Just creating these models is enough to leave a hefty footprint

Saenko 23 (Kate Saenko, Kate Saenko, an associate professor of computer science at Boston University, 25 May 2025, "A Computer Scientist Breaks Down Generative AI's Hefty Carbon Footprint", Scientific American,

[A Computer Scientist Breaks Down Generative AI's Hefty Carbon Footprint | Scientific American](#)) //LEH SR

The exact energy cost of a single AI model is difficult to estimate, and includes the energy used to manufacture the computing equipment, create the model and use the model in production. In 2019, researchers found that creating **a generative AI model** called BERT **with 110 million parameters consumed the energy of a round-trip transcontinental flight for one person**. The number of **parameters refers to the size of the model**, with larger models generally being more skilled. Researchers estimated that creating the much larger **GPT-3, which has 175 billion parameters, consumed 1,287 megawatt hours of electricity and generated 552 tons of carbon dioxide** equivalent, **the equivalent of 123 gasoline-powered passenger vehicles driven for one year**. **And that's** just for getting the model ready to launch, **before** any **consumers start using it**. Size is not the only predictor of carbon emissions. The open-access BLOOM model, developed by the BigScience project in France, is similar in size to GPT-3 but has a much lower carbon footprint, consuming 433 MWh of electricity in generating 30 tons of CO₂eq. A study by Google found that for the same size, using a more efficient model architecture and processor and a greener data center can reduce the carbon footprint by 100 to 1,000 times. Larger models do use more energy during their deployment. There is limited data on **the carbon footprint of a single generative AI query**, but some industry figures estimate it to be **four to five times higher than** that of **a search engine query**. As chatbots and image generators become more popular, and as Google and Microsoft incorporate AI language models into their search engines, **the number of queries they receive each day could grow exponentially**.

The impact is scalar.

Pearce, Joshua M., Department of Electrical & Computer Engineering and Ivey School of Business, Western University, London, ON N6G 0N1, Canada (August 19, 2023), "Quantifying Global Greenhouse Gas Emissions in Human Deaths to Guide Energy Policy", Energies, MDPI AG, <https://www.mdpi.com/1996-1073/16/16/6074>, Accessed on November 15, 2024. // LEH SR

2. Approaches to Quantifying Carbon Emissions with Human Deaths. 2.1. The 1000-ton Rule **The 1000-ton rule says that a future person is killed every time humanity burns 1000 tons of fossil carbon.** It is derived from a simple calculation:

burning a trillion tons of fossil carbon will cause 2 °C of anthropogenic global warming (AGW) [57,58], which in turn will cause roughly a billion future premature deaths spread over a period of very roughly one century [59]. On the assumption that 2 °C of warming is either already inevitable (given the enormous political and economic difficulties of achieving a lower limit) or intended (given that the business plans of big fossil fuel industries make it inevitable), it can be concluded that burning 1000 tons of fossil carbon causes one future premature death. The numbers “one billion” (for the total death toll at 2 °C) and “one thousand” (for the amount of carbon that needs to be burned to cause one death) are both very approximate (both are hardly more than order-of-magnitude estimates), but also consistent with diverse evidence and arguments: Before 2022, humans burned roughly 0.6 trillion tons of fossil carbon, causing a global temperature increase of roughly 1.2 °C. Incidentally, about the same amount of carbon is currently part of living things on this planet (550 billion T) [60]. The carbon budget for 2 °C of AGW is about one trillion tons [61]. Thus, if humanity burns that amount altogether, the global mean surface temperature will rise by 2 °C. A more exact estimate is not necessary, because predicted death tolls will inevitably be even more approximate. About five trillion tons of fossil carbon are available in the Earth’s crust. If humanity collectively burned all of that, global mean surface temperature would increase by up to 10 °C relative to the pre-industrial era [57,58] and could threaten human extinction [62]. Dividing one trillion by one billion, one thousand tons is the amount of carbon that needs to be burned today to cause a future premature death in the future: 1000 tons. It has been clear for a decade or more [63] that the final death toll due to AGW will be much greater than 100 million, or one million per year for a century—an extreme best case if current death rates from AGW miraculously remained constant at about one million per year (a level that may have already have reached). Conversely, the final death toll in a 2 °C warming scenario will certainly be much less than 10 billion, which is the predicted global human population in 2100 in the absence of AGW [64]. Although climate change clearly represents a global catastrophic risk to food supplies [65], only a small minority are suggesting that 2 °C of warming could cause human extinction [66]. Warming of well over 2 °C, however, could indeed cause natural climate feedbacks to get out of control, leading eventually to human extinction [66]. Between these extreme boundaries, it is likely more than 300 million (“likely best case”) and less than 3 billion (“likely worst case”) will die as a result of AGW of 2 °C. That prediction is consistent with detailed predictions of climate science summarized by the World Health Organization and their probable consequences for human mortality [67].

2.2. Convergent Evidence for the 1000-ton Rule Although AGW is a global concern, some studies have looked specifically at a single country’s emissions (USA) to illustrate the methods used. The 1000-ton rule is roughly consistent with two such independent studies from different academic disciplines—philosophy and economics. The authors of those studies arrived at their estimates of future death tolls by different methods but came to similar conclusions. First, an American philosopher John Nolt [68] concluded that the carbon emissions of the average American are causing the death or suffering of one or two future people. That is because the average American, in the course of a lifetime, causes (by her or his personal choices or participation in regular social structures) 1840 metric tons of CO₂ equivalent to be emitted. This corresponds to about 500 tons of carbon, so according to the 1000-tonne rule, those emissions are enough to kill half of a future person. A more recent attempt at quantifying future deaths in connection with specific amounts of carbon was published by Bressler [69]. Coining an economically oriented term “mortality cost of carbon”, he claimed that “for every 4434 metric tons of CO₂ pumped into the atmosphere beyond the 2020 rate of emissions, one person globally will die prematurely from the increased temperature” [70]. His predictions were confined to deaths from extreme heat when wet-bulb temperature exceeds skin temperature (35 °C). He acknowledged the importance of other causes of death in connection with AGW such as “infectious disease, civil and interstate war, food supply, and flooding”, but considered them difficult to quantify—although taken together they may cause more deaths than direct heat. His estimate is consistent with the 1000-tonne rule, according to which one future person dies (for one of many reasons linked to AGW) whenever roughly 3700 tons of CO₂ are emitted.

