



How Facebook's Algorithmic Amplification Misinformation and Emotional Climate Narratives Shape Public Perception and Climate Policy Support

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ARTICLE INFO

Article History:

Received: October 16, 2025
Revised: November 12, 2025
Accepted: November 21, 2025
Available Online: December 05, 2025

Keywords:

Facebook, climate change perception, misinformation, echo chambers, algorithmic amplification, climate policy support, mixed methods.

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ABSTRACT

Introduction: The digital platforms have become central intermediaries of climate communication; however, Facebook is still under-researched as a platform-specific ecology where algorithms, affective relations, and social interactions come together to shape climate-related perceptions. The explanation of the ways of how the content structures of Facebook resonate the attitudes of the people is vital to improving climate governance and curbing misinformation.

Methods: A mixed-method design that was used was concurrent. Content and thematic analysis of a corpus of 300 Facebook posts by climate-oriented groups and pages were analysed and used to classify information according to facts, emotive narratives and misinformation and conspiracy frame. Those findings were compared to survey data of 200 participants who evaluated climate awareness, affective, institutional trust, digital exposure behaviour, and policy endorsement.

Results: Posts that contained misinformation and conspiracy posts received disproportionately high engagement compared to posts that had empirical content. Narratives founded on fear increased user attention, though, it also increased polarization. The role of Echo-chamber reinforcement was that of a salient mediator, which in turn affected the perception and attitudes towards climate science. On the other hand, emotive and solution-focused messages made substantial contributions to supporting the support of climate-reduction policies and ensuring more constructive interaction.

Conclusion: Facebook has the effect of molding an informational milieu in which predominantly emotive and misleading climatic message lines are exaggerated and a limited distribution of factually validated material is placed. Such observations highlight the need to implement changes at platform level, promote digital literacy programs, and implement communicative practices deployed in strategic frames that can tapped into positive affective factors. The analysis provides practical information to policy makers, communicators and technological platforms who are determined to make society support climate action.



Introduction

The social media platforms have fundamentally transformed the nature of environmental communication, as they have turned the hitherto lethargic, editorially filtered climate discourses into a dynamic participatory and algorithmically organized flow of information. Throughout history, traditional journalism had been the major gatekeeper of climate knowledge, which dictated what scientific knowledge was relayed to the masses, and how this information could be disseminated. Conversely, modern online platforms do not have a central gatekeeping role, as millions of users now have permission to produce, remix, and share climate-related information in real-time. Among such platforms, Facebook is one of the most impactful, and it has over 2.9 billion monthly active users globally (Kochkorova, 2025). The sheer scale of the platform, combined with its algorithmic system of content curation, places Facebook well beyond being a communication tool to being a powerful media infrastructure that actively shapes the ways that individuals internalize climate science, the judgments of environmental risk, the attributions of responsibility, the emotional reactions, and ultimately the attitude to climate policy. The public perception, covering both the awareness, the concern, institutional trust, emotional engagement, and perceptions of legitimacy of climate information, holds a prime and empirically validated place in the context of climate action across the societal and political levels. A large amount of academic research has consistently shown that these perception variables influence the tendency of people to support climate policies, adopt sustainable behaviours, and tend to be climate skeptics (Drews, 2016); (Bouman, 2020). However, this informational environment, which shapes these impressions, has undergone the most drastic disruption ever with the emergence of the social media. Unlike traditional media institutions, which generally follow the tenets of journalism, such as being accurate, under editorial scrutiny, verified, and scientifically consulted, Facebook is optimised through algorithms, and the content that is most likely to increase engagement is shown instead of the one based on scientific integrity.

The affordances of Facebook, the algorithmic curation, Social recommendation system, emotional optimisation, and user-generated content, together create a discourse space, which is fundamentally different than the existing communication space (Bruns, 2019). Such affordances work together to increase subjective perceptions of climate change and at the same time reduce the availability of scientifically sound data. An example of this is the News Feed algorithm that considers user behaviour, emotional response, and social connections to decide what users see and serves to produce personalised informational realities that differ significantly among users. Thus, people are not subjected to homogeneous climate discourses, and they do not receive climate information as often or in the same manner or emotional tonality. The idea of such fragmentation of informational exposure confirms the idea that the perception of climate is no longer governed by scientific consensus alone, but by digital systems that dictate the voices and narratives that will be seen. More importantly, not all content is treated equally on the algorithmic systems on Facebook. They rank in series those posts that provoke a high emotional response, either positive or negative, as this type of content is what results in increased engagement and increased time spent on the platform (Piccardi, 2024). Such bias towards emotionally charged content compared to factually based information leads to the fast propagation of content that shocks, polarises or causes outrage. Research into digital misinformation underscores the fact that climate-related lies, conspiratorial theories, or misquotation tend to be more popular than scientific posts in terms of reach, visibility, and interaction with users (Treen, 2020); (Humprecht, 2024). This process is not an accident but the product of the logic of algorithms in media: sensational content is favoured and balanced scientific explanations are relatively devalued.

