

“There are more serious problems”: Exploring Climate Change Denial in YouTube’s Search recommendations

Team Members

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Summary of Key Findings

The goal of this research was to determine what kinds of videos were recommended based on Youtube's algorithm under anti climate related videos and how these were perceived by the public. Through using tools such as Youtube Data Tools, 4Cat and Prompt Compass we have found that the majority of the videos in total were pro-climate change (believed in climate change) however the keyword climate change alarmism, although suggests a pro stance, had the most anti-climate videos and comments overturning positive comments.

1. Introduction

Youtube

YouTube is one of the most influential video platforms, with over 2.7 billion monthly active users worldwide (Global Media Insight, 2025). Its recommendation algorithm plays a critical role in shaping user experiences by promoting content based on search queries. Given the platform's wide reach, the nature of the videos it recommends on urgent topics like climate change has significant implications for public understanding, discourse and action.

Climate Change

Climate change is one of the most pressing global challenges, requiring informed action. However, the topic is also rife with misinformation and anti climate science narratives, ranging from outright denial to healthy skepticism on the fairness of certain actions. The types of videos YouTube recommends when users search for climate change-related content can influence how audiences perceive the issue, their trust in climate science, and their motivation to support climate action (Allgaier, 2019).

Content Creation

YouTube allows for various video formats on the topic, ranging from 30 second vertical filmed shorts to 3 hour horizontal filmed roundtable discussions, from privately funded vlogger opinions to publicly funded news outlets, from sobering and unbiased data driven content to emotional appeals driven by personal experiences. Both the format and the content can influence what stance the video ultimately takes, where videos may fall largely under: pro-climate science, neutral climate science or anti-climate science (Erviti et al., 2020). While

pro-climate science content tends to emphasize data-driven insights and solutions, anti-climate science videos often question the credibility of research or frame climate change as exaggerated. However, YouTube's algorithm seeks to maximize engagement, potentially recommending videos with provocative or controversial content, which can create the appearance of 'neutrality'. This occurs when videos from both pro- and anti-climate science perspectives are presented as equally valid, regardless of their alignment with the scientific consensus.

Narrative Creation

The tactics of climate misinformation may have evolved, with denialism giving way to alarmism about the costs or feasibility of addressing climate change. Anti-climate science content often shifts focus from outright denial of climate change to portraying climate policies as economically disastrous or socially disruptive (de Nadal, 2024). Conversely, alarmism from pro-climate science may emphasize catastrophic scenarios to drive urgency. These strategies on YouTube contribute to heightened emotional responses, creating places for polarization and reducing the likelihood of constructive actions together. Furthermore, terminology used in content, such as "denial" and "alarmism," carries inherently negative connotations. For pro-climate science, searching for climate 'denial' may skew search results, by recognising denial as a negative thing it will show content which clearly paints climate deniers in a bad light. Meanwhile 'alarmist' is often used to discredit proponents of climate action as overly dramatic or fearmongering.

Comment Creation

YouTube's comments section allows individuals from opposing sides of the climate debate to converge. Pro-climate science viewers often comment on videos challenging the scientific consensus, attempting to correct misinformation, while skeptics may engage with pro-climate science content to voice dissent. Previous research suggests that comment sections may become echo chambers with recurrent impoliteness and consistent points of view shared (Andersson, 2021). However, comment section analysis over extended periods of time may reveal different findings.

Our Research

This research investigates YouTube as a video platform without clear moderation policies about climate content (unlike, for example, TikTok). This means that channels can post climate-change related videos which may spread misinformation, disinformation or twisted narratives that go against scientific consensus on climate change. While these videos do not violate the guidelines of the platform, they may be causing environmental harm outside of the digital spaces. Users exposed to misinformation are often less likely to support vital mitigation policies (Cook, 2020).

In this study, we combine quantitative and qualitative methods and large language models (LLMs) to analyze how the YouTube algorithm prioritizes videos of different stances on climate change by comparing the search outputs across different climate-change related keywords. We then more closely examine the most engaged videos categorised as anti-climate science and user comments through sentiment detection, and finally examine stances of comments over time. Our research sheds more light on YouTube's role in shaping the public discourse about climate change and reflects on the use of LLMs for classification problems in social sciences.