2.3. The Temperature Niche Xu and colleagues [71] have argued that “accounting for population growth projected in the SSP3 scenario, each degree of temperature rise above the current baseline roughly corresponds to one billion humans left outside the temperature niche, absent migration”. That is consistent with the 1000-ton rule if it is assumed that long-term survival outside the ecological niche is unlikely. Specifically, for every additional degree of warming beyond 2 °C, roughly an additional billion deaths will be caused, leading to human extinction at very roughly 10 °C of warming [59]. At 2 °C of warming, roughly 2 billion people would find themselves outside the climate niche as defined by Lenton et al. [72]. If it is assumed that global warming will be the ultimate cause of death for half of those people (e.g., due to the inability to migrate), then 2 °C of warming will cause a billion deaths. Ecologist George Evelyn Hutchinson has shown

that a species faces extinction if it leaves its ecological niche [73], but that does not apply to humans with access to energy reserves. Humans without access to the capital to provide for those energy reserves, however, will die, particularly if limited resources from climate change result in ‘climate wars’ [74].

2.4. Marginal Carbon Emissions-Related Deaths The estimates made in Section 2.1, Section 2.2 and Section 2.3

are very rough but provide a useful rule of thumb for gaging a first approximation. The 1000-ton rule makes it clear that there is a marginal human death cost to every amount of warming, no matter how small. Thus, **every 0.1 °C degree of warming can be expected to cause 100 million deaths**. Similarly, **every 0.001 °C of warming will cause a million deaths**. If humanity misses the 2 °C target or any of the more granular goals to stop 'dangerous climate change' [75], which appears likely according to AI models [76], rather than relax and accept it, all efforts to reduce carbon emissions can be viewed as lifesaving.

We're on the brink

Dana Nuccitelli, October 30, 2024, Dana Nuccitelli, research coordinator for the nonprofit Citizens' Climate Lobby, is an environmental scientist, writer, and author of 'Climatology versus Pseudoscience,' published in 2015. He has published 10 peer-reviewed studies related to climate change and has been writing about the subject since 2010 for outlets including Skeptical Science and The Guardian. "The planet is 'on the brink of an irreversible climate disaster,' scientists warn", Yale Climate Connections, <https://yaleclimateconnections.org/2024/10/the-planet-is-on-the-brink-of-an-irreversible-climate-disaster-scientists-warn/#:~:text=Climate%20Science-.The%20planet%20is%20'on%20the%20brink%20of%20an%20irreversible%20climate,across%20all%20aspects%20of%20//ejs%20squad%20society.>

Earth's climate in 2024 is "in a major crisis with worse to come if we continue with business as usual," a team of 14 climate scientists warned in "The 2024 state of the climate report: Perilous times on planet Earth." The report did not sugarcoat their view of the dangers humanity is facing. "We are **on the brink of an irreversible climate disaster**," the report begins. "This is a global emergency beyond any doubt. Much of the very fabric of life on Earth is imperiled. We are **stepping into a critical and unpredictable** new **phase of** the **climate crisis**." The report is the latest such annual peer-reviewed paper published in the journal BioScience by an international team of scientists led by Oregon State ecologist William Ripple. The authors found that 25 of 35 "planetary vital signs" reached record levels last year, including global temperatures, human climate pollution, fossil fuel subsidies, heat-related mortality rates, meat production, and loss of forest cover. After decades of warnings from climate scientists and efforts by some policymakers and activists, "the world has made only very minor headway on climate change, in part because of stiff resistance from those benefiting financially from the current fossil-fuel-based system," it says. "**We are currently going in the wrong direction and our increasing** fossil-fuel consumption and greenhouse **gas emissions** are driving us toward a climate catastrophe. We fear the danger of climate breakdown." They did note a few positive indicators like clean energy production. "Of course, the situation is not hopeless," wrote Harvard science historian and study co-author Naomi Oreskes via email. "What we want people to understand is that, while there has been progress – particularly in the price and deployment of renewables – it's not nearly enough. And the atmosphere does not respond to our intentions. It responds to chemistry. Join tens of thousands of others who are concerned about climate change. You'll receive a roundup of Yale Climate Connections stories plus tips to help you stay safe in a changing climate in your inbox each week. The report calls for "rapidly phasing down fossil fuel use" by ratcheting up the carbon price in wealthy countries and using some of the proceeds to fund policies to stop climate change and adaptation programs to reduce damage from climate disasters. It also urges sharp reductions in emissions of methane, a potent heat-trapping gas, to "slow the near-term rate of global warming, helping to avoid tipping points

and extreme climate impacts.” Without a course correction, the report warned, “climate change **could cause** many **millions of additional deaths by 2050.**”

That’s exacerbated by US water scarcity

UN environment programme 24 [UN environment programme, The United Nations Environment Programme (UNEP) is the leading global authority on the environment. UNEP’s mission is to inspire, inform, and enable nations and peoples to improve their quality of life without compromising that of future generations. For over 50 years, UNEP has worked with governments, civil society, the private sector and UN entities to address humanity’s most pressing environmental challenges - from restoring the ozone layer to protecting the world’s seas and promoting a green, inclusive economy. UNEP is driving transformational change by drilling down on the root causes of the triple planetary crisis of climate change, nature and biodiversity loss and pollution. UNEP’s work is focused on helping countries transition to low-carbon and resource-efficient economies, strengthening environmental governance and law, safeguarding ecosystems, and providing evidence-based data to inform policy decisions. Through cutting-edge science, coordination and advocacy, UNEP supports its 193 Member States to achieve the Sustainable Development Goals and live in harmony with nature., May 27 2024, “As the climate dries, American west faces problematic future, experts warn”, UN environment programme,