These dynamics have provided a fertile ground in which echo chambers form and are reinforced by social and algorithmic reinforcement groups of similarly minded users who keep perpetually

circulating the narratives that reinforce already held attitudes (Del Vicario, 2016). In such echo chambers, climate information is filtered by ideological identities and cultural values and not by evidence. People inclined to environmental worry are more prone to read articles that focus on a sense of urgency, moral obligation or catastrophic consequences, whereas those who do not believe in climate science are more inclined to read articles that challenge the credibility of science or the economic or political threat of climate policy. Exposure to ideologically homogeneous networks, as research has revealed, decreases the chances of being exposed to different perspectives and increases attitude polarisation in the long run (Bakshy, 2015). Facebook thus is not merely a conveyor of climate information but is also a force at work in a process of forming the ideological framework of climatic appropriation. This communication environment is heavily mediated algorithmically and this is a major challenge towards climate governance. The social institutions that the community needs to take collective climate action are torn apart when the influence of misinformation, emotional content, and identity-consistent narratives disproportionately influence the ways people perceive climate change. Confidence in scientific organizations may be undermined, policy discussions may degenerate into partisan wars, and citizenship agreement on mitigation measures is diluted. However, even though the body of research on general trends in climate communication and misinformation is considerable, it appears that there is a massive lack of platform-specific empirical research investigating Facebook as a distinct ecosystem. A large portion of the available literature examines media usage in general or studies overall online behaviours, with little to no subdivision into how the mechanics inherent in Facebook are skewed to amplify some types of climate stories and minimise others.

The given study is going to address a major gap in the literature through a platform specific analysis of the ecological content of the information in Facebook and the corresponding impact it exerts on climate perception. Specifically, this study looks into:

1. The dissimilar involvement, presence, and affective resonance of different types of Facebook climate content such as scientific, emotive, conspiratorial, advocacy-oriented, and misinformation texts.
2. How exposure to misinformation, emotive storytelling, and echo-chamber processes influence the understanding of climate change among individuals, including beliefs, affective reactions, and trust.
3. The transfer of these digitally mediated perceptions to support or oppose climate policies at both individual-level and societal levels.

Placing the analysis of climate communication in the algorithmic logic of Facebook and incorporating both qualitative content analysis and quantitative data of perception, this paper will help advance the global academic research to clarify the digital determinants of climate action. Since climate change is gaining momentum and digital platforms are increasingly shaping popular opinion instead of traditional scientific or journalistic institutions, it is important to explore how Facebook is shaping the climate reality so that evidence-based communication, misinformation resistance, and support of climate policy among the populace can be fortified.

Methods

A concurrent mixed-methods design was adopted to comprehensively analyse both the nature of climate-related content circulating on Facebook and the ways in which individuals interpret and respond to such content. This design allowed qualitative insights from content analysis and quantitative evidence from survey data to be integrated within a single analytical framework, enabling a deeper understanding of how platform-specific communication dynamics influence public perception and policy attitudes. The study proceeded in two major components: (1)

systematic analysis of Facebook climate content and (2) a structured survey examining individual-level perceptions.

Facebook Content Sampling and Data Collection

A total of 300 Facebook posts were systematically sampled from publicly accessible climate-related groups and pages over a six-month period. These groups/pages were selected based on predefined criteria: high visibility, active user participation, and explicit focus on climate change topics, including environmental advocacy pages, climate science communities, and general-interest public forums where climate discussions frequently emerge. Only posts with public visibility were included to ensure compliance with ethical standards and to maintain transparency of content access. Posts were extracted at regular intervals to avoid temporal clustering and to capture variations in content themes, emotional tone, and engagement patterns. Each post was archived with metadata including posting date, post type (text, image, video, link), number of reactions, shares, comments, and the nature of user interactions. This ensured a comprehensive dataset representative of the diversity of climate communication on Facebook.