2. Initial Data Sets

Youtube Videos

The data that we used was extracted from Youtube. Firstly we had to come up with keywords related to climate change. We gathered YouTube videos using the YouTube Data Tools (Rider, 2015). We collected 50 videos per keyword and scraped transcripts that were available on 7 January, 2025. Our final dataset includes 288 videos: climate change (n = 50), climate change denial (n = 46), climate change hoax (n = 47), climate change myth (n = 49), climate change conspiracy (n = 49), climate change alarmism (n = 47).

Initially we collected data from Tiktok, for the same keywords used for the YouTube data except for hoax and conspiracy where we received an error: “This text may be associated with behavior or content that violates our guidelines. Promoting a safe and positive experience is TikTok's top priority. For more information, we invite you to read our Community Guidelines.” We then used the keywords “ho@x” and “c0nspiracy” instead.

However, later in our research when we used Prompt Compass software to do stance detection (Borra & Plique, 2024), the software failed to detect the stances accurately and therefore we have decided to not go further with our TikTok data.

Comments

YouTube Data Tools (Rider, 2015) was used again to gather data on the comments. We ended up with 10,000 comments in total. After filtering out the comments with no likes and no replies, we ended up with 600, which we then uploaded to Prompt Compass software (Borra & Plique, 2024) in order to detect their stances. We ended up having 150 comments with the results from the software.

3. Research Questions

For our research we came up with one main research question and 3-sub questions:

Main RQ: What kind of videos does YouTube recommend when searching for climate-change related content?

How are videos of varying stances on climate change – pro-climate science, neutral and anti-climate science – distributed within the top search results?

What kinds of narratives emerge from the anti-climate science videos?

How does the audience react to anti-climate science videos?

We wanted to see the discourse around climate change through Youtube videos, and how the formats of the videos contributed to the spread of climate change related narratives. Our goal was also to consider the contribution and reaction of the user and through our methodology we managed to answer these questions successfully.

4. Methodology

Stance categorisation with LLM

As the first step of our analysis, we categorized the stances of YouTube videos based on their transcripts into three categories: (1) pro-climate science, (2) neutral, and (3) anti-climate science. To determine these stances, we utilized a large language model (LLM) through the

Prompt Compass software (Borra & Plique, 2024), which provides access to various LLMs and tasks rooted in academic literature.

We experimented with multiple models and prompts, observing significant variation in outputs depending on the specific model, prompt design, and dataset used. To ensure reliability, we validated the results of each iteration against a random sample of data. Based on this validation process, we selected GPT-4o-mini for its cost-effectiveness and its tendency to classify anti-climate science content accurately, minimizing the risk of false positives. We tasked the LLM with sentiment detection (Møller et al., 2023) of the video transcripts using the following prompt:

If a media scholar considered the YouTube transcripts, which stance would they say it held towards climate change?

A: Pro climate change issues (The content accepts climate change as an issue)

B: Neutral on climate change issues (The content is undecided on climate change as an issue)

C: Anti climate change issues (The content does not accept climate change as an issue)

Constraint: Answer with only the option above that is most accurate and nothing else.

The LLM outputs were visualized in RStudio to analyze the distribution of stances across keywords, with the potential to map these results against other video characteristics, such as search position and view counts. We used the same prompt to categorise user comments under the anti-climate science video with the most engagement. The results were visualized using RAWGraphs 2.0.

We have used the same software, *Prompt Compass*, for sentiment detection of the 600 comments we have gathered under different anti-climate keywords by using the following prompt:

If a political Youtube moderator considered the above comments, which stance would she say it held towards climate change?

A: For climate change

B: neutral on climate change

C: against climate change

Constraint: Answer with only the option above that is most accurate and nothing else.

The outputs, which were 150 comments, were used to visualise the most engagement under the specific keyword climate change alarmism by using a beeswarm graph on RAWGraphs 2.0.