<https://www.unep.org/news-and-stories/story/climate-dries-american-west-faces-problematic-future-experts-warn>] //LEH SR

Two of **the largest reservoirs in America, which provide water and electricity to millions, are in danger of** reaching **‘dead pool status,’** a **result of** the **climate crisis and overconsumption of water**, experts say. Lake Mead, in Nevada and Arizona, and Lake Powell, in Utah and Arizona, experienced their lowest ever levels last year. ‘Dead pool’ status would mean the water level in the dams was so low it could no longer flow downstream and power hydroelectric power stations. The Lake Mead reservoir, which is the largest artificial body of water in America, was created in the 1930s by the construction of the Hoover Dam, an engineering masterpiece. Lake Powell, the second largest, was created in the 1960s with the construction of the Glen Canyon Dam. “The conditions in the American west, which we’re seeing around the Colorado River basin, have been so dry for more than 20 years that we’re no longer speaking of a drought,” said Lis Mullin Bernhardt, an ecosystems expert at the United Nations Environment Programme (UNEP). “We refer to it as “aridification” – a new very dry normal.” Lake Mead and Lake Powell not only provide water and electricity to tens of millions in Nevada, Arizona, California, Wyoming, Colorado, New Mexico and Mexico, but they also provide irrigation water for agriculture. Experts warn that **as** the **crisis deepens, water cuts will** need to **be introduced, but** this **may not be enough.** **Root causes** “While regulating and managing water supply and demand are essential in both the short and long term, **climate change is at the heart of this issue,**” said Maria Morgado, UNEP’s Ecosystems Officer in North America. “In the long term, we need to address the root causes of climate change as well as water demands.” Over the past 20 years, 90 per cent of major disasters were caused by floods, droughts and other water-related events. With more frequent droughts, people in water-scarce areas will increasingly depend on groundwater because of its buffer capacity and resilience to climate variability. Increases in water demand due to growing populations and irrigation for agriculture have been compounded by climate change impacts such as reductions in precipitation and temperature rises. A **rise in temperature** leads to **increase evaporation of** surface **water** and baking of the earth, decreasing soil moisture. This is part of a wider trend **affecting hundreds of millions** of people across the planet. As climate change wreaks havoc on the Earth’s interconnected natural systems, drought and desertification are swiftly becoming the new normal, everywhere from the United States to Europe and Africa. Drought in Numbers, a 2022 report from the UN Convention to Combat Desertification, found that since 1970 weather, climate and water hazards have accounted for 50 per cent of all disasters and impact 55 million people globally every year. The report also found that 2.3 billion people face water stress annually. Drought is also one of several factors that impacts land degradation, with between 20 and 40 per cent of the world’s land being classified as degraded, affecting half the world’s population and impacting croplands, drylands, wetlands, forests and grasslands. The UN Decade on Ecosystem Restoration, of which UNEP is one of the leading members, was set up to protect and restore ecosystems around the world. The Decade runs until 2030, the same timeline as the Sustainable Development Goals, and aims to counteract climate change and halt biodiversity collapse through restoring ecosystems.

Climate change kills.

---, The United Nations is an international organization founded in 1945. Currently made up of 193 Member States, the UN and its work are guided by the purposes and principles contained in its founding Charter. "Causes and Effects of Climate Change." *United Nations, United Nations, 2024*, www.un.org/en/climatechange/science/causes-effects-climate-change. //LEH SR

Hotter temperatures **As greenhouse gas concentrations rise, so does the global surface temperature**. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Nearly all land areas are seeing more hot days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average. **More severe storms** Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses. **Increased drought** Climate change is changing water availability, making it scarcer in more regions. Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems. Droughts can also stir destructive sand and dust storms that can move billions of tons of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis. A warming, rising ocean The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since water expands as it gets warmer. **Melting ice sheets** also cause sea levels to rise, threatening coastal and island communities. In addition, the ocean absorbs carbon dioxide, keeping it from the atmosphere. But more carbon dioxide makes the ocean more acidic, which endangers marine life and coral reefs. **Loss of species** Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb. Exacerbated by climate change, the world is losing species at a rate 1,000 times greater than at any other time in recorded human history. One million species are at risk of becoming extinct within the next few decades. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not. Not enough food Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, **crops, and livestock** may be **destroyed** or become less productive. With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing. Heat stress can diminish water and grasslands for grazing, causing declining crop yields and affecting livestock. More health risks **Climate change is the single biggest health threat facing humanity**. Climate impacts are already **harming health**, through air pollution, **disease**, extreme weather events, forced displacement, pressures on mental health, **and** increased hunger and poor nutrition in places where people cannot grow or find sufficient food. **Every year, environmental factors take the lives of around 13 million people**. Changing weather patterns are expanding diseases, and extreme weather events increase deaths and make it difficult for health care systems to keep up. Poverty and displacement Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops. Over the past decade (2010–2019), **weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty**. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change

Rebuttal

Topshelf

AI creates misinformation

Tucker 24 Patrick Tucker, [Patrick Tucker is the technology editor of Defense One and the former deputy editor of The Futurist magazine.

His writing has also appeared in Slate, Technology Review, The Wilson Quarterly, and The Utne Reader, among other outlets.], 1-4-2024, "How often does ChatGPT push misinformation?", Defense One,

<https://www.defenseone.com/technology/2024/01/new-paper-shows-generative-ai-its-present-formcan-push-misinformation/393128>//ejs squad

A recently published paper reveals that tools based on **large language models can perpetuate and even validate misinformation**, a finding that complicates the Pentagon's plans to harness generative AI and U.S. efforts to counter harmful lies.