Coding Framework and Content Categorisation

All posts were coded using a structured coding guide developed through an iterative process. The coding framework categorised each post into one of five content types based on its primary communicative intent and framing:

1. **Scientific/Factual content** – posts presenting empirical data, scientific explanations, or objective climate information.
2. **Emotive narratives** – posts invoking emotional responses through personal stories, imagery, metaphors, or moral appeals.
3. **Advocacy/Solutions** – posts promoting climate action, behavioural change, policy initiatives, or technological solutions.
4. **Misinformation** – posts presenting inaccurate, misleading, or scientifically unsupported claims about climate change.
5. **Conspiracy content** – posts claiming climate change is a hoax, politically orchestrated, or part of hidden agendas.

Each post was independently coded by two trained researchers to ensure inter-rater reliability. Coding discrepancies were resolved through discussion and consensus. This process enhanced the validity and consistency of the content analysis.

Thematic and Engagement Analysis

Beyond categorical classification, a thematic analysis was performed to identify dominant frames, narrative patterns, emotional tones, and underlying discursive structures. Themes such as fear/urgency, hope/solutions, echo-chamber reinforcement, blame framing, and denialism were identified through open and axial coding procedures. Engagement metrics, including likes, comments, shares, and reaction types, were recorded for every post. These metrics were analysed to determine which content types received disproportionate visibility and interaction. Descriptive summaries, comparative analyses across categories, and ranking tables were generated to reveal engagement trends. This enabled examination of how platform algorithms and user behaviours amplify certain narratives over others.

Survey Design and Participant Recruitment

To complement the content analysis, a structured survey was administered to 200 respondents. Participants were recruited using a mixed outreach strategy involving online distribution through public groups, university networks, and social contacts to ensure demographic diversity. Participation was voluntary, and informed consent was obtained from all respondents.

The survey instrument consisted of multiple sections measuring key variables:

- Climate awareness and knowledge
- Perceived risks and severity
- Emotional responses (**fear, hope, frustration, optimism**)
- Trust in scientific and governmental institutions
- Digital literacy and ability to identify misinformation
- Exposure to climate content on Facebook
- Support for climate mitigation and adaptation policies

Likert-scale items, multiple-choice questions, and short-answer responses were used to capture both categorical and continuous data.

Quantitative Analysis

Survey responses were analysed using descriptive statistics (means, frequencies, distributions) and correlations to explore associations between digital exposure, emotional responses, trust levels, and policy attitudes. Cross-tabulations were used to examine how demographic factors or digital literacy influenced susceptibility to misinformation. All analyses were performed using standard statistical software.

Mixed-Methods Integration

Findings from the qualitative and quantitative components were integrated using triangulation. Patterns in Facebook content were compared with patterns in public perception to identify convergence, divergence, and explanatory relationships. This mixed-methods integration enabled a holistic interpretation of how Facebook's communication environment shapes climate understanding and policy support.

Results

Content Type Distribution

The analysis of 300 Facebook posts revealed a diverse landscape of climate-related communication, reflecting varying intentions, emotional tones, and informational qualities. Scientific or factual posts constituted **20%** of the dataset. These posts typically presented empirical findings, climate science updates, or data-driven explanations of environmental trends. They were generally neutral in tone, emphasising accuracy and clarity rather than emotional appeal.

- a) **Scientific/Informational narratives** accounted for **30%** of posts. These posts primarily aimed to disseminate factual, evidence-based, or educational content about climate science, environmental processes, and observed climate impacts. They typically relied on data-driven explanations, graphs, scientific references, or informational summaries that aligned with established research. Unlike emotive or advocacy content, these posts were neutral in

tone and prioritised clarity, accuracy, and public education. They formed the backbone of credible climate communication within the sample and served as a counterbalance to the emotive or misleading narratives circulating on the platform.

- b) **Emotive narratives**, which accounted for **25%** of the content, represented the largest category. These posts relied on personal stories, compelling imagery, or moral framing to evoke emotional responses such as fear, concern, empathy, or hope. Examples included firsthand accounts of climate impacts, depictions of natural disasters, or emotionally charged appeals for climate action. The prevalence of emotive content suggests that Facebook users frequently rely on storytelling and affective communication to capture attention and mobilise perceptions.
- c) **Advocacy and solution-oriented posts** made up **20%** of the dataset. These posts focused on promoting climate-friendly behaviours, policy initiatives, community actions, or technological solutions such as renewable energy. This category often employed motivational language, emphasising empowerment, efficacy, and collective responsibility. While less emotionally intense than emotive narratives, these posts aimed to inspire action and reinforce community engagement.
- d) **Misinformation**, representing **15%** of the content, consisted of posts spreading false, misleading, or exaggerated claims about climate science. These included assertions that climate change was exaggerated, naturally occurring, or fabricated for political purposes. Misinformation posts often blended pseudo-scientific language with emotionally charged rhetoric, making them difficult for some users to critically evaluate.
- e) **Humor and satire**, comprising **10%**, included memes, sarcastic commentary, or humorous takes on climate events. While these posts varied in tone, from playful to cynical, they frequently reinforced existing perceptions through light-hearted or mocking portrayals of climate topics.

