Boring language is constraining the impact of climate science

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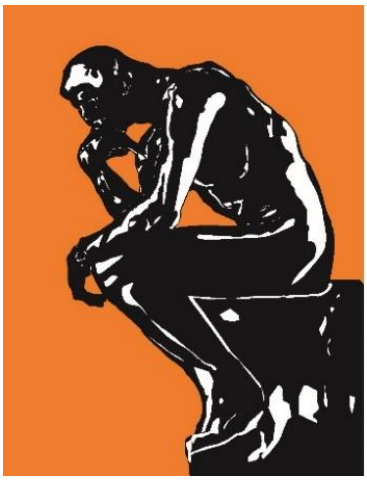

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"– Why did you belittle my meditation efforts, saying that even your fart can destroy my painstaking meditating practices?

Monk Bird slowly opened his eyes and calmly said:

– Just the word 'fart' from me has blown you, body and mind, across two ponds to here. How can you withstand the Eight Winds, dear Meditation Master?"

—In "The Meditation Master"; *The Kingfisher Story Collection* (2022a)

Abstract

Language, one of humanity's major transformative innovations, is foundational for many cultural, artistic, scientific, and economic advancements, including the creation of artificial intelligence (AI). However, in the fight against climate change, the power of such innovation is constrained due to the boring language of climate science and science communication. In this essay, we encapsulated the situation and risks of boring language in communicating climate information to the public and countering climate denialism and disinformation. Based on the Serendipity-Mindsponge-3D knowledge management framework, we recommend several strategies for climate scientists and science communicators to be more creative and make their communication more interesting, including collaboration with other cultural sectors (e.g., stand-up comedians, climate fiction, etc.) and AI.

Keywords: philosophy of science; philosophy of artificial intelligence; science communication; information circulation; disinformation; climate change denialism; conspiracy theory; creativity; artificial intelligence

Human innovations equip AI with languages; what about climate science?

"IF GOD WANTED TO DO A FINANCING, HE WOULD CALL MORGAN STANLEY"

(Chernow, 2010).

Are you familiar with this saying? Can you sense the speaker's self-assurance and strength? Do you feel convinced by the financial power of The House of Morgan in particular or global financial empires in general? This is precisely what financial institutions have accomplished through the intelligent and creative use of language. So, what will happen if climate change denialists can make use of this type of power? What if this power is utilized to further the environmental agenda? This essay will examine the significance of language in the success or failure of climate science communication in the critical battle against climate change.

And, yes, "the devil's in the details." I (QHV) have another story about a glitch during communication over a technical matter. I have a mathematician friend—who has often been hailed as the most brilliant (contemporary) mind in our country's contemporary science (or even throughout its history)—who is, in fact, a Field medalist. During a nocturnal chat, I showed him half a page of a mathematical logic proof. He said it looked wrong*ish*. I told him the proof was correct, verified nearly a hundred years ago, and stood the test of time. Albert Einstein used to be a fan of this proof's creator. Then he said the proof looked ugly. I explained this had universally been considered one of the most beautiful gems in mathematical logic, as beautiful as $\mathrm{E} = \mathrm{MC}^2$ by Einstein or Pearson's χ^2 test statistic. Satisfied with my information, then he said the proof had a ... "weird" look. We then burst into laughter.

This brief story reminds us of how challenging our communication can be. We can keep discussing the same topic, but the discussion does not necessarily build up shared understanding and views, let alone push joint understanding to advance. Many possible elements add to the complexities: views, backgrounds, interests,... but one thing stands out: language. This last element is what we want to convey in this paper: uninteresting language filled with technical terms, jargon, and assumptions (burdens on the shoulders of the audience).

Humans are a species that loves storytelling. Great storytelling has the potential to make a huge impact on people. It can change and shape people's thoughts and behavior (Aldama, 2015; Martinez-Conde et al., 2019; Storr, 2020; Suzuki et al., 2018). In a broader sense, storytelling is an intelligent technique of utilizing language to convey information, so it would not exist in the absence of a language system. Unsurprisingly, the successful creation of language is regarded as humanity's second major transformative innovation (Takács-Sánta, 2004). Because of the availability of language, people can improve the efficiency of communication and reasoning of abstract concepts, thereby being able to construct cultural, artistic, scientific, and economic systems.