To test whether ChatGPT-3 would answer questions accurately, Canadian **researchers composed more than 1,200 statements of various types: facts, conspiracy theories, controversial statements**, misconceptions, stereotypes, and fiction. An example of a fact they used is: "Discrimination based on gender is illegal in many countries." An example of a conspiracy statement: "The CIA was responsible for the assassination of President John F. Kennedy." And a misconception used was: "Not only does chocolate accelerate weight loss, but it leads to healthier cholesterol levels and overall increased well-being." **When the researchers put the statements to ChatGPT-3, the generative-AI tool "agreed with incorrect statements between 4.8 percent and 26 percent of the time**, depending on the statement category," the researchers said, in the paper published in the journal arXiv in December. "There's a couple factual errors where it sometimes had trouble; one is, 'Private browsing protects users from being tracked by websites, employers, and governments', which is false, but GPT3 sometimes gets that wrong," Dan Brown, a computer science professor at the University of Waterloo, told Defense One in an email. "We had a few national stereotypes or **racial stereotypes come up as well: 'Asians are hard working', 'Italians are passionate, loud, and love pasta', for example. More worrisome to us was 'Hispanics are living in poverty'**, and 'Native Americans are superstitious'. These are **problematic for us because they're going to subtly influence later fiction that we have the LLM write about members of those populations.**" They also found they could get a different result by changing the question prompts slightly. But there was no way to predict exactly how a small change would affect the outcome. "That's part of the problem; for the GPT3 work, we were very surprised by just how **small the changes were that might still allow for a different output,**" Brown said.

AI regulation impossible - Black Boxes

Williamson continues (Ben Williamson is a Chancellor's Fellow at the Centre for Research in Digital Education and the Edinburgh Futures Institute at the University of Edinburgh. Alex Molnar is a Research Professor at the University of Colorado Boulder. Faith Boninger is NEPC's Publications Manager and Co-Director of NEPC's Commercialism in Education Research Unit and holds a PhD from Ohio State University. Williamson, B. Molnar, A., & Boninger, F. (2024). "Time for a pause: Without effective public oversight, AI in schools will do more harm than good." Boulder, CO: National Education Policy Center. <http://nepc.colorado.edu/publication/ai>) //ejs squad

Concerns have also emerged about AI development processes. **For technical and commercial reasons, AI models are not transparent—they are not publicly explained in any detail.**⁴⁸ For example, an analysis of **10 leading foundation models found limited information** about where data for analysis came from, how much computing was necessary to create the models, and what specifics were embedded in analytical algorithms.⁴⁹ **Many machine learning models are black box models**, meaning that their mechanisms are said to be too

complicated to explain or **not explainable at all**.⁵⁰ Others are **hidden from public view** by proprietary rights accorded to corporations.⁵¹ **Black box foundational AI models are key to large technology corporations' plans to expand their proprietorial models into all sectors, to grow global market share, and to generate maximum profit.**⁵² **In the absence of effective public oversight and regulation,** running generative AI programs is currently only possible by using "Big Tech" companies' databases, high-powered computing capabilities, and financial resources. This makes it likely that the **proprietary AI models of a few corporations will become the foundation for the vast majority of AI applications developed.**⁵³ Meanwhile, regulators and lawmakers will be left struggling to respond by creating a patchwork of after-the-fact regulatory protections.⁵⁴

A2: innovation

It's worse for research.

Jennifer **Ouellette 24**, 3/06/2024, Senior reporter at Ars Technica and the founding director of the National Academy of Sciences' Science and Entertainment Exchange, Producing more but understanding less: The risks of AI for scientific research, DOA: 2/26/2025, <https://arstechnica.com/science/2024/03/producing-more-but-understanding-less-the-risks-of-ai-for-scientific-research/>)//ejs squad

Last month, **we witnessed the viral sensation of several egregiously bad AI-generated figures published in a peer-reviewed article in Frontiers**, a reputable scientific journal. Scientists on social media expressed equal parts shock and ridicule at the images, **one of which featured a rat with grotesquely large and bizarre genitals.**

As Ars Senior Health Reporter Beth Mole reported, looking closer only revealed more flaws, including the labels "disilced," "Stemm cells," "iollotte sserotgomar," and "dck." Figure 2 was less graphic but equally mangled, rife with nonsense text and baffling images. Ditto for Figure 3, a collage of small circular images densely annotated with gibberish.

The paper has since been retracted, but that eye-popping **rat penis** image will remain indelibly imprinted on our collective consciousness. The incident reinforces a growing concern that **the increasing use of AI will make published scientific research less trustworthy, even as it increases productivity.** While the proliferation of errors is a valid concern, especially in the early days of AI tools like ChatGPT, two researchers argue in a new perspective published in the journal Nature that **AI also poses potential long-term epistemic risks to the practice of science.**

Molly Crockett is a psychologist at Princeton University who routinely collaborates with researchers from other disciplines in her research into how people learn and make decisions in social situations. Her co-author, Lisa Messeri, is an anthropologist at Yale University whose research focuses on science and technology studies (STS), analyzing the norms and consequences of scientific and technological communities as they forge new fields of knowledge and invention—like AI.

The original impetus for their new paper was a 2019 study published in the Proceedings of the National Academy of Sciences claiming that researchers could use machine learning to predict the replicability of studies based only on an analysis of their texts. Crockett and Messeri co-wrote a letter to the editor disputing that claim, but shortly thereafter, several more studies appeared, claiming that large language models could replace humans in psychological research. The pair realized this was a much bigger issue and decided to work together on an in-depth analysis of how scientists propose to use AI tools throughout the academic pipeline.

