

Review of: "Motivated Reasoning Leads Climate Change Deniers to Access Unreliable Online Sources of Information: Automated Text Analyses of Multiple Reddit Communities"

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Using an R program to “scrape over” 68,000 user-generated comments from multiple Reddit communities, and the software Leximancer to identify the internet domains which these comments cite, Charles Areni addresses the question of whether climate sceptics are more likely to post links to unreliable sources whereas climate change ‘believers’ are more likely to post links to peer-reviewed science and solid news sources. The results that Areni obtains are interesting in more than one respect, and in particular what I find most revealing about them is something that Areni does not mention. But before I get to these positive aspects of Areni’s text, I would like to raise two different points.

The first concerns the expressions of climate change “deniers” and “believers” that the author uses throughout the text. As a scientist, trying as much as possible to define precisely the terms I refer to, I find those two expressions very fuzzy, in the sense that they can conceivably encompass all kinds of nuances. Someone (against all available experimental evidence to the contrary) may not believe that the global climate is changing, or may not believe that the changing climate is due to anthropic influences. Both perspectives seem to be lumped together indiscriminately under the heading of climate change “deniers”. The same goes for climate change “believers”, who can be very heterogeneous as well with regard to the viewpoints they adopt. It may be that for the Reddit comments that Areni consulted, it is not possible to determine to which category of denier or believer their authors belong. In that case, it would be helpful to add a discussion about how confusing the terminology potentially is. If, on the other hand, it is possible to tease apart the deniers and believers into subcategories, that would be very useful, and may prove enlightening.

A second criticism is related to the belief Areni seems to hold that blogs and social media are necessarily of “low credibility”, whereas news media and academic journals (especially *Nature*) are “credible, unbiased sources” (page 3 of the preprint). It would be nice if things were as simple as that... But unfortunately, there are plenty of reasons to think that they are not. For starters, one could legitimately argue that the objectivity of scholarly journals is largely a myth, in the sense that journal editors, through the choice they make of several anonymous reviewers, pretty much can dictate a priori if a manuscript will or will not eventually be published in their journal (e.g., discussion in Baveye, 2021c). Experience shows that editors of scholarly journals are routinely under intense pressure by publishers to raise the impact factor of their journal, for example by favouring manuscripts that have a high chance of getting numerous citations, regardless of the soundness of that they contain. Solutions exist to make the peer-review process less subjective and more resilient to misuse, but none has been implemented so far.

The lack of objectivity in this context may be responsible in part for the severe “replication crisis” that has been affecting science over the last two decades. Already 17 years ago, Ioannidis (2005) shockingly concluded that “most published research findings are false”. Since 2005, researchers have identified numerous instances of data fabrication and other similar frauds, biased analyses, misuses of statistical techniques, bypass of conflicting ideas, misrepresentation or erroneous interpretation of results, and hype in a variety of forms (e.g., Ritchie, 2020; West and Bergstrom, 2021; Baveye, 2021a,b, 2022). Examples of biased, non-credible, or unreliable statements can be found in virtually all of the disciplines that deal in one way or another with climate change. In my own field of soil science, in relation to the capacity of soils to sequester carbon and thereby mitigate climate change, researchers have for years been making claims that are demonstrably misleading and unfounded. The story, covered in Baveye (2022), is worth retelling here. In 2015, during the 21st annual international Conference of Parties (COP21) meeting in Paris (France), the then French minister of agriculture (an economist by training, turned politician) suggested that the agricultural sector could by itself alleviate climate change, no less. The reasoning behind this vision was that since global soils contain two to three times more carbon than the atmosphere, an annual growth rate of 0.4%, or 4‰ of the carbon content in the top 30–40 cm of soils would halt the increase in CO₂ concentration in the atmosphere related to human activities, and in particular to the consumption of fossil fuels. This “4 per 1000” proposal, as it came to be known, was inherently likely to please the agricultural sector who, after decades of being criticized as major polluters, could now be praised for their positive action regarding climate change. Politicians also welcomed the proposal since it meant that efforts to transition to renewable forms of energy could be downscaled or even halted, as agriculture, all alone, supposedly had the potential to save the day.

