




Artificial Intelligence, the Production of Scientific Texts, and the Implications for Sleep Science: Exploring Emerging Paradigms and Perspectives

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Abstract

The emergence of artificial intelligence (AI) has revolutionized many fields, including natural language processing, and marks a potential paradigm shift in the way we evaluate knowledge. One significant innovation in this area is ChatGPT, a large language model based on the GPT-3.5 architecture created by OpenAI, with one of its main aims being to aid in general text writing, including scientific texts. Here, we highlight the challenges and opportunities related to using generative AI and discuss both the benefits of its use, such as saving time by streamlining the writing process and reducing the amount of time spent on mundane tasks, and the potential drawbacks, including concerns regarding the accuracy and reliability of the information generated and its ethical use. In respect of both education and the writing of scientific texts, clear rules and objectives and institutional principles must be established for the use of AI. We also consider the positive and negative effects of the use of AI technologies on interpersonal interactions and behavior, and, as sleep scientists, its potential impacts on sleep. Striking a balance between the benefits and potential drawbacks of integrating AI into society demands ongoing research by experts, the wide dissemination of the scientific results, as well as continued public discourse on the subject.

Keywords

- generative artificial intelligence
- ChatGPT
- education
- institutional guide

The emergence of artificial intelligence (AI) has revolutionized many fields, including natural language processing. Among these AI technologies, ChatGPT, a large language model trained by OpenAI based on the GPT-3.5 architecture, has garnered attention, especially in relation to its potential to assist in writing text in general. The GPT in the acronym stands for generative pre-trained transformer, which is a type of neural network-based model that generates natural

language text. Generative pre-trained transformer-3 was released in 2020 and became public in the same year, while ChatGPT was made available to the public in 2022 and is constantly updated to improve its capabilities. The last two versions of ChatGPT have significantly impacted generative writing by expanding the possibilities of using the tool as an aid in writing scientific papers. While AI can offer benefits, such as streamlining the writing process, ensuring

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consistency, and saving time, there are concerns regarding the accuracy and reliability of information generated by AI. This letter aims to provide a scientific-based overview of ChatGPT and to highlight the challenges and opportunities associated with AI-assisted scientific writing and AI-powered applications in medicine.

Recent research (published on a preprint server) comparing original scientific abstracts with those generated by ChatGPT reported that the latter produced credible scientific abstracts with no plagiarism detected.¹ The scientific texts were evaluated, and 66% of the AI-generated abstracts were identified by an AI output detector and 68% by human reviewers. However, the human reviewers incorrectly identified 14% of the original abstracts as being generated by an AI, while the AI output detector only mistakenly identified one (2%) original article as being generated.¹ Despite the difficulty in differentiating the articles in the two formats, the reviewers pointed out that generated abstracts were vaguer and presented stereotyped wording (which may be related to the clarity of the command/richness of information given to the AI). The authors highlighted the possible unethical use of the tool to falsify research (as it generates credible numbers) and stressed the importance of clear disclosure when the technology is used to support the researcher's scientific knowledge.¹

In academic work, the ability to concatenate information, present results, and discuss ideas in scientific texts is a valued and welcomed skill, and the submission of the written work (course completion paper, monograph or thesis) is part of the requirements for obtaining a degree in most undergraduate and graduate programs. As generative AI becomes more prevalent, we may be on the cusp of a paradigm shift in how we evaluate knowledge. With this in mind, we invite teachers and researchers to consider the implications of the use of this tool in the current scientific landscape.

This debate about AI takes place against a background of a general debate about the impact of a range of technologies. For example, a 2019 study by Zinnatullina et al., which looked at the relationship between cinema and literature in the 21st century, discussed the positive and negative impacts of cinema on literature.² In her book *Reader, Come Home: The Reading Brain in a Digital World*, the American cognitive neuroscientist Maryanne Wolf discussed the impact of digital technology (cell phones and tablets) on the ability of humans to read and comprehend information, understand complex arguments, and critically analyze different points of view addressed in texts.³ Although this author argued that the nature of digital media does not automatically condemn the practice of deep reading, and can even enhance it, the digital universe does present a threat that can erode this form of attention and that we need to teach our brains to become all-encompassing in the age of electronic technology.

