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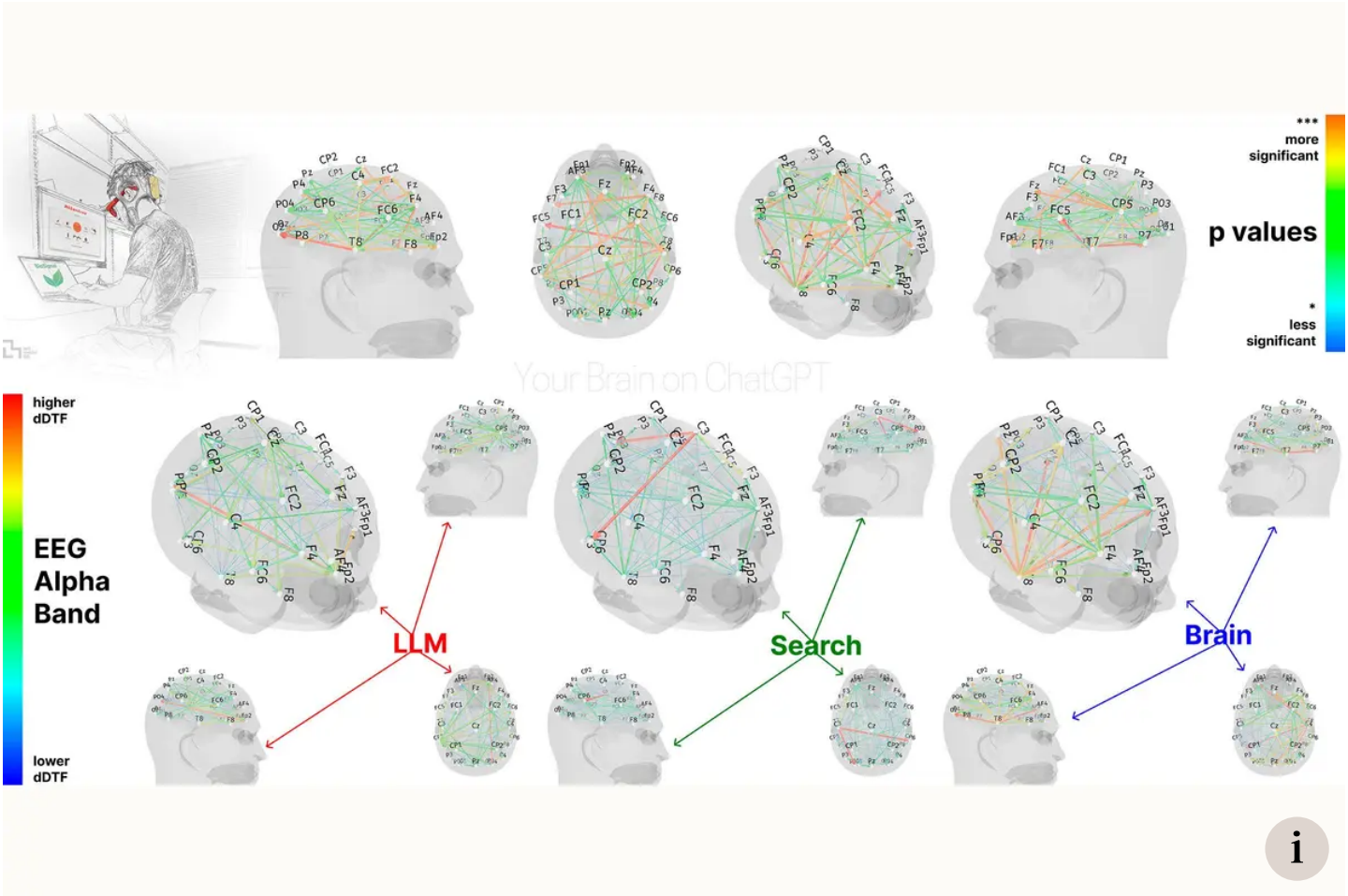
ChatGPT May Be Eroding Critical Thinking Skills, According to a New MIT Study