Overall, the distribution shows that while factual information is present, it is matched or exceeded by categories that prioritise emotional resonance, persuasion, or misinformation. This content ecology shapes users' exposure to climate narratives in multiple, sometimes conflicting ways.

Table 1:

<i>Content Category</i>	<i>Frequency</i>	<i>Percentage</i>
<i>Scientific/Informational</i>	90	30%
<i>Emotive/Personal Narratives</i>	75	25%
<i>Advocacy/Campaigns</i>	60	20%
<i>Misinformation/Denial</i>	45	15%
<i>Humour/Satire</i>	30	10%
<i>Total</i>	300	100%

Engagement Dynamics

Analysis of engagement metrics, likes, reactions, comments, and shares, revealed significant differences among content types. Misinformation and conspiracy posts consistently received the highest engagement, outperforming scientific content by a factor of 2 to 3 across all engagement indicators. These posts tended to provoke strong emotional responses, which translated into high user interaction. Polarising or sensational claims such as “climate change is a hoax” or “global warming is engineered for control” often generated extensive comment threads, including both support and heated debate. Fear-based content, whether part of emotive narratives or misinformation, generated rapid engagement spikes shortly after posting. Posts showing dramatic imagery, wildfires, floods, or melting glaciers, elicited immediate emotional responses. However,

such engagement was associated with polarised comments, with users expressing fear, urgency, scepticism, or hostility, often leading to contentious debates. This polarisation contributed to ideological clustering within comment sections. Scientific content, in contrast, received more modest engagement. While often shared by users interested in climate education, these posts rarely produced large comment threads or high reaction counts. Their more neutral tone and reliance on data appeared less engaging within Facebook's attention-driven environment. Advocacy and solution-oriented posts generated moderate engagement, particularly when framed around collective action or community mobilisation. Humor and satire posts received mixed engagement. Memes and humorous content were often widely shared but generated fewer in-depth discussions. Facebook's engagement patterns favoured emotionally provocative or controversial content, amplifying narratives that are not always aligned with scientific reality.

Table 2:

<i>Content Type</i>	<i>Avg. Likes</i>	<i>Avg. Shares</i>	<i>Avg. Comments</i>
<i>Emotive/Personal Narratives</i>	480	270	130
<i>Misinformation</i>	440	310	120
<i>Scientific Content</i>	320	180	90
<i>Advocacy Posts</i>	250	140	70
<i>Satire/Humour</i>	190	90	40

Thematic Analysis

Five major themes emerged from the thematic analysis:

Echo Chamber Reinforcement (30%)

This was the most dominant theme. Many posts were shared within ideologically homogeneous groups where members held similar beliefs about climate change. As a result, posts often reinforced existing attitudes rather than exposing users to diverse viewpoints. Comments typically expressed solidarity, validation, or mutual confirmation, suggesting strong group cohesion. In some groups, dissenting opinions were discouraged, leading to further insulation of shared beliefs.

Hope/Solutions (25%)

Posts within this theme emphasised positive action, innovation, and collective capability. Examples included community-led initiatives, technological advancements in renewable energy, and success stories of sustainable practices. These posts fostered empowerment and optimism, encouraging users to feel that climate challenges were solvable. Engagement tended to include supportive comments expressing motivation and shared commitment.

Fear/Urgency (20%)

This theme included distressing imagery, warnings about extreme weather, and narratives emphasising catastrophic consequences. Posts invoked fear, sadness, or alarm to highlight climate risks. While effective in attracting attention, these posts often triggered emotional fatigue or defensive reactions in comment sections. They contributed to both heightened awareness and increased polarisation.

Conspiracy/Denial (15%)

These posts questioned the validity of climate science or alleged hidden agendas. Comments often included strong ideological positions, reinforcing mistrust in institutions. Threads showed clusters

of users who mutually reinforced climate scepticism, sometimes supplementing the original post with additional misinformation.