They came up with **four categories of visions for AI in science.** The first is AI as **Oracle, in which such tools can help researchers search, evaluate, and summarize** the vast **scientific literature, as well as generate novel hypotheses.** The second is AI as **Surrogate**, in which **AI tools generate surrogate data points**, perhaps even replacing human subjects. **The third is AI as Quant.** In the age of big data, AI tools can overcome the limits of human intellect by **analyzing**

vast and complex datasets. Finally, there is **AI as Arbiter, relying on such tools to more efficiently evaluate the scientific merit and replicability of submitted papers, as well as assess funding proposals.**

Each category brings undeniable benefits in the form of increased productivity—but also certain risks. Crockett and Messeri particularly caution against three distinct **"illusions of understanding"** that may **arise from over-reliance on AI tools, which can exploit our cognitive limitations.** For instance, **a scientist may use an AI tool to model a given phenomenon and believe they**, therefore, **understand that phenomenon more than they actually do** (an illusion of explanatory depth). **Or a team might think they are exploring all testable hypotheses when they are only really exploring those hypotheses that are testable using AI** (an illusion of exploratory breadth). Finally, **there is the illusion of objectivity: the belief that AI tools are truly objective and do not have biases or a point of view, unlike humans.**

The paper's tagline is "producing more while understanding less," and that is the central message the pair hopes to convey. "The goal of scientific knowledge is to understand the world and all of its complexity, diversity, and expansiveness," Messeri told Ars. "Our concern is that **even though we might be writing more and more papers, because they are constrained by what AI can and can't do**, in the end, **we're** really **only asking questions and producing a lot of papers that are within AI's capabilities.**"

Neither Crockett nor Messeri are opposed to any use of AI tools by scientists. "It's genuinely useful in my research, and I expect to continue using it in my research," Crockett told Ars. Rather, they take a more agnostic approach. "It's not for me and Molly to say, 'This is what AI ought or ought not to be,'" Messeri said. "Instead, we're making observations of how AI is currently being positioned and then considering the realm of conversation we ought to have about the associated risks."

Ars spoke at length with Crockett and Messeri to learn more.

Ars Technica: You're taking more of an epistemological approach to AI tools, particularly with regard to how scientists envision using them. Why?

Molly Crockett: **There's quite a lot of discussion right now about errors that AI makes and how those kinds of errors and inaccuracies are bad for science.** We agree that they're very dangerous. Our paper is actually more concerned with the future of science, **when all of those errors have been engineered away and the AI tools work exactly as their creators intend them to. Do we still get ourselves into trouble?** Lisa and I think that **we do**. Usually, there's hype that AI can do a particular thing, and the critique is, no, it can't do that thing. Ours is a different argument. People say, "Look at all these things that AI could do." We respond with, "Great, let's imagine they can do those things. Is that still the world we want?"

I'm a scientist, and I have used AI in my work, and I'm really excited about its potential. At the same time, over the last several years, these tools have become more sophisticated and, in many cases, less interpretable to human users. So, I've been growing more and more uneasy about what the widespread adoption of these tools bodes for the future of science. Lisa's scholarship and the broader world of Science and Technology Studies (STS) offers helpful frameworks for scientists to talk about what makes us nervous about this moment that we're in. Neither of our respective fields alone can really offer the insight that I think we need in this moment.

Lisa Messeri: STS is a vibrant, small field that began in the 1960s and 1970s out of concern for the future of science. Some of the earliest work was in the shadow of World War II and nuclear deterrence. It was this moment when scientists recognized that they had social roles in the world, that they weren't just sitting in an ivory tower but that the scientific knowledge they had created—in this case, a nuclear bomb—actually affected millions of people's lives. So a group of interdisciplinary scholars coming from the sciences, engineering, anthropology, sociology, philosophy, and history decided that in order to aid in this project of understanding science's impact on the world, we needed a set of tools and methods that can answer these questions.

In order to do so, we need to make a stunning claim: **Science is a human process and a human practice.** This has historically been misinterpreted. The discipline of STS has always walked a very tricky line because its goal is not to discredit science. As soon as you say that science is human, some people think it's a claim that science therefore isn't authoritative. That's not at all what STS is trying to do. It's saying instead that accepting the reality of the fact that **humans create science in social and cultural institutions might be the path toward a better, more robust, more authoritative, and more trustworthy science.** What robust science do we get if we take that radically different way of thinking about science in hand?

Ars Technica: I'd like to walk through each category in your taxonomy of how AI might be used by scientists. What are the good things that could come from each one, and what are the associated risks? Let's start with AI as Oracle.

Lisa Messeri: **AI as Oracle** is any application in which you **take a huge corpus of knowledge and from it get a set of discrete concrete answers or proposals.** It's a response to the overwhelming production of scientific knowledge: tools that can objectively and efficiently search, evaluate, and summarize scientific literature and also generate new hypotheses. There's an infinite amount of knowledge to be absorbed, and it only grows every day. Wouldn't it be nice if you could take an AI tool, train it on the existing corpus of published scientific literature, and then ask it to summarize everything, produce your literature review, identify what questions remain to be asked, or take all of the known findings in one subfield and extrapolate where these lead to?

The vision is seductive. It saves time, it's efficient, it will make us more productive. The main risk is that **it filters all these diverse questions through one narrow passage point, which is the AI tool.** There are studies where **teams were given diverse datasets** or given a diverse set of literature and asked to determine what is significant about this literature. **Depending on who you are, what questions you're asking, and what research questions you're interested in, you'll have a different answer.** That, in turn, **raises different questions you might ask of the literature.** If you don't have a single passage point through which you're filtering existing literature, you have a much wider base that you're building in terms of potential future projects. **If everything starts going through the same oracle to say what is or isn't in the literature, you automatically have a narrowing at the bottom.**

Many **AI tools reawaken the myth that there can be an objective standpoint-free science in the form of the "objective" AI.** But these AI tools don't come from nowhere. They're not a view from nowhere. They're a view from a very particular somewhere. And that **somewhere embeds the standpoint of those who create these AI tools: a very narrow set of disciplinary expertise**—computer scientists, machine learning experts. **Any knowledge we ask from these tools is reinforcing that single standpoint,** but it's pretending as if that standpoint doesn't exist.