It should not be forgotten that, over recent decades, the way that individuals gather information and connect with each other has been shaped by internet access and an increasingly technology-integrated daily life.⁴ In this scenario, the focus should not be on the technological advances, but rather on the

potential consequences of deviating from traditional patterns in areas such as natural intelligence and interpersonal interactions. Regarding the use of AI generative technology, we believe it should not be evaluated in a purely dichotomous way, either blaming it for dumbing down the human species or praising it for accelerating scientific development—through, for example, facilitating the writing of manuscripts. Rather, the main consequences related to the use of this technology need to be properly evaluated, and institutional principles must be created to guide when generative AI should and should not be used. These might include factors, such as the criteria for authorship, the appropriate use of AI content, and ensuring accuracy, completeness, and originality of the content produced.

Although it is possible for an author to write a text on a subject that they do not know, or produce a manuscript from the input of data using generative AI, it should be noted that the type of request or command given to the AI directly impacts the quality of the text generated; asking the right question and using proper reasoning are central points to consider when trying to solve a problem - as Albert Einstein said, "If I had an hour to solve a problem, I would spend 55 minutes thinking about the problem and 5 minutes thinking about solutions". In this context, could the ability to ask the right question/give the correct command be the human skill that will be most valued in the AI era?

As sleep researchers, we are particularly interested in the possible impact of the use of generative AI on sleep; however, to the best of our knowledge, no studies have yet been published on this topic. Over recent decades, there has been marked growing awareness and evidence concerning the importance of sleep; it has been shown that cognitive performance,⁵ memory retention,⁶ and productivity (a desired aspect for AI users) depend on sleep in sufficient quantity and quality. Moreover, sleep has a widespread impact on homeostasis and health. Yet, despite this knowledge, insufficient sleep has become commonplace, and sleep deprivation presents a global health problem.^{7,8} It is already well documented that increased access to technologies can result in sleep curtailment.⁹⁻¹¹ One example of the negative effects of technology on sleep is nighttime exposure to the short wavelength blue light produced by smartphone screens, which causes a dose-dependent suppression of melatonin production and is associated with altered circadian rhythms.^{12,13} Regarding the use of generative AI-powered applications, they might prove to be so engaging and addictive that they could become an additional factor contributing to sleep disruption. However, technology can also positively affect sleep, since the development of improved wearable devices that use AI to assess sleep can provide helpful feedback and help those who sleep poorly to improve their sleep quality.¹⁴ One of the most common and health-threatening sleep problems, obstructive sleep apnea (OSA), with a prevalence of one third of the population,¹⁵ can now be detected and quantitatively measured using a wearable watch device that uses photoplethysmography to detect pulse intervals and an automated algorithm to detect heart

rate rhythms characteristic of OSA.¹⁶ In the future, wearable devices using AI may be able to assess parameters that can currently only be evaluated by polysomnography, a gold-standard test that requires specific equipment and qualified technical support, thus aiding in the assessment of sleep quality and the diagnosis of sleep disorders.

The use of AI will yield both positive and negative outcomes, but its potential applications are clear. For example, it could be a valuable tool in scientific writing, especially in respect of meta-analysis studies, systematic reviews and other complex evaluations. It could also be of great benefit to educators by performing routine, time-consuming tasks and thus freeing up their time to be spent in more productive ways. However, in relation to both education and the writing of scientific texts, clear rules and objectives must be established for the use of AI. This technology also has potential practical applications in medicine in areas such as drug discovery¹⁷ and clinical decision making.¹⁸ Moreover, the use of AI could give professionals more time to focus on basic research questions, thus accelerating the speed of scientific progress.