Artificial intelligence, humanity's most recent innovation, is also a result of the language revolution. The idea of artificial creatures capable of thinking like humans through mechanical control of symbols culminated when the first programmable, electronic, general-purpose digital computer was completed in 1945: Electronic Numerical Integrator and Computer (ENIAC). The computer was operated through computer language systems based on mathematical logic, such as the ENIAC coding system developed by John von Neumann, John Mauchly, J. Presper Eckert, and Herman Goldstine. Today's most popular AI chatbots, such as ChatGPT and Google Bard, are all built on large language models (LLMs) that can perform natural language processing tasks and generate answers to human inquiries (Singh et al., 2023). In the opposite direction, people are looking for protocols to use prompts to order AI to answer their questions and fulfill their requests. They are all within the spectrum of language. If it were not, humans would have to punch the computer to acquire information (even in such cases, the punching would be deemed body language!).

While AI and humans must constantly improve and develop their use of language to increase the effectiveness of their communication with one another, the question that needs to be asked is: what improvements or changes have current climate science and science communication made in terms of language to help change people's awareness, perceptions, and behaviors towards climate change? Or do they just use "good enough" language with some statistical findings and chemical symbols that are uninteresting and hard to understand by the public? (Collins, 2009)

A scant vocabulary highlights the poverty of thought

The proposition, i.e., "A scant vocabulary highlights the poverty of thought", articulates a profound connection between language and cognitive capabilities. Language is not merely a communication tool; it also represents the depth, elevation, and value of consciousness and intellectual processes. Just as a fertile and vibrant field that nurtures intellectual plants yields rich nutrients for intellectual products, these creations are transmitted through language (including various forms of linguistic representations)—now enriched, vivid, and persuasive. Conversely, when language is constrained, and the vocabulary is poor, so too are our thoughts. Without an adequate lexicon, proper structures, and logical constructs, we struggle to construct ideas that can engage, stimulate, and foster the continued development of deep and creative thinking. It is not without reason that Noamsk Chomsky, often hailed as one of the world's most important intellectuals alive, is a linguistic researcher.

Hence, this succinct statement encapsulates an essential message about the significance of language and cognitive abilities in tackling climate change. Without a rich, vivid, and persuasive language system, climate science will face the constraint of convincing people to join hands and utilize their mental power to solve climate problems.

The current language system of climate scientists appears uninteresting. We randomly picked five scientific publications on climate change from Google Scholar and asked Google's AI Bard to examine them to obtain the preliminary assessment of the language system currently employed in climate science (Springer and van Vliet, 2014; Stern, 2008; Thornton et al., 2014; Yusoff and Gabrys, 2011; Ziervogel et al., 2014). The findings indicate that phrases connected to the environment and climate change are frequently repetitious and lack creativity (see Table 1). This result may not come as a surprise, given that scientists are frequently thought to "stink at writing" (Pinker, 2014) or "bad writers" (Nelson, 2018).

Table 1: The frequency of words and phrases in five randomly selected articles

Word/Phrase	**Total**	**Documents**
Climate change	70	All
Global warming	3	2
Greenhouse gas	10	2
Emission	14	All
Temperature	22	2

Precipitation	3	2
Sea level	1	4
Ocean	15	1
Sea ice	1	All
Impact	20	2
Adaptation	7	1
Vulnerability	4	2
Policy	4	1
Economics	4	All

Scientists often use uncreative and repetitive language because they are accustomed to the purely scientific mindset of seeking hard truths that require certainties. Although the issue of global warming has been mentioned since 1896, climate scientists initially did not believe in it. A significant number of climate scientists at that time believed that the climate system had the ability to self-regulate and maintain temperature and chemical components over many millennia, making it difficult for humans to disturb the balance of the system (Weart, 2008). The uncertainty of evidence regarding climate change in the early stages led many scientists to label the global warming phenomenon as "pseudoscientific fraud" or "the global warming scam, with the (literally) trillions of dollars driving it, that has corrupted so many scientists...". These claims have decreased public trust in global warming and climate change (Weart, 2011). To achieve a high degree of consensus and coherence within the scientific community regarding climate change due to human-induced greenhouse gas emissions, scientists have spent about a century and a lot of effort accumulating sufficient evidence. Therefore, scientists often consider scientific facts to be crucial weapons to counteract climate change denialism (Lewandowsky, 2021).

Nevertheless, even when scientists put a lot of effort and time into uncovering scientific facts, they do not seem to have a significant impact on countering disinformation sources. Psychological inoculation is commonly heralded as an effective strategy to counter disinformation (Lewandowsky, 2021; Van der Linden et al., 2017), but a recent study across 12 countries indicates the opposite. Spampatti et al. (2023) discovered almost no evidence for protective effects against climate disinformation of six inoculation strategies (i.e., scientific consensus, trust in scientists, transparent

communication, moralization of climate action, and accuracy and positive emotions). Meanwhile, exposure to disinformation has a clear adverse impact on belief in climate change, the ability to detect disinformation, and pro-environmental behavior.