Blame Framing (10%)

Posts framed climate responsibility around specific actors such as governments, corporations, or particular countries. Comments frequently turned into debates about accountability. Blame framing amplified frustration and sometimes diverted attention from solutions.

Survey Findings

Survey responses from 200 participants offered insights into how exposure to these content types influenced climate perceptions.

- i. Respondents who frequently engaged with emotive or solution-focused content reported higher empathy toward climate-affected communities and a stronger sense of personal and collective efficacy. These individuals also demonstrated greater support for mitigation policies such as renewable energy incentives, carbon taxation, and stricter emissions regulations.
- ii. Conversely, exposure to misinformation correlated with increased scepticism, reduced trust in scientific institutions, and a greater likelihood of questioning the seriousness of climate risks. Respondents who interacted regularly with conspiracy content showed heightened mistrust of governmental and international institutions.
- iii. Digital literacy emerged as a key moderating variable. Participants with higher ability to evaluate online sources and identify misleading content were more likely to accept scientific explanations and less likely to be influenced by misinformation.
- iv. Institutional trust also played a central role. Individuals who trusted scientific bodies and government agencies expressed greater willingness to support regulation-based climate policies. Those with low institutional trust showed resistance even when aware of climate risks.

Overall, the survey indicates that Facebook content significantly shapes public attitudes, with emotional tone, information quality, and user literacy interacting to influence climate-policy support.

Discussion

This study provides strong evidence that Facebook operates as a climate knowledge infrastructure in which algorithmic curation, emotional valence, and social reinforcement interact to shape how climate information is encountered, interpreted, and circulated. Rather than acting as a neutral communication platform, Facebook's structural and behavioural logics actively influence the visibility, credibility, and emotional impact of climate-related narratives. The findings offer important insights into the digital determinants of climate perception and illustrate how platform-specific mechanisms contribute to public understanding, and misunderstanding, of climate change. A key outcome of the study is the confirmation that engagement-driven algorithms consistently amplify sensational, polarising, and misleading content at the expense of credible scientific communication. Despite scientific posts comprising a significant share of the dataset, they consistently generated the lowest levels of engagement. In contrast, misinformation and conspiracy narratives achieved disproportionately high reach, visibility, and interaction. This pattern reinforces earlier research which shows that false or misleading information spreads more rapidly and broadly on social media than factual content (Treen, 2020); (Humprecht, 2024). Algorithmic prioritisation of content that stimulates emotional or cognitive arousal means that provocative or controversial posts are rewarded with greater exposure, regardless of their accuracy. Consequently,

users' informational environments become saturated with content that may distort or undermine scientific understanding.

The heightened engagement observed for fear-based and emotionally charged narratives also aligns with psychological research showing that arousal increases sharing but reduces cognitive deliberation (Kensinger, 2004) (Brady, 2019). In this study, posts emphasising climate catastrophes, extreme weather, or apocalyptic scenarios generated rapid engagement spikes, confirming that fear attracts attention. However, such content also magnified polarisation, as reflected by emotionally charged and ideologically polarised comment threads. While fear can momentarily heighten awareness, it may also promote fatalism or disengagement if not paired with solutions or efficacy cues. This suggests a complex dual role for fear-based messaging: it captures attention but does not necessarily cultivate constructive support for climate action. On the other hand, solution-oriented and hope-based posts demonstrated more positive behavioural and attitudinal outcomes. Users exposed to messages emphasising technological innovation, community action, or achievable climate goals reported higher perceived efficacy and stronger policy support. These findings align with broader research arguing that hope-based communication can strengthen motivation and foster sustained engagement (Gustafson, 2020); (Geiger, 2023). This study therefore highlights the importance of balancing emotional resonance with constructive messaging to avoid overwhelming audiences while still conveying urgency.