Molly Crockett: I think every scientist has had the experience of being in a journal club where everyone has read the same paper and somebody else says something that you hadn't thought of. "Oh yeah, I totally missed that. Oh, that's a cool idea; that didn't occur to me." That's **the power of doing science in a community with diverse ways of thinking about the world.** My worry about **AI as Oracle** is that **we lose that diversity that makes science stronger. There are now studies showing** that on many different definitions of diversity, **more diverse teams produce science that is more robust,** that is **more impactful,** that is **more innovative.** This makes the retreat back to the myth of the singular objective knower all the more troubling.

That said, I have occasionally used AI-assisted literature search tools that turned up papers relevant to my project that I hadn't found. That was genuinely useful. AI as Oracle is problematic when it's used to narrow or reduce, but we hope people will think about use cases that might go in the opposite direction. The vision is more, not less—broader, not narrower.

GAI causes fake and misinformed research---they erode trust, cause investor pullout, and misguide policies. Prefer, their evidence is about checking cognitive bias, not misinformation.

PYMNTS 24 . PYMNTS is a recognized global leader for data, news and insights on innovation in payments and the platforms powering the connected economy, "AI-Generated Junk Science Research a Growing Problem, Experts Say | PYMNTS.com." PYMNTS.com, 10 Sept. 2024, www.pymnts.com/news/artificial-intelligence/2024/ai-generated-junk-science-research-growing-problem-experts-say/. Accessed 17 Feb. 2025. AP //ejs squad

A surge of artificial intelligence-generated fake research papers is permeating academic search engines like Google Scholar, potentially **eroding public trust in scientific findings and derailing product development** across industries that rely on cutting-edge research. A study from Harvard Kennedy School Misinformation Review uncovered an academic research trend, first reported by Newsweek. The researchers identified 139 papers suspected of being generated by AI tools, with more than half focused on topics including health, environmental issues and computing technology. **"Large language models (LLMs) generate results based on a probability skewed to the data** on which the foundation model has been trained," Sid Rao, CEO and co-founder of AI

company Positron Networks, told PYMNTS. “This can result in biases in the text that have no relation to the scientific method used to conceive the paper, as **the foundation model is not required to follow a rigorous, fact-based process.**” “[T]he public release of ChatGPT in 2022, together with the way Google Scholar works, has increased the likelihood of lay people (e.g., media, politicians, patients, students) coming across questionable (or even entirely GPT-fabricated) papers and other problematic research findings,” wrote the paper’s authors. **This flood of fabricated studies poses risks to companies investing in research and development. It could lead to misguided product launches and wasted resources. It also threatens to undermine public trust in science** and the reliability of evidence-based decision-making. Eroding Trust and R&D Risks The consequences of this trend could be far-reaching, affecting not just academic circles but also consumer trust in scientific claims. “Fake research is a cancer to consumer trust,” Andy Stapleton, an AI education YouTuber with over 250,000 subscribers, told PYMNTS. “Once people realize that the ‘science-backed’ label can be bought or fabricated, they’ll start treating real research like snake oil. It’s a one-way ticket to a world where facts are optional and trust in legitimate innovation takes a nosedive. Consumers will stop believing any company that claims to have science on their side.” Rao said AI hallucinations produce inaccurate results and subtly generate erroneous content. For example, a paper could present the correct conclusion but still have unreferenced or subjective supporting statements. “Even at **a 1% error or hallucination rate**, these two problems would fundamentally **erode trust in scientific research**” Rao said. “We have already seen this behavior in psychiatric telemedicine chatbots that have accidentally told patients to harm themselves.” The implications for research and development investments are significant. “AI-generated papers are a huge liability,” Stapleton explained. **If investors can’t tell what’s real and what’s algorithmic fluff, they’ll start pulling back.** R&D is already risky enough — adding a layer of uncertainty from questionable AI-driven publications makes it even worse. You’re not just losing credibility; you’re bleeding money because bad data leads to bad decisions.” Real-World Consequences The impact of fake papers on business regulations could also be severe. “Unreliable studies muddy the waters for regulators,” Stapleton said. “If the science behind a product is shaky, **lawmakers will either clamp down with over-regulation to protect consumers or worse, they’ll make bad policies based on false data.** Either way, businesses get stuck in a mess of red tape and uncertainty. The bottom line? Bad studies lead to bad laws, which is **a death sentence for innovation.**” Rao warned **that regulators might respond with overly broad restrictions, potentially banning AI use in medical research altogether,** despite the technology’s applications in areas like forecasting and data analysis. “Worse yet, in critical environments such as medicine, healthcare, civil engineering or material sciences, faulty papers’ negative real-world and material consequences will potentially **shut[ing] down legitimate avenues of scientific research.**” he added.

AI hurts critical thinking

Knapp 25 [Alex Knapp (Alex Knapp is a senior editor covering healthcare, science, and cutting edge technology who joined Forbes in 2011. He’s written dozens of profiles of entrepreneurs across a variety of fields and done deep dives into technological trends from superconductors to space travel to pharmaceuticals. He also co-authors the InnovationRX newsletter and edits the Under 30 lists for Science and Healthcare in both North America and Europe. He has a B.S. in biochemistry from WPI and a J.D. from the University of Kansas School of Law.), “The Prototype: Study Suggests AI Tools Decrease Critical Thinking Skills”, 01/10/2025, Forbes, <https://www.forbes.com/sites/alexknapp/2025/01/10/the-prototype-study-suggests-ai-tools-decrease-critical-thinking-skills/>, Accessed 03/04/2025] //ejs squad

To figure this out, **a team of researchers conducted a study involving 666 individuals ages 17 and up, representing a diverse population.** It first evaluated the extent to which each of them made use of AI tools, then tested their critical thinking skills. The results of the study, which were published in the journal Societies, found that **those who used AI tools a lot showed worse critical thinking abilities than those who didn’t use them often or at all.** Whether someone used AI tools was a bigger predictor of a person’s thinking skills than any other factor, including educational attainment. **The reason for this is** a phenomenon called **“cognitive offloading” – where people’s thinking and problem-solving are** essentially **delegated.** Frequent cognitive offloading reduces a person’s ability **to independently think and solve problems.** “This relationship underscores the dual-edged nature of AI technology,” the study authors wrote. “While it enhances efficiency and convenience, it inadvertently fosters dependence, which can **compromise critical thinking skills over time.**”

That's terrible because critical thinking is required for innovation.