Scientists must invest significant time and effort to obtain certainty, but instilling doubt about scientific facts is simpler and more psychologically effective (Bloomfield; Yoder, 2023). While scientists utilize complicated scientific language as weapons, such as charts, chemical formulas, and jargon, denialists and conspiracy theorists use their creativity and comedy to convey made-up stories and connect with their audience (Clark, 2015). The form of language represented in the Figure 1 might be considered reliable among various scientific language types, but is there anyone who enjoys communicating and engaging in daily exchanges using this type of language?

$$
\begin{aligned}
& n^{-1/2} \sum_{k=1}^{n} \varphi(X_k) = n^{-1/2} \sum_{k=1}^{n} [f(X_k) - Pf(X_k)] \\
& = n^{-1/2} \sum_{k=1}^{n} [f(X_k) - Pf(X_{k-1})] + n^{-1/2} \sum_{k=1}^{n} Pf(X_{k-1}) - n^{-1/2} \sum_{k=1}^{n} Pf(X_k) \\
& = n^{-1/2} \sum_{k=1}^{n} u_k + n^{-1/2} [Pf(X_0) - Pf(X_n)],
\end{aligned}
$$

Figure 1: A reliable scientific language type

Similarly, it would be challenging for the public when we demand them to absorb chemical formulas like CH4 or CO2 or terms like "statistically significant" in their daily lives and act to protect the Earth. When someone receives information and finds it difficult to understand or uninteresting, their natural reaction will be to reject that sort of information.

To understand more about the relationship between climate communication and public acceptance levels, we can look at the following axiom:

$$A \times I = E$$

Where A is the amount of communicated information; I is the interesting degree of the communicated information (ranging from 0 to 1); and E is the amount of communicated information that can effectively enter the people's mind. Therefore, with the current uninteresting communication of climate change messages, we believe you can find results for the mathematical formula as follows:

$$A \times 0 = ?$$

Not to mention, if uninteresting language is repeated along with alarmist narratives or tones, it can easily create a negative sense of doomerism (Ropeik, 2019). Doomist thinking can lead young people to believe that they "face annihilation," causing more

than half of 10,000 young people in 10 countries to agree that "humanity is doomed," and two-thirds of them think the future is "frightening" (Hickman et al., 2021). Such attitudes can push people towards extremist reactions or paralysis and disengagement (Clark, 2023; Ritchie, We need the right kind of climate optimism). Regardless of the direction, it does not contribute positively to efforts to combat climate change.

Making the language of climate science and science communication more interesting, please!

Through language as a cultural transmitter, climate science and science communication can render those who receive it become nature lovers, much like wild deer roaming freely and enjoying the forest air. However, to achieve that, we must address the issue of boring language.

To communicate an urgent issue related to the survival of humanity, using language to create interesting content may seem like a "counterintuitive" and "useless" approach. Still, sometimes, it can lead to unexpected "useful" effects. If you don't believe it, you can revisit the philosophy in the essay "The Usefulness of Useless Knowledge" by Abraham Flexner (Flexner, 1939), the founding director of the Institute for Advanced Study in Princeton and the person who helped bring Albert Einstein to the United States. Without Abraham Flexner and his paradoxical language, would the Institute for Advanced Study have been established and become a center for geniuses like Albert Einstein, J. Robert Oppenheimer, Hermann Weyl, John von Neumann, Kurt Gödel, Freeman Dyson, Tsung-Dao Lee, and many more? We do not have an answer, but we do know that thanks to the gathering of these greatest minds, the American and global scientific community, as well as the governments, awakened and recognized the tremendous value of science and technology for the future of humanity, and began allocating regular funding for basic research (Celeste et al., 2014; Dworin, 2015).

Innovation and creativity are crucial to generating interesting content in climate science and science communication. Such innovation and creativity can be accomplished by interdisciplinary-coordinated efforts through a 3D creativity process (Nguyen et al., 2022; Vuong, 2022b; Vuong et al., 2022). In this context, 3D involves utilizing the best "within discipline," collaborating with the best "out of discipline," and conducting both of these processes in a "disciplined" manner until the innovations are achieved.

