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On the Emergence of Tortured Phrases: A Threat to Scientific Integrity—The Example of “Heavy Metal”

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For a while now, I have advocated to ban the term “heavy metal” from the scientific literature. I have highlighted its misuse and even proposed to replace it with a “potentially toxic element.”¹ The concept of “heavy metal” in scientific research is now also being compromised by the rise of “tortured phrases.”² These awkward, often nonsensical terms emerge from the misuse of paraphrasing software designed to evade plagiarism detection. In their quest to skirt around the original phrasing, some authors inadvertently create gibberish that complicates the understanding and integrity of their work. For example, well-established scientific terms like “heavy metal” are transformed into bizarre alternatives, thus undermining the clarity and precision crucial in scientific discourse.

Guillaume Cabanac and his colleagues have been actively identifying and reporting these tortured phrases since March 2021.³ By screening publications and posting comments on PubPeer (<https://pubpeer.com/>), they aim to highlight and correct problematic papers. Their work is crucial in maintaining the accuracy and reliability of the scientific literature. The Problematic Paper Screener (<https://www.irit.fr/~Guillaume.Cabanac/problematic-paper-screener>), a tool they regularly update, serves as a repository for these tortured tips, allowing the scientific

community to stay informed about potential issues in published research.

This issue extends beyond mere semantics. The introduction of tortured phrases can lead to significant misunderstandings, impede the replication of studies, and ultimately degrade the quality of scientific communication. For instance, the term “heavy metal” has been replaced with convoluted alternatives like “substantial metal” or even more bizarre phrases, as highlighted in various studies and articles (Table 1). Such substitutions, while potentially intended to clarify, often achieve the opposite, creating confusion and misinterpretation (Figure 1).

The case of “overwhelming metal,” used instead of “heavy metal,” exemplifies the absurdity that can arise from paraphrasing software. These distorted phrases not only obscure the intended meaning but also call into question the authenticity of the research. As Cabanac’s initiative reveals, the use of these tortured phrases can be a red flag for broader issues within a paper, such as potential fraud or a lack of understanding of the subject matter.

The implications for the scientific community are profound. Maintaining the integrity of scientific literature is paramount, and this requires vigilance against the encroachment of such distortions. Researchers, reviewers,

Table 1. Number of Retrieved Articles using Tortured Phrases Related to “Heavy Metal”
[https://dbrech.irit.fr/pls/apex/f?p=9999:5::::RIR:IRC\[tortured\]_ROWFILTER:heavy%20metal](https://dbrech.irit.fr/pls/apex/f?p=9999:5::::RIR:IRC[tortured]_ROWFILTER:heavy%20metal)
 (Retrieved on 07/05/2024).

Fingerprint—Tortured Phrase	Number of Articles
“Substantial metals”	1861
“Overwhelming metals”	246
“Weighted metals”	191

Analysis of **heavy metal** in industrial soil through atomic absorption spectroscopy and its relation with some soil properties

The disease of soil is a premise of peril to the strength of individuals at diverse stages as well as towns and urban areas. **Overwhelming metals** unconstrained as poisonous effluents from smelters are dumped into close by biological system and are connected with wellbeing danger. Modern industrialization is main root to release different **overwhelming metals** which spreads to the dirt as aerosols, particulate issue, residue, effluents and strong waste. Those **substantial metals** will portion from soil to plants lastly imperil for human wellbeing. The principle point of this investigation is to solve the problem of **heavy metal** concentration in the industrial land soils of Gorakhpur (Gida) zone (industrial). Industrial outrush which directly dumped to the atmosphere and its finally disposed into the soil causes pollution at great extent. To study about that 10 distinct samples were collected from distinct sites. Soil tests from these particular destinations got dried and processed through nitric corrosive. By using Atomic Absorptive Spectrophotometry (AAS) these digested samples were examined. The degrees of cadmium, arsenic, lead, chromium, iron, copper, zinc, and manganese in mg/kg went from 35.32–44.9053, ND, ND, 23.603–39.80203, 4.2–7.5, 0.114–1.8, 0.52–4 and 1.04–10. Statistical analysis of data is also presented. After evaluating these samples, we will find out constant of relationship amongst **overwhelming metals** and other soil belongings which are natural issue (organic matter) and ph. Atomic absorption spectrometry (AAS) is a strategy which is useful for estimating the amounts of follow components present in soil samples.

Figure 1. Example of tortured phrases (snapshot of the title and abstract from a random article⁴) where “overwhelming metals” and “substantial metals” are randomly used instead of “heavy metals”, 27 and 21 times in the whole article, respectively.

and publishers must prioritize clarity and precision, ensuring that paraphrasing software is used judiciously and that original meanings are preserved. The trend of using tortured phrases must be curbed to uphold the standards of scientific inquiry and communication.

In summary, the phenomenon of tortured phrases like the misrepresentation of “heavy metal” in scientific studies is a growing concern that jeopardizes the clarity, reliability, and overall integrity of the scientific literature. Through initiatives like the Problematic Paper Screener, the scientific community can identify and mitigate these issues, ensuring that the language used

in research remains clear, accurate, and meaningful.

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