silicon counterpart also have the highest score, or close to it? Did the overall data sets produced by the models and the humans look similar, with similar means and distributions of scores? And were the virtual participants' scores on the two scales weakly correlated, as human scores are?

He found that the 252 choice combinations produced a wide range of different outcomes. Some settings led models to more closely match the rankings of human participants, for instance, whereas others more closely matched the correlation between the measures. But no single combination of settings worked well across the board. "There doesn't appear to be one true answer," Cummins says. If two different researchers ran the same study in silicon samples, making different defensible choices, they could reach opposite conclusions, he says.

The finding "emphasizes how many choices we have as researchers and how these choices can subtly influence the results that we get out," says Benjamin Paaßen, a computer scientist at Bielefeld University whose own work has cautioned against using LLMs to simulate human responses. Although even the most optimistic proponents of silicon sampling still recommend checking results against human participants, Paaßen says, some studies might soon rely exclusively on LLM results. But "maybe one cannot rely on LLM-generated data as much as one might think."

Cummins is particularly uneasy at the idea of using agents to simulate the responses of vulnerable or hard-to-reach populations, such as older people, minorities, or people living in countries far removed from dominant Western cultures. Sen agrees this could be harmful, partly because these groups are often underrepresented in LLM training data. "It could really risk disenfranchising people, further reducing trust in science," she says.

Lisa Argyle, a political scientist at Purdue University, agrees that not every LLM or prompt is "equally capable of valid simulation"—but if researchers carefully check that their precise model, prompts, and settings are appropriate for a given task, they can still be valuable, she says. The paper would have been more convincing if it had tackled a data set where LLMs have already been shown to accurately mimic human responses, adds Suhaib Abdurahman, a social psychologist at the University of Southern California, because that would demonstrate that researcher choices can lead to poor outcomes even in data sets where LLMs had previously excelled.

Scientists haven't yet discussed the ethical issues surrounding silicon sampling in enough depth, Sen says, or settled on the situations where it might be appropriate to use them, such as pilot experiments or as a way to test-run surveys. "This seems like a good time to have those discussions, before the technology is ready." □

CLIMATE CHANGE

Science teachers scramble as U.S. climate resources vanish

As government websites go dark, some nonprofits are trying to provide classroom materials **GAEA CABICO**

When news broke that climate.gov was about to go dark in June, Jeffrey Grant scrambled to download as many graphs and data tables from the website as he could. The high school biology teacher had relied heavily on the U.S. National Oceanic and Atmospheric Administration (NOAA) website to teach students about climate change, showing data on carbon dioxide levels and asking the students to analyze trends and make connections like real climatologists. "Science is always expanding," says Grant, who works at Downers Grove North High School in Illinois. "So, it is important that I always provide them with the latest research. Otherwise, they just have to take my word for it."

Grant is not alone. As the school year kicked into gear this fall, educators across the country have been reworking lesson plans and searching for reliable sources of up-to-date scientific information. The URL climate.gov, which was shuttered after President Donald Trump's administration terminated 10 science communication and data visualization experts who maintained it, now redirects web users to a NOAA web page on climate that contains a fraction of the original information. A NOAA spokesperson says the move was "an effort to centralize and consolidate resources."

> **"It's absolutely critical that teachers continue to have access."**
> **Rebecca Lindsey**
> Former climate.gov program manager

Since taking office in January, Trump has moved to restrict climate change research and education and retreat from U.S. commitments to reducing greenhouse gas emissions. Last month, he told world leaders at the United Nations that climate change was "the greatest con job ever perpetrated." As part of the campaign, officials have deleted climate data sets used by scientists and the public or made them more difficult to reach.

Many science teachers depended on those resources. The Next Generation Science Standards, which were created by a consortium of states and nonprofit organizations to provide guidance on what K-12 students should know, recommend introducing humanmade climate change in fifth grade and weaving it through all science classes. But that may become increasingly difficult if teachers can't readily find the information they need. "The more time it takes for them to find those things, the less apt they're going to use it. So that's discouraging," Grant says.

The cuts go beyond climate.gov to sites explicitly designed for educators, such as the Climate Literacy and Energy Awareness Network (CLEAN), a University of Colorado Boulder project funded by NOAA. The program, which is home to more than 800 lessons and videos covering topics such as droughts, wildfires, energy efficiency, and climate anxiety for high school– and college-level courses, went into hibernation on 31 August after it was defunded. "It's not just a priority for NOAA anymore and not something that they see worthwhile to spend money on," says Gina Fiorile-Desranleau, a former CLEAN program coordinator who was laid off.

The lessons and videos remain on CLEAN's website. But unless new funding materializes, there will be no staff support to update the lessons with new data.

Breck Foster, a teacher at Lake Oswego High School in Oregon who weaves climate change into her social studies classes, says she has used disappearing resources as an

opportunity to teach about politics and science. "I've shown my students in real time as materials have been taken off the internet, materials that we have used. I've called attention to that not in a political way, but just to say this is what happens when any administration will have political changes," she says.