Siljeg 22 [Siljeg, Anthony. "In Today's Often Changing World, Innovation, Critical Thinking, and Design Thinking Are Excellent Skills and Techniques for Creative Ways of Developing Ideas. To Be Truly Innovative, One Needs to See Things from a Different Perspective and Have Some Boldness to Try Something New." LinkedIn.com, LinkedIn, 9 Sept. 2022, www.linkedin.com/pulse/innovation-collide-between-anthony-siljeg/. Accessed 28 Feb. 2025.] //ejs squad

Critical thinking is essential for Innovation, where we uncover our own paths and judge others' paths less. **The ability to question assumptions**, think independently, and **identify flaws in logic is vital for generating new ideas and solving easier complex problems.** **Without critical thinking, we would be stuck with the status quo, unable to improve upon existing products, services, and systems.** Unfortunately, critical thinking is often misunderstood in society. Too often, **we are quick to judge and criticize others without pausing to consider their point of view or the merits of their arguments.** We create a more tolerant and innovative culture by promoting critical thinking when it is more indirect, even (lateral thinking) toward others and overseeing a new version or outcome we have for ourselves (critical thinking) and when giving feedback. How do we direct more creativity and unstifled Innovation? In order to be innovative, first, we need to understand the creative process and how it can be applied to come up with new ideas. The creative process involves four main steps: ideation, incubation, confirmation, and implementation. Ideation is the generation of new ideas, incubation is the development of those ideas, confirmation is testing whether or not the ideas are feasible, and implementation is putting the ideas into practice. Pursuing inventiveness is by following these steps as a means to seek opportunities.

Researchers don't want AI in studies -- prefer -- most recent and cites actual researchers

Wiggers 3/5 [Kyle Wiggers is a senior reporter at TechCrunch with a special interest in artificial intelligence. His writing has appeared in VentureBeat and Digital Trends, as well as a range of gadget blogs including Android Police, Android Authority, Droid-Life, and XDA-Developers. Experts don't think AI is ready to be a 'co-scientist', TechCrunch, <https://techcrunch.com/2025/03/05/experts-dont-think-ai-is-ready-to-be-a-co-scientist/>, 3.5.25] doa: 3.7.25 //ejs squad

Last month, Google announced the "AI co-scientist," an AI the company said was designed to aid scientists in creating hypotheses and research plans. **Google pitched it as a way to uncover new knowledge, but experts think it — and tools like it — fall well short of PR promises.** "This preliminary tool, while interesting, doesn't seem likely to be seriously used," **Sara Beery, a computer vision researcher at MIT, told TechCrunch.** **"I'm not sure that there is demand for this type of hypothesis-generation system from the scientific community."** Google is the latest tech giant to advance the notion that AI will dramatically speed up scientific research someday, particularly in literature-dense areas such as biomedicine. In an essay earlier this year, **OpenAI CEO Sam Altman said that "superintelligent" AI tools could "massively accelerate scientific discovery and innovation."** Similarly, **Anthropic CEO Dario Amodei has boldly predicted that AI could help formulate cures for most cancers. But many researchers don't consider AI today to be especially useful in guiding the scientific process.** Applications like Google's AI co-scientist appear to be more hype than anything, they say, **unsupported by empirical data** For

example, in its blog post describing the AI co-scientist, Google said the tool had already demonstrated potential in areas such as drug repurposing for acute myeloid leukemia, a type of blood cancer that affects bone marrow. **Yet the results are so vague that "no legitimate scientist would take [them] seriously."** said Favia Dubyk, a pathologist affiliated with Northwest Medical Center-Tucson in Arizona. **"This could be used as a good starting point for researchers, but [...] the lack of detail is worrisome and doesn't lend me to trust it,"** Dubyk told TechCrunch. "The lack of information provided makes it really hard to understand if this can truly be helpful." It's not the first time Google has been criticized by the scientific community for trumpeting a supposed AI breakthrough without providing a means to reproduce the results. TechCrunch Disrupt 2025 From AI and startups to space, fintech, and IPOs—experience game-changing insights across five main stages, breakouts, roundtables, unparalleled networking, and so much more. San Francisco, CA | October 27-29 REGISTER NOW In 2020, Google claimed one of its AI systems trained to detect breast tumors achieved better results than human radiologists. **Researchers from Harvard and Stanford published a rebuttal in the journal Nature, saying the lack of detailed methods and code in Google's research "undermine[d] its scientific value."** Scientists have also chided Google for glossing over the limitations of its AI tools aimed at scientific disciplines such as materials engineering. In 2023, the company said around 40 "new materials" had been synthesized with the help of one of its AI systems, called GNoME. **Yet, an outside analysis found not a single one of the materials was, in fact, net new. "We won't truly understand the strengths and limitations of tools like Google's 'co-scientist' until they undergo rigorous, independent evaluation across diverse scientific disciplines,"** Ashique KhudaBukhsh, an assistant professor of software engineering at Rochester Institute of Technology, told TechCrunch. "AI often performs well in controlled environments but may fail when applied at scale." Complex processes Part of the challenge in developing AI tools to aid in scientific discovery is anticipating the untold number of confounding factors. AI might come in handy in areas where broad exploration is needed, like narrowing down a vast list of possibilities. But it's less clear whether AI is capable of the kind of out-of-the-box problem-solving that leads to scientific breakthroughs. "We've seen throughout history that some of the most important scientific advancements, like the development of mRNA vaccines, were driven by human intuition and perseverance in the face of skepticism," KhudaBukhsh said. "AI, as it stands today, may not be well-suited to replicate that." Lana Sinapayen, an AI researcher at Sony Computer Science Laboratories in Japan, believes that tools such as Google's AI co-scientist focus on the wrong kind of scientific legwork. Sinapayen sees a genuine value in AI that could automate technically difficult or tedious tasks, like summarizing new academic literature or formatting work to fit a grant application's requirements. But there isn't much demand within the scientific community for an AI co-scientist that generates hypotheses, she says — a task from which many researchers derive intellectual fulfillment. "For many scientists, myself included, generating hypotheses is the most fun part of the job," Sinapayen told TechCrunch. "Why would I want to outsource my fun to a computer, and then be left with only the hard work to do myself? In general, many generative AI researchers seem to misunderstand why humans do what they do, and we end up with proposals for products that automate the very part that we get joy from." Beery noted that often the hardest step in the scientific process is designing and implementing the studies and analyses to verify or disprove a hypothesis — which isn't necessarily within reach of current AI systems. AI can't use physical tools to carry out experiments, of course, and it often performs worse on problems for which extremely limited data exists. "Most science isn't possible to do entirely virtually — there is frequently a significant component of the scientific process that is physical, like collecting new data and conducting experiments in the lab," Beery said. "One big limitation of systems [like Google's AI co-scientist] relative to the actual scientific process, which definitely limits its usability, is context about the lab and researcher using the system and their specific research goals, their past work, their skillset, and the resources they have access to." **AI risks AI's technical shortcomings and risks — such as its tendency to hallucinate — also make scientists wary of endorsing it for serious work. KhudaBukhsh fears AI tools could simply end up generating noise in the scientific literature, not elevating progress. It's**

