

Editorial

Convenient untruths: Artificial Intelligence and its risks to scientific integrity

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It is not news that fake and science often intersect. The history of science itself is populated by episodes of absurdity, such as the belief that the world was flat, but this is more a reflection of ignorance than distorted knowledge.

There are also moments of folly, such as in the theories of racial eugenics, which represented a manipulation of experiments for racist political ends. Scientists in Nazi Germany were involved in barbaric experiments with torture, human manipulation, and mutilation to demonstrate the unprovable, even though some new knowledge may have been generated under condemnable ethical procedures. Current Research Ethics Committees also aim to prevent interest-oriented research from overriding the values that society cultivates and values.

Individual cases of plagiarism are not new but have become more frequent with the speed and publicity provided by the internet and social networks. The web facilitates plagiarism but also its exposure. A German minister was removed from office after it became public that his doctoral thesis contained plagiarism.

Manipulating data and research results to gain academic visibility or benefit economic and political interests, such as climate change negationism or advocating for the introduction of invasive exotic species, is a phenomenon in our daily lives.

In 2005, the prestigious journal *Science* "unpublished" an article by South Korean Woo-Suk Hwang on human cloning, published the previous year, after discovering that the study was based on falsified data¹. Nevertheless, the work still received subsequent citations (van der Heyden, 2009). In another instance, the Kansas Geological Survey, a research and service division of the University of Kansas, identified plagiarism in the work of one of its technical staff members at the time^{2,3}. Scientific arguments based on research not validated by consistent peer review may also serve religious proselytism by validating dogmas or beliefs. The acceleration of academic production, with a corresponding race for productivity measured in publications (publish or perish), a phenomenon of recent decades, is accompanied by the exponential growth in the number of journals aligned with various specialities and readers. However, as a side effect, it opens space for errors and malicious conduct.

Not surprisingly, article retractions in scientific journals continue to rise. Data published in the journal *Nature* indicate that in the year 2023 alone, over 10,000 articles were retracted⁴. In such cases, even if the damage is halted, its effects are not fully reversed, as they may fuel a chain of misinformation that feeds political, cultural, and religious interest groups, which only need some validated citation (even if subsequently retracted) to deceive unsuspecting audiences. Social networks can quickly replicate, under a news format, facts and data extracted from snippets of scientific (or pseudoscientific) works once made public. The formal retraction of articles does not prevent them from being cited or referenced.

The practice of peer-reviewing, which is ancient and important, is not infallible. It acts as a filter but lets flaws pass through. The responsibility of the checks and balances of journals is increasingly challenging. The authors are responsible for ethical protocols, presentation of methodological procedures, and

clarification of data sources and information. Verifying such practices is the responsibility of reviewers. Furthermore, critical analysis is also a prerogative of those who read published articles.

Information science is evolving rapidly. Artificial Intelligence (AI) is already capable of producing texts that appear real but are susceptible to containing false content, manipulations, and plagiarism. In this sense, science faces serious risks that must be adequately addressed.

In 1972, Jacob Bronowski - a physicist who participated in the Manhattan Project, which produced the first atomic bombs - warned scientists about the inherent risks of (mis)using the knowledge they produce. He referred to the artefacts dropped on Hiroshima and Nagasaki. In his view, it had become imperative for science to be regulated by mechanisms established by science itself. He was one of the first scientists to warn that humanity had reached a point where it would be capable of directly influencing the future of its own existence as if man had usurped the role of God. Since then, the debate about the responsibility of knowledge creators has continued to grow. Scientists cannot succumb to the temptation to act like sorcerers' apprentices who do not care about the consequences of their creations and can foresee and undo any potentially harmful effects they may cause.

Fake science has several ways to flourish: falsified data, misleading methods and tools, and conclusions without a basis in proven scientific evidence. In his warning work about the risks of ecological disasters, Al Gore pointed out a series of Inconvenient Truth (2006)⁵ about climate change. It is time to be vigilant about the various expressions of fake science. Many articles related to COVID-19 have also been retracted, and due to the recurrence and quantity of these situations, a platform to monitor and publicise retracted works has emerged.

The arrival of AI in the scientific realm, while simultaneously enabling remarkable advances, also opens up ample space for the emergence of convenient untruths for groups of interest that are not always well-intentioned. In addition to the product-related component, the associated cognitive and formative process must also be analysed. With the copy & paste tool, text editing softwares have sped up writing and editing. However, they have also caused damage to the practice of prior reflection and planning of the textual structure, which requires long periods of reflection before starting to write a sentence. Manuscript writing and data analysis require a long training period, with abundant reading of other works and reflection on their contents during and after these readings before forming ideas and opinions that guide their communication. This formative and reflective period can be lost or undervalued, potentially conveying a misguided view of power and wisdom the researcher may not possess but deludes themselves into, supported by AI.

Therefore, there are several aspects to consider in this debate: 1) there is a context that encourages the publication of works, even if they have dubious foundations, which is the productivity measure based on the number of publications and needs to be rethought; 2) the fragmentation of knowledge in science, which goes hand in hand with the productivity logic that disconnects the scientist from ethical reflection, needs to be reversed; 3) it is necessary to question the consequences on the formation of new generations of researchers and the illusion that AI can sell about the reflective capacity of these individuals, and think of strategies that ensure the development of critical thinking and the ability to develop a logical chain of relationships between facts and causalities.

In sustainability, which is essentially multi-, inter-, and transdisciplinary, these three aspects are particularly relevant and crucial for developing an ethical and responsible science.

Given the processes and facts narrated above, SiD enters the debate on the responsibility of scientific journals and the community of authors, reviewers, and readers in its field of interest.

In its first issue of 2024 (issue 1, volume 15), SiD publishes 9 articles in the Varia section.

Firstly, Fagundes and Schreiber discuss the main sources of greenhouse gas emissions (GHG) in the footwear industries in a study involving four companies in the South of Brazil. Following this, Meurer and van Bellen present an analysis of how different countries disclose their Environmental-economic accounting for water through the use of the SEEA-Water methodology, while Barbosa and Ribeiro present an analysis of the conflicts and governance structure of water in the Paraguay River Basin (South America). Monteiro *et al.* then provide an overview of Science and Technology in the Amazon, discussing the role of various institutions and addressing the challenges of mobilising them for sustainable territorial development. Oliveira-Monteiro *et al.* present an evaluation of the environmental perception, pro-ecological behaviours, and quality of life of the caiçara community of Praia do Perequê, located in the city of Guarujá (SP). Lastly, Brites analyses the different environmental urban problems in the city of Posadas (Argentina), seeking to understand and describe the actions or omissions of legislation and/or environmental policies regarding different urban areas.

Ronquim *et al.* discuss the main factors favouring the regeneration of native vegetation in two regions of the state of São Paulo within a period of 30 years, while Budiyoko *et al.* investigate sustainable livelihood strategies of communities in the Monte Slamet region in the Central Java Province, Indonesia. Finally, Menke and Menke discuss traditional taboos in Suriname in the context of the recent convergence of various groups in the capital, Paramaribo, and surrounding areas.

We hope you enjoy the reading of this issue.

NOTES

- 1| <https://revistapesquisa.fapesp.br/era-tudo-mentira/> (access in 6/4/2024)
- 2| <https://link.springer.com/article/10.1007/s10040-014-1215-0>
- 3| <https://news.ku.edu/news/article/2013/12/11/public-censure>
- 4| <https://www.nature.com/articles/d41586-023-03974-8> (access in 6.4.2024)
- 5| Al Gore. *An Inconvenient Truth*, 2006. Oscar-winning film for best documentary film.

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