Some nonprofit organizations have been scrambling to fill the void. Margaret Wang-Aghania, executive director and co-founder of SubjectToClimate, a nonprofit that curates and develops free teaching materials, says her organization is spending a lot of time reworking lesson plans and finding replacement data—a strain for her small, 15-person team.

"As an organization, you always want to be moving forward—building and reaching more teachers—not backtracking and fixing these things," Wang-Aghania says. Right now, SubjectToClimate's resources are instead being utilized "just to maintain what we already have." For instance, the organization was forced to find a new data source for a lesson on sea level rise in January after a data set on ice thickness in Antarctica vanished from a government website.

Former NOAA employees hope to mitigate the loss of climate.gov. "We intend to restore all that content ... outside the federal domain, where it is safe from further political interference," says Rebecca Lindsey, former program manager of climate.gov. "It's absolutely critical that teachers continue to have access to that type of resource," she says.

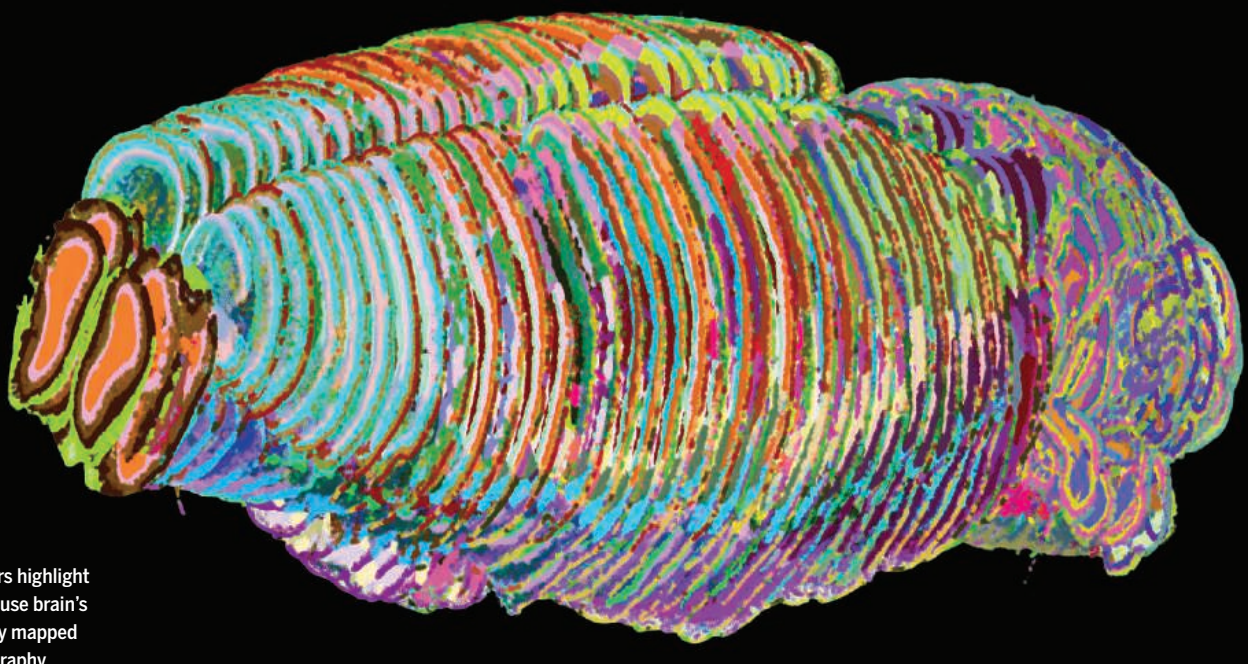
Lindsey's team is currently crowdfunding. If they can raise enough money, she says they will produce updates and new content and post the materials on climate.us, an independent, nongovernmental website. "To make smart, effective decisions about climate change, we need unbiased, uncensored information," she argues. □

Gaea Cabico is a journalist based in New York City.

IN FOCUS

AI maps the brain's neighborhoods

Unleash artificial intelligence (AI) on a catalog of all cell types in a mouse brain and voilà—you get one of the most granular brain visualizations to date: a vibrant patchwork highlighting 1300 brain regions and subregions, many previously uncharted. "It's like going from a map showing only continents and countries to one showing states and cities," says Bosiljka Tasic, director of molecular genetics at the Allen Institute for Brain Science. She and colleagues developed an AI tool called CellTransformer to make sense of vast data sets that record where millions of cells sit and which genes they express. Traditional methods for mapping the brain's cellular geography rely on hand-drawn, or annotated, atlases; CellTransformer's algorithms infer from so-called spatial transcriptomic data how cells are organized into functional neighborhoods. When researchers applied CellTransformer to the Allen Brain Cell Atlas, which documents nearly 4 million cells, it picked out known structures such as the hippocampus, but also hundreds of previously unannotated microregions, the team reported on 7 October in *Nature Communications*. Some appeared in areas that lack detailed maps, such as the midbrain reticular nucleus, suggesting the AI tool had found genuinely new patterns. —Richard Stone



Colors highlight a mouse brain's newly mapped geography.

IMAGE: UNIVERSITY OF CALIFORNIA SAN FRANCISCO