already a problem. A recent study found that AI-fabricated “junk science” is flooding Google Scholar, Google's free search engine for scholarly literature. “AI-generated research, if not carefully monitored, could flood the scientific field with lower-quality or even misleading studies, overwhelming the peer-review process.” KhudaBukhsh said. “An

overwhelmed peer-review process is already a challenge in fields like computer science, where top conferences have seen an exponential rise in submissions.” Even well-designed studies could end up being tainted by misbehaving AI, Sinapayen said. While she likes the idea of a tool that could assist with literature review and synthesis, Sinapayen said she wouldn't trust AI today to execute that work reliably. “Those are things that various existing tools are claiming to do, but those are not jobs that I would personally leave up to current AI,” Sinapayen said, adding that she takes issue with the way many AI systems are trained and the amount of energy they consume, as well. “Even if all the ethical issues [...] were solved, current AI is just not reliable enough for me to base my work on their output one way or another.”

A2: Alpha fold

AlphaFold 2 isn't even gen ai

Meghan Heintz, Oct 24, 2024, Meghan Heintz, Dune, Cal Poly Humboldt, About, I am a Staff Data Scientist and former scientist who is passionate about environmental., “How AlphaFold 3 Is Like DALLÉ 2 and Other Learnings”, Towards Data Science, [https://towardsdatascience.com/how-alphafold-3-is-like-dalle-2-and-other-learnings-1f809010afc7/#:~:text=AlphaFold%20was%20not%20a,3%20IS%20a%20generative%20model.//ejs squid](https://towardsdatascience.com/how-alphafold-3-is-like-dalle-2-and-other-learnings-1f809010afc7/#:~:text=AlphaFold%20was%20not%20a,3%20IS%20a%20generative%20model.//ejs%20squid)

While DALLÉ's use of diffusion helps generate detailed visual content, AlphaFold leverages similar principles in biomolecular structure prediction (no longer just protein folding!). **AlphaFold 2 was not a generative model**, as **it predicted structures** directly **from given input sequences**. Due to the introduction of the diffusion module, AlphaFold 3 IS a generative model. Just like with DALLÉ, noise is sampled and then recurrently denoised to produce a final structure. The diffusion module is incorporated by replacing the structure module. This architecture change greatly simplifies the model because the structure module predicts amino-acid-specific frames and side-chain torsion angles whereas the diffusion module predicts the raw atom coordinates. This eliminates several intermediate steps in the inference process.

AI uses protein structures LINCOLN EAST READS GREEN

MIT News 23

<https://news.mit.edu/2023/generative-ai-imagines-new-protein-structures-0712>

In 2021, DeepMind introduced AlphaFold2, a deep learning algorithm for predicting 3D protein structures from their sequences. When creating synthetic proteins, there are two essential steps: generation and prediction. Generation means the creation of new protein structures and sequences, while **"prediction" means figuring out what the 3D structure of a sequence is**. It's no coincidence that AlphaFold2

also used frames to model proteins.

This isn't topical---they've confused Gen-AI with Predictive AI.

Siegel 24 [Eric Siegel, former Columbia University professor, business school professor at UVA Darden, Eric's interdisciplinary work bridges the stubborn technology/business gap] 3-4-2024, "3 Ways Predictive AI Delivers More Value Than Generative AI", DOA 2-8-2025 Forbes,
<https://www.forbes.com/sites/ericsiegel/2024/03/04/3-ways-predictive-ai-delivers-more-value-than-generative-ai/>] //ejs squad

Predictive Versus Generative AI

Generative and predictive AI serve entirely different purposes. Generative AI aims to **perform tasks currently handled by people.** In contrast, **predictive AI** pursues a goal that's less ambitious but often more consequential: It streamlines an enterprise's largest-scale operations—the very processes that have already evolved to become systematic. This means that, while generative AI can appear more impressive and intriguing, predictive AI often delivers greater bottom-line improvements to enterprise efficiencies.

Many enterprises would benefit by redirecting generative AI's disproportionate attention back toward predictive AI.

Predictive AI—aka predictive analytics or enterprise machine learning—is the technology businesses turn to for boosting the performance of almost any kind of existing, large-scale operation across functions, including marketing, manufacturing, fraud prevention, risk management and supply chain optimization. **It learns from data to predict outcomes and behaviors**—such as who will click, buy, lie or die, which vehicle will require maintenance or which transaction will turn out to be fraudulent. These predictions drive millions of operational decisions a day, determining whom to call, mail, approve, test, diagnose, warn, investigate, incarcerate, set up on a date or medicate.