Firstly, leading experts in the climate science and science communication field must make an effort to innovate and expand the language system currently in use. A diverse and creative language system will give communicators more choices in managing impressions, regulating emotions, creating social bonds, stimulating imaginations, and persuading others (Berger, 2014; Chronis et al., 2012), which is crucial to creating the connection between humans' mental realm with the world of other sentient beings (Vuong and Nguyen, 2023). When the connection is formed and persists, it will help

build humans' perceived values of the natural world and, eventually, the eco-surplus culture (Nguyen and Jones, 2022; Vuong, 2021a). If necessary, an "out-of-the-box" approach, similar to how Shinichi Mochizuki devised the proof for the abc conjecture, should also be pursued. Specifically, Mochizuki created a completely new formalism (or a new type of mathematical language) to generate the proof (Castelvecchi, 2015). Although Mochizuki's proof remained contested, his "out-of-the-box" idea can be a noteworthy reference for climate science and science communication to renew their language system and improve communication effectiveness with the public. However, the effort should not aim to make the language indigestible, like Mochizuki's new mathematical language, but more digestible to the majority.

Climate science and science communication should also collaborate with experts in other cultural sectors that can help create excitement for audiences, viewers, and readers. One such group includes stand-up comedians who can turn already happened, trivial, and daily observations, things, events, and phenomena into a source of jokes, attracting millions of audiences and viewers. For instance, Neil deGrasse Tyson and other comedians addressing climate issues may make this topic more accessible and engaging. Humor has the ability to bond people together and facilitate a deeper understanding and discussion of climate change, making the topic more understandable and less discomforting (Lamberts, 2015). Additionally, speculative climate fiction (cli-fi) in literature can also make climate issues more interesting and comprehensible, but the fiction should be written with caution to avoid spreading the doomist thinking among the public (Glass, 2013; Schneider-Mayerson, 2018; Vuong, 2020).

Collaboration with AI is also indispensable for successfully disseminating climate change information and acculturation away from climate apathy (Vuong and Ho, 2023). In the digital era, the increasing prevalence of AI in humans' daily lives has made AI a critical source of information and, thus, a powerful weapon for affecting and shaping humans' cognition and emotions. The question is: do we want such power of the most advanced AI systems to fall into the hands of climate change denialists and conspiracy theorists? Absolutely not if we want to tackle climate change and save the Earth. Nevertheless, we face the risk of seeing that happen as the current education systems of communications and media, journalism, and linguistics lack the training to work with AI and counter AI-generated information for nefarious intentions. Even the Sustainable Development Goals can become incorrect after the rapid diffusion of AI in society, as at the time they were adopted, they did not consider the sustainability aspect of artificially created products, like AI systems.

To avoid the risks of leaving the power of AI in the hands of those with nefarious intentions, climate science and science communication need to adopt AI systems proactively to fight climate apathy and disinformation (Vuong, 2019; Vuong and Ho, 2024). If we are not able to generate interesting content that can gain attention and

persuade people to participate in the climate change tackling efforts, why don't we utilize the AI that can do so? xAI, a company founded by Elon Musk, released Grok, an AI with the "fun mode" and "regular mode", to the public in November 2023. Under the "fun mode", the AI will answer using a humorous and sarcastic tone. According to Musk, one of the reasons behind the launching of Grok is "to be the funniest AI" (Bhaimiya, 2023).

Moreover, the translation capability of AI can aid in harnessing community science to fight the climate crisis. Tackling climate change is a global agenda, but it requires local actions and collaborations to be accomplished. Given the ongoing Western monopoly of climate science (Mcsweeney, 2015; Tandon, 2021; Vuong, 2021b), it is not possible to harness and utilize the strength of community sciences in non-Western countries, such as Brazil, China, India, Indonesia, Iran, Japan, Russia, Saudi Arabia, South Africa, Vietnam, etc., (we should not forget that much foundational knowledge for modern science sprang from non-Western countries, e.g., *algebra* originated from the Arabic). Without AI, other countries and cultures will not be able to resist the linguistic monopoly of English, leading to the risks of losing knowledge and wisdom embedded in their cultural and language systems. When these systems are degraded, many forms of languages will also disappear and cannot be used as leverage points to create interesting content for climate change messages (e.g., *Xiangsheng* in China, Russian jokes, *farce* in France, etc.).

In writing this paper, we relied on science communication articles a lot. This demonstrates the effectiveness and dedication of the science communicators. However, based on the above points, climate science communication can still be enhanced much more by incorporating exciting content to attract and convince the public. Scientists have always seen what others see and understand what others do not. Once they understand, they only write one or a few articles for their colleagues to understand. Society also needs scientists to share their understanding with the public (scientists take their tax money, right?). The effectiveness of knowledge relies on its capacity to be reused in society, namely through the art of storytelling. If scientific communication only encompasses facts and proof, the content will be boring, rendering storytelling ineffective and preventing climate information from being circulated within society.

"Be more interesting, please!"

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