Regarding sleep, AI can also have both positive and negative effects; AI-powered technologies have immense potential to advance our understanding of sleep patterns and disorders; however, AI may also have the capability to disrupt sleep routines due to its captivating and potentially addictive attributes. Striking a balance between the benefits and potential drawbacks of integrating AI into society demands ongoing research by experts, the wide dissemination of the scientific results, as well as continued public discourse on the subject.

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Conflict of Interests

The authors have no conflict of interests to declare.

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References

- Gao C, Howard F, Markov Net al. Comparing scientific abstracts generated by ChatGPT to original abstracts using an artificial intelligence output detector, plagiarism detector, and blinded human reviewers. *Biorxiv* 2022 <https://doi.org/10.1101/2022.12.23.521610>
- Zinnatullina Z, Davletbaeva D, Mukhametshina R. Literature and Cinema: Ways of Interaction in the 21ST Century. *Journal of Social Studies Education Research* 2019;10:357–369
- Wolf M. Reader, Come Home: The Reading Brain in a Digital World. HarperCollins, New York; ISBN: 9780062388773. 2018:288 pages.
- Firth J, Torous J, Stubbs B, et al. The “online brain”: how the Internet may be changing our cognition. *World Psychiatry* 2019;18(02):119–129
- Honn KA, Halverson T, Jackson ML, et al. New insights into the cognitive effects of sleep deprivation by decomposition of a cognitive throughput task. *Sleep* 2020;43(07):zsz319
- Rasch B, Born J. About sleep’s role in memory. *Physiol Rev* 2013;93(02):681–766
- Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. The Global Problem of Insufficient Sleep and Its Serious Public Health Implications. *Healthcare (Basel)* 2018;7(01):1
- Johansson AE, Petrisko MA, Chasens ER. Adolescent Sleep and the Impact of Technology Use Before Sleep on Daytime Function. *J Pediatr Nurs* 2016;31(05):498–504
- Alhola P, Polo-Kantola P. Sleep deprivation: Impact on cognitive performance. *Neuropsychiatr Dis Treat* 2007;3(05):553–567
- Jniene A, Errguig L, El Hangouche AJ, et al. Perception of Sleep Disturbances due to Bedtime Use of Blue Light-Emitting Devices and Its Impact on Habits and Sleep Quality among Young Medical Students. *BioMed Res Int* 2019;2019:7012350
- Pham HT, Chuang HL, Kuo CP, Yeh TP, Liao WC. Electronic Device Use before Bedtime and Sleep Quality among University Students. *Healthcare (Basel)* 2021;9(09):1091
- West KE, Jablonski MR, Warfield B, et al. Blue light from light-emitting diodes elicits a dose-dependent suppression of melatonin in humans. *J Appl Physiol* (1985) 2011;110(03):619–626
- Ostrin LA, Abbott KS, Queener HM. Attenuation of short wavelengths alters sleep and the ipRGC pupil response. *Ophthalmic Physiol Opt* 2017;37(04):440–450
- Scott H, Lack L, Lovato N. A systematic review of the accuracy of sleep wearable devices for estimating sleep onset. *Sleep Med Rev* 2020;49:101227
- Tufik S, Santos-Silva R, Taddei JA, Bittencourt LR. Obstructive sleep apnea syndrome in the Sao Paulo Epidemiologic Sleep Study. *Sleep Med* 2010;11(05):441–446
- Hayano J, Yamamoto H, Nonaka I, et al. Quantitative detection of sleep apnea with wearable watch device. *PLoS One* 2020;15(11):e0237279
- Paul D, Sanap G, Shenoy S, Kalyane D, Kalia K, Tekade RK. Artificial intelligence in drug discovery and development. *Drug Discov Today* 2021;26(01):80–93
- Dahmen J, Kayaalp ME, Ollivier M, et al. Artificial intelligence bot ChatGPT in medical research: the potential game changer as a double-edged sword. *Knee Surg Sports Traumatol Arthrosc* 2023;31(04):1187–1189