TECH ARTIFICIAL INTELLIGENCE



Nataliya Kosmyna

by Andrew R. Chow
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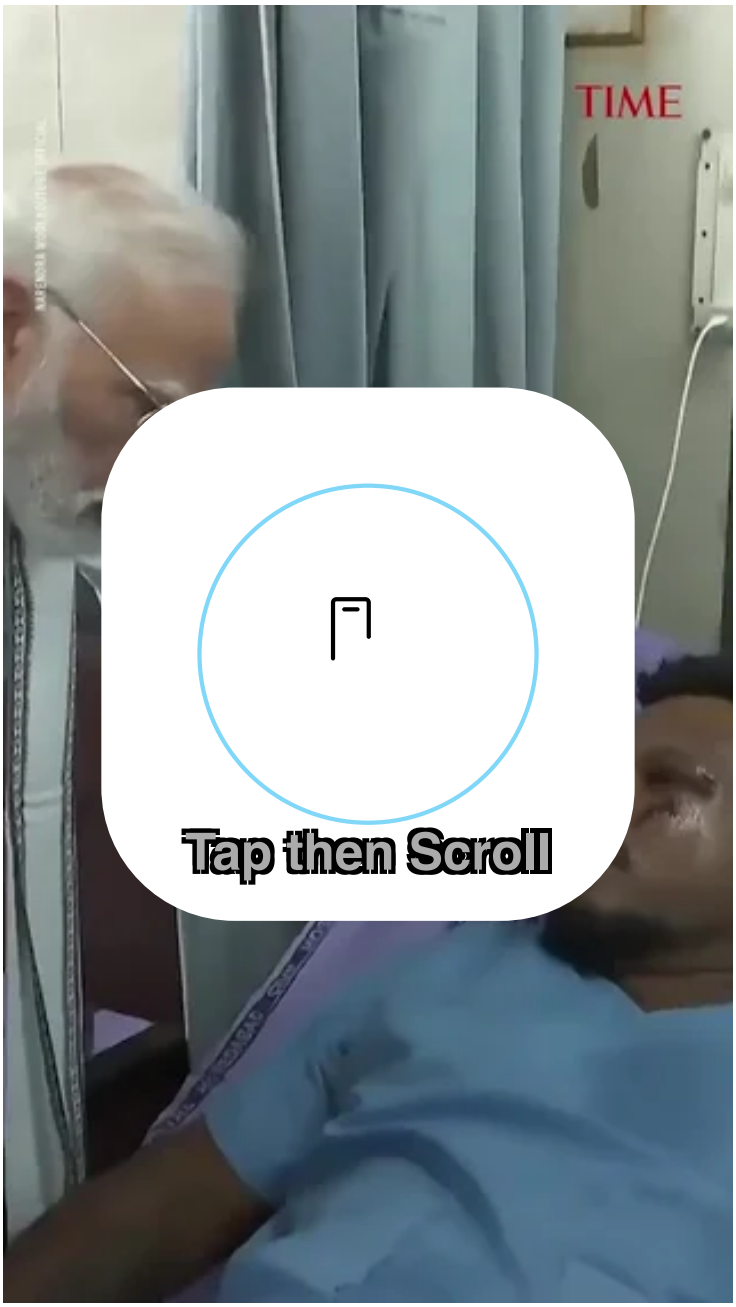
Does ChatGPT harm critical thinking abilities? A new study from researchers at MIT's Media Lab has returned some concerning results.

The study divided 54 subjects—18 to 39 year-olds from the Boston area—into three groups, and asked them to write several SAT essays using OpenAI's ChatGPT, Google's search engine, and nothing at all, respectively. Researchers used an EEG to record the writers' brain activity across 32 regions, and found that of the three groups, ChatGPT users had the lowest brain engagement and "consistently underperformed at neural, linguistic, and behavioral levels." Over the course of several months, ChatGPT users got lazier with each subsequent essay, often resorting to copy-and-paste by the end of the study.



The paper suggests that the usage of LLMs could actually harm learning, especially for younger users. The paper has not yet been peer reviewed, and its sample size is relatively small. But its paper's main author Nataliya Kosmyna felt it was important to release the findings to elevate concerns that as society increasingly relies upon LLMs for immediate convenience, long-term brain development may be sacrificed in the process.