Researchers did not immediately point out as they should have, when the proposal was made, that several reports (Arrouays et al., 2002; Lal, 2004; Chenu et al., 2014) had previously demonstrated conclusively that carbon sequestration in soils could compensate only a relatively small fraction (<10%) of the CO₂ released in the atmosphere via consumption of fossil fuels, a far cry from the full compensation alluded to by the “4 per 1000” proposal. With the exception of a short note by White and Davidson (2016) in a regional magazine, it took a while for mainstream scholarly journals to publish articles that called the soundness of the proposal into question. More than six years after the COP21, some researchers (e.g., Angers et al., 2022; Minasny et al., 2022) still argue that the “4 per 1000” proposal had merit, even though it is now widely acknowledged that the initial idea was unrealistic other than in a vaguely “aspirational” sense, and that carbon sequestration in soils could contribute credibly only in a very small measure to the fight against climate change (Baveye et al., 2017; Berthelin et al., 2022a,b; Janzen et al., 2022a,b; Schlesinger, 2022).

Faced with the fact that the scholarly literature contains a non-negligible percentage of articles that convey misleading, unsound information, some observers have argued that the key cause of this is the pathological way “the current system of funding and publishing science not only fails to safeguard against scientists’ inescapable biases and foibles, it actually encourages them” (Ritchie, 2020). Whatever the underlying reasons of the current crisis in science, it has clearly eroded the confidence that researchers themselves have in the work of their colleagues. Part of that feeling has permeated in the general public as well, and has contributed to its rising distrust toward the opinions of experts, some of whom, for a variety of reasons, are conveying entirely misleading perspectives. I feel that this state of affairs has to be dealt with somehow when one discusses the citation patterns of members of different communities. Specifically, it seems too simplistic to

assume that truth is necessarily on the side of the news media and academic journals, in particular when the latter include chiefly the suite of *Nature* journals, known more for the sensationalism and hype of the articles they publish than for the trustworthiness of their content, as the high retraction rate in these journals demonstrates (e.g., Ritchie, 2020). Perhaps we, scientists, should acknowledge that we might bear some responsibility for the fact that a sizeable portion of the public no longer trusts what we say, and we should be more proactive about policing our own ranks and insisting on ethical conduct, to revert this state of affairs.

Now that these minor criticisms of Areni's (2022) preprint are out of the way, I can concentrate on its key message. Areni considers that this message revolves around the demonstration that climate sceptics are more likely to post links to unreliable sources whereas climate change 'believers' are more likely to post links to peer-reviewed science and solid news sources. Areni frames his analysis in the context of "motivated reasoning". I am not entirely sure that envisaging things from this perspective really adds anything to the discussion or to the conclusions he reaches, which in many ways are entirely as one would intuitively expect, regardless of any theoretical framework. Nevertheless, it is clear that the data Areni has obtained from his analysis of Reddit websites confirm his initial hypothesis. However, that may not be the most interesting aspect of these data. Indeed, if one looks carefully at his table 2, one notices that sure, climate change "believers", in their Reddit comments, cite Academic Journals (25.55%) and News Media (26.18%) far more than do the "deniers", but the believers also do not cite Social Media at all (0%), and cite Blogs very little (4.59%). This absence of citation to the other side suggests that climate change believers do not attempt at all to correct the misconceptions that may be present in the information that is spread and consulted by the deniers. It is possible that when climate change believers cite comments made in Reddit posts, which they seem to do frequently (in 43.71% of the citations), they address comments made by deniers. It would be interesting if Areni could provide a breakdown of this category of citations. Nevertheless, the low percentages of citations to Blogs and Social Media are indicative in themselves of an absence of reaction by believers.

The reason this may be significant is that, if climate change believers and especially scientists never make the effort to rectify misleading statements spread by climate change deniers, algorithms used by search engines on the web will systematically stir the latter toward content that is in line with their beliefs, and they will never be exposed to more rational viewpoints. It is not sufficient for scientists, in particular, to be satisfied with the knowledge that they are right and the confidence that, in the end, truth will prevail. My personal experience is that this always seems to be the attitude scientists take about controversial ideas emanating from outside the ivied walls of universities or research centres, and also to misleading hype promulgated by some of their colleagues, whom they are often reluctant to criticize openly. I know from experience in my own discipline that it is very difficult for scientists to overcome the reserve that they feel is their solemn duty, as unnerving as that may be in the face of falsehoods being widely circulated and influencing public policy (e.g., Baveye et al., 2006; Baveye, 2022). Yet, given the extreme urgency of the climate change crisis, the fact that scientists "stay above the fray" and choose to not address head-on the misguided perspectives of deniers might have very dire consequences, and it is urgent, I feel, to put any ill-inspired reserve aside.

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