One of the most significant findings concerns the centrality of echo chambers. The thematic analysis showed that a substantial proportion of content circulated within ideologically homogenous networks, reinforcing group norms and limiting exposure to diverse viewpoints. This is consistent with previous studies demonstrating that Facebook's network structure and algorithmic filtering foster selective exposure and ideological clustering (Del Vicario, 2016); (Bakshy, 2015). Within such echo chambers, climate narratives become identity-aligned, meaning that beliefs about climate change are shaped not only by information content but also by group identity, cultural values, and political loyalty. (Sunstein, 1999) model of group polarisation helps explain the intensification of attitudes observed in these environments: when individuals interact primarily with like-minded users, their views tend to become more extreme, less flexible, and more resistant to counter-evidence. This fragmentation of the digital climate sphere has direct implications for climate policymaking and public engagement. As (Drews, What explains public support for climate policies? A review of empirical and experimental studies., 2016) argues, public support for climate policies depends heavily on perceptions of scientific legitimacy, institutional trust, and shared societal understanding. However, when users inhabit distinct informational ecosystems, each reinforcing their own beliefs, consensus becomes increasingly difficult to achieve. The study's findings reflect this fragmentation: misinformation exposure was associated with scepticism and reduced trust in institutions, while solution-oriented content facilitated greater openness toward regulatory climate measures. These divergent effects underscore the role of digital environments in shaping policy attitudes.

A further contribution of this study lies in its integrative mixed-methods approach, which combines content analysis with survey data to map the relationship between digital communication patterns and individual-level perceptions. While prior research has described the presence of misinformation, echo chambers, and emotional amplification on social media, fewer studies have empirically linked these content dynamics to psychological and attitudinal outcomes. By synthesising qualitative and quantitative evidence, this study demonstrates that climate communication on Facebook cannot be understood solely through traditional media theories focused on mass messaging and broadcast effects. Instead, it must be analysed within the broader context of algorithmic media logic, which shapes what information circulates, how users interact with it, and which narratives gain prominence. The findings also extend agenda-setting theory into

the digital domain. In classical agenda-setting, media outlets influence public priorities through selective emphasis. In Facebook's environment, however, agenda-setting is co-produced by users, algorithms, emotional cues, and engagement metrics. This hybrid form of influence means that both platform design and user behaviour collectively determine which climate narratives become salient. This study demonstrates that Facebook's climate discourse is not simply a reflection of public opinion but a digitally mediated phenomenon shaped by algorithmic amplification, emotional engagement, and social identity dynamics. These findings emphasise the urgency of developing strategies that address the structural drivers of misinformation while leveraging emotionally constructive communication to enhance climate-policy support.

Conclusion

Facebook's algorithmic and social architecture plays a decisive role in shaping the climate information landscape to which users are exposed. By prioritising content that maximises engagement, the platform systematically amplifies emotionally charged, polarising, and misleading narratives. This dynamic environment influences how individuals perceive climate risks, whom they trust as credible information sources, and which policy measures they are willing to support. The study demonstrates that misinformation and conspiracy narratives not only circulate widely but consistently outperform scientific communication in terms of visibility and user interaction. Fear-based and sensational content further intensify emotional arousal, contributing to heightened polarisation and reducing the likelihood of balanced, evidence-based dialogue. At the same time, the findings highlight that not all emotionally charged communication is detrimental. Solution-oriented, hopeful, and positively framed climate messages enhanced engagement, strengthened perceptions of personal and collective efficacy, and increased support for mitigation policies. These results underscore the importance of recognising the dual role of emotion in digital climate communication: while certain emotional triggers can distort understanding, others can mobilise constructive attitudes and behaviours. Addressing the challenges posed by Facebook's climate discourse requires a multi-level response. Platform-level interventions, such as algorithmic transparency, reduced amplification of misinformation, and promotion of verified scientific sources, are essential. Equally important is the enhancement of public digital literacy to enable users to critically evaluate online climate content. Finally, communicators and policymakers must adopt strategic approaches that integrate emotional and psychological insights to promote engagement while safeguarding scientific integrity.

Limitations

This study is subject to several limitations that should be considered when interpreting the findings. First, the analysis focused exclusively on Facebook, which, although one of the most widely used social media platforms, has distinct algorithmic features and user demographics. As a result, the patterns observed here may not be fully generalisable to other platforms such as Twitter, YouTube, TikTok, or Instagram, each of which exhibits unique content dynamics, engagement cultures, and misinformation pathways. Second, the six-month sampling frame may not adequately capture temporal variations in climate discourse, particularly during periods of extreme weather events, political shifts, or global climate negotiations, which can temporarily reshape online discussions. Additionally, the survey component relied on self-reported data, which may introduce biases related to recall accuracy, social desirability, or subjective interpretation of questions. The sample size, while adequate for exploratory analysis, may not represent the full diversity of Facebook users or climate-engaged populations. Future research would benefit from longitudinal designs that track changes in climate discourse over extended periods and cross-platform comparisons to identify how different algorithmic logics shape climate narratives. Incorporating

behavioural measures and experimental designs may further strengthen causal interpretations and deepen understanding of digital climate communication.

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