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MAGAZINE

What a 400-Million-Tweet study revealed about the “War on Science”

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The European project “Understanding Misinformation and Science in Societal Debates” (UnMiSSeD) aims at understanding the overlap between science and misinformation with a particular focus on the COVID-19 pandemic.

The UnMiSSeD project was founded by the European Media and Information Fund, EMIF, which provides grants to researchers, fact-checkers, not-for-profits, and other public interest-oriented organizations working on mis- and disinformation. Its grants focus on initiatives such as debunking false claims and developing tools to strengthen society’s ability to detect, understand, and respond to disinformation.

It’s More Complicated Than a War

The common narrative of a “war on science” paints a simple picture: on one side stands scientific truth, and on the other, a wave of misinformation designed to oppose it. But what if this picture is too simple? A massive new study that analyzed over 400 million COVID-19-related tweets suggests it is.

“We analyzed – commented Lucila Alvarez-Zuzek fromCHuB Lab @ FBK Digital Society – *the interaction between misinformation and science on Twitter (now X) during the COVID-19 pandemic using over 400 million tweets collected from 2020 to 2023 by the COVID-19 Infodemics Observatory (developed by FBK). Each tweet is checked for URLs, with domains manually classified as reliable (mainstream media, science) or unreliable (satire, clickbait, political news, hoax, conspiracy) using MediaBias/FactCheck. The novelty of our project lies in the fact that we have now been able to identify in the dataset the tweets mentioning scientific publications through Altmetric and enriched it with bibliometric data from OpenAlex, including open access, preprint, retraction, and citation indicators. We also classified users who are scientists based on prior work from our partners in the University of Leiden.“*

The project has been done in collaboration with the University of Leiden, with Vincent Van Traag and collaborators, and the MEDIA LAB at the University of Geneva, with Tommaso Venturini and his collaborators. The findings reveal a more complex, surprising, and fascinating relationship between how we share science and how misinformation spreads online. Here are the most counter-intuitive takeaways from the research.

Misinformation spreaders don't hate science—they use it

The study's most startling finding challenges the very foundation of the "war on science" narrative. It reveals a massive, but asymmetrical, overlap between people who share scientific content and those who also share content from unreliable sources (a broad category including everything from conspiracy and fake news to hyper-partisan political media, satire, and clickbait).

Specifically, the data shows that **46.09% of users who shared scientific content also shared content from unreliable sources**. But the reverse is not true: only **19.64% of users who shared unreliable content also shared science**. This reveals a key dynamic: while nearly half of science sharers dip into the unreliable ecosystem, the unreliable-sharing community is far more insular.

This directly contradicts the "deficit model"—the long-held idea that people spread misinformation simply because they lack exposure to good science. The problem is not just a lack of access; recent evidence shows that factually correct information is often actively used to support misinformation narratives. Those sharing unreliable information are not necessarily rejecting science outright. Instead, they appear to be co-opting the authority and credibility of "science" to support their own narratives. But how, exactly, do they find scientific-sounding material to support their claims? The study reveals they are particularly drawn to the output of a modern scientific practice: open science.

"People who share misinformation also use science to advocate and support their viewpoints. This suggests that science offers a great epistemic reputation upon which to build, even to people who share otherwise unreliable or even untrustworthy sources. That is, there is not necessarily a 'war on science', and it may not be helpful to frame the problem of misinformation in these terms."

Open Science has an unexpected dark side

The study found that users who frequently share unreliable content do not engage with all scientific papers equally. They gravitate toward specific types of publications that share a distinct set of characteristics. Compared to papers shared in more reliable contexts, these "unreliably used" publications are:

- Slightly more likely to be *preprints* (17.21% vs. 10.03% for reliably used papers).
- Published more often in *open-access sources* (93.65% vs. 91.94%)
- Published in *lower-impact journals* (61.65 vs 90.31, normalised journal impact 3.29 vs 4.73).
- Recipients of significantly *fewer citations* (an average of 107.69 vs. 370.12).
- Slightly more likely to be *retracted* (0.10% vs 0.20%).

The role of preprints is especially critical. A preprint is a scientific paper that has not yet undergone formal peer review, the process where other experts vet its methods and conclusions. The finding highlights a paradox of the open science movement. While practices like making preprints publicly available are intended to accelerate and democratize science, they can also inadvertently provide unvetted material that is easily misinterpreted or weaponized. Crucially, the study notes that these papers are not necessarily wrong; rather, **it is the interpretation** of their results and implications that becomes incorrect when co-opted into misleading narratives.

Why do scientists with more followers share more misinformation?

One of the most counter-intuitive findings relates to scientists themselves. The study revealed that the ratio of scientific to untrustworthy sources is higher among scientists with smaller followings, indicating that scientists with a larger number of followers on Twitter tend to share a higher proportion of content from untrustworthy sources compared to scientists with smaller followings.

Before jumping to conclusions, it is crucial to understand the study's hypothesis for this behavior: these influential scientists are not spreading misinformation. Results suggest that they are actually most likely debunking it.

This explanation is supported by sentiment analysis of the tweets. When scientists mentioned untrustworthy content, they did so with a much more negative sentiment compared to when they discussed scientific content. This suggests they were adopting a critical or corrective tone, pushing back against false claims. This finding highlights a vital, but complex, role for influential scientists on social media: not just sharing research, but actively engaging with and correcting false narratives.

The most effective weapon is not just more research, it is also more engaged scientists

Amid the complexities, the study uncovered a clear, positive correlation: the presence of active scientists on Twitter is strongly associated with a healthier information environment in a given country.

Put simply, countries where scientists post more frequently have a higher proportion of scientific content circulating relative to untrustworthy content.

The study illustrates this by contrasting the United States with Panama. The U.S. has a very large number of scientists, but because the platform is so widespread among the American public, their activity was dwarfed by the sheer volume of content from non-scientists. The general public dominated the landscape, resulting in an online discourse dominated by untrustworthy content. In contrast, Panama had a tiny community of just 16 identified scientists, but they were highly active. Their engagement had a significant positive influence on the country's information landscape, demonstrating that a small but dedicated scientific community can make a huge difference in shaping public discourse.

"When large-scale infodemics unfold, the scientific community's responsibility extends beyond the lab – says Riccardo Gallotti – It is not enough to rapidly produce research: we must also actively communicate it. These findings show that even small numbers of engaged scientists can reshape a country's information landscape. In times of crisis, scientists must recognize that public communication is not optional: it is a crucial part of the response."

Rethinking our approach to the “Infodemics”

The study reveals a connected system: misinformation spreaders do not reject science but co-opt it (Takeaway 1), a tactic made easier by the unvetted nature of some open science outputs like preprints (Takeaway 2). This creates a fraught information environment where influential scientists must step in not just to share facts, but to actively debunk misinterpretations (Takeaway 3), demonstrating that the proactive engagement of a scientific community is a powerful force for a healthier discourse (Takeaway 4).

“This dismantles the idea of a simple battle between science and misinformation – Lucila Alvarez-Zuzek concludes – ***The reality is a complex landscape of interpretation, co-option, and engagement. If the architects of misinformation are already using science as a weapon, how can the scientific community move beyond just publishing research and learn to shape the narrative around it?”***

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