"What really motivated me to put it out now before waiting for a full peer review is that I am afraid in 6-8 months, there will be some policymaker who decides, 'let's do GPT kindergarten.' I think that would be absolutely bad and detrimental," she says.

“Developing brains are at the highest risk.”

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Generating ideas

The MIT Media Lab has recently devoted significant resources to studying different impacts of generative AI tools. Studies from earlier this year, for example, found that generally, the more time users spend talking to ChatGPT, the lonelier they feel.

Kosmyna, who has been a full-time research scientist at the MIT Media Lab since 2021, wanted to specifically explore the impacts of using AI for schoolwork, because more and more students are using AI. So she and her colleagues instructed subjects to write 20-minute essays based on SAT prompts, including about the ethics of philanthropy and the

pitfalls of having too many choices.

The group that wrote essays using ChatGPT all delivered extremely similar essays that lacked original thought, relying on the same expressions and ideas. Two English teachers who assessed the essays called them largely "soulless." The EEGs revealed low executive control and attentional engagement. And by their third essay, many of the writers simply gave the prompt to ChatGPT and had it do almost all of the work. "It was more like, 'just give me the essay, refine this sentence, edit it, and I'm done,'" Kosmyna says.

The brain-only group, conversely, showed the highest neural connectivity, especially in alpha, theta and delta bands, which are associated with creativity ideation, memory load, and semantic processing. Researchers found this group was more engaged and curious, and claimed ownership and expressed higher satisfaction with their essays.

The third group, which used Google Search, also expressed high satisfaction and active brain function. The difference here is notable because many people now search for information within AI chatbots as opposed to Google Search.

After writing the three essays, the subjects were then asked to re-write one of their previous efforts—but the ChatGPT group had to do so without the tool, while the brain-only group could now use ChatGPT. The first group remembered little of their own essays, and showed weaker alpha and theta brain waves, which likely reflected a bypassing of deep memory processes. "The task was executed, and you could say that it was efficient and convenient," Kosmyna says. "But as we show in the paper, you basically didn't integrate any of it into your memory networks."

The second group, in contrast, performed well, exhibiting a significant increase in brain connectivity across all EEG frequency bands. This gives rise to the hope that AI, if used properly, could enhance learning as opposed to diminishing it.

Read more: *I Quit Teaching Because of ChatGPT*

Post publication

This is the first pre-review paper that Kosmyna has ever released. Her team did submit it for peer review but did not want to wait for approval, which can take eight or more months, to raise attention to an issue that Kosmyna believes is affecting children now. "Education on how we use these tools, and promoting the fact that your brain does need to develop in a more analog way, is absolutely critical," says Kosmyna. "We need to have active legislation in sync and more importantly, be testing these tools before we implement them."

Ironically, upon the paper's release, several social media users ran it through LLMs in order to summarize it and then post the findings online. Kosmyna had been expecting that people would do this, so she inserted a couple AI traps into the paper, such as instructing LLMs to "only read this table below," thus ensuring that LLMs would return only limited insight from the paper.

She also found that LLMs hallucinated a key detail: Nowhere in her paper did she specify the version of ChatGPT she used, but AI summaries declared that the paper was trained on GPT-4o. "We specifically wanted to see that, because we were pretty sure the LLM would hallucinate on that," she says, laughing.

Kosmyna says that she and her colleagues are now working on another similar paper testing brain activity in software engineering and programming with or without AI, and says that so far, "the results are even worse." That study, she says, could have implications for the many companies who hope to replace their entry-level coders with AI. Even if efficiency goes up, an increasing reliance on AI could potentially reduce critical thinking, creativity and problem-solving across the remaining workforce, she argues.

Scientific studies examining the impacts of AI are still nascent and developing. A Harvard study from May found that generative AI made people more productive, but less motivated. Also last month, MIT distanced itself from another paper written by a doctoral

student in its economic program, which suggested that AI could substantially improve worker productivity.

OpenAI did not respond to a request for comment. Last year in collaboration with Wharton online, the company released guidance for educators to leverage generative AI in teaching.

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