Theme analysis

To answer the RQ2, we closely examined the anti-climate science videos as categorised by the LLM focusing on 10 most viewed videos. We watched and read through the transcripts of these videos and conducted a thematic analysis to extract the “patterns of meaning” prevalent in the anti-climate science videos (Braun & Clarke, 2012). The thematic analysis in our case was fully deductive, meaning that categories derived from the data.

5. Findings

1. Distribution of different stances

Figure 1 illustrates the distribution of different stances per search query. The majority of the videos in our sample ($n = 226$) were categorized as pro-climate science, comprising approximately 78.5%, illustrating that the top search results on YouTube are dominated by content that goes along the scientific consensus. Anti-climate science videos accounted for 56 videos (19.4%), while 6 videos (2.1%) were categorized as neutral. Pro-climate science videos were the most prevalent for the keyword *climate change*, with 96% of all ($n = 48$) representing pro-science content and the rest 4% ($n = 2$) being on the side of climate denialism. Anti-climate science videos were most prevalent for the keyword climate change alarmism, with over half of the videos ($n = 25$) representing climate obstruction.

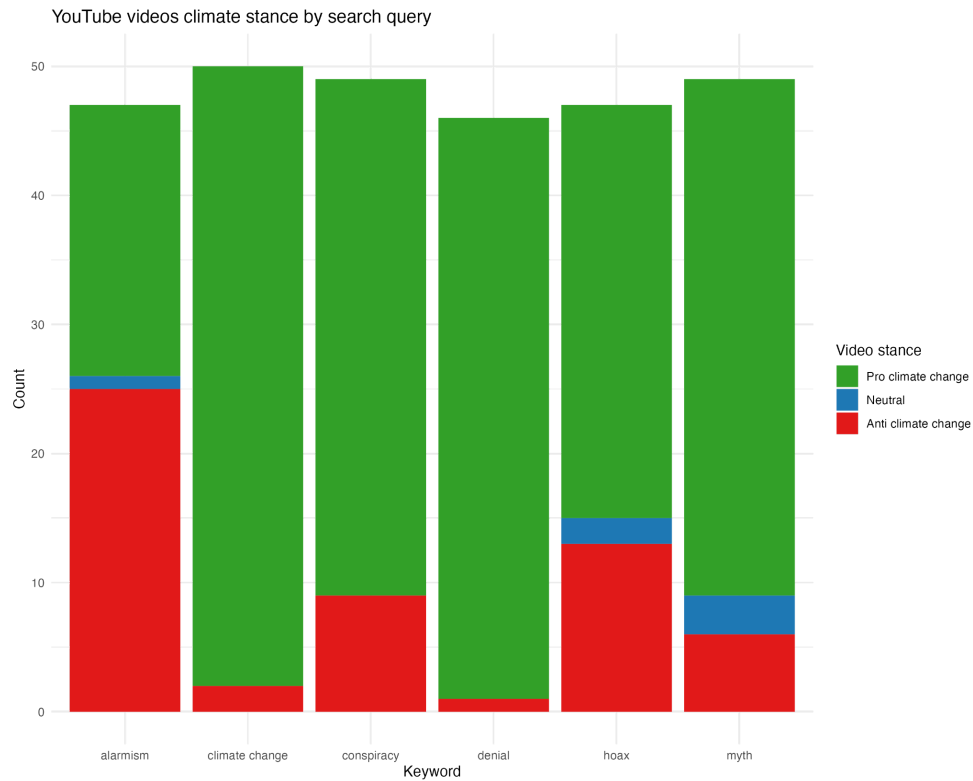


Figure 1. Video stance distribution across search queries

2. Youtube's top recommendations

Figure 2 illustrates the distribution of these stances across various keywords, while also visualizing the videos' positions in the search output and their view counts. Notably, anti-climate science videos frequently appeared at the top of the search results, even for a neutral keyword like *climate change*, reflecting YouTube's moderation policies – misleading videos about climate are demonetized but allowed¹.

¹ YouTube (2021): Updating our ads and monetization policies on climate change. <https://support.google.com/google-ads/answer/11221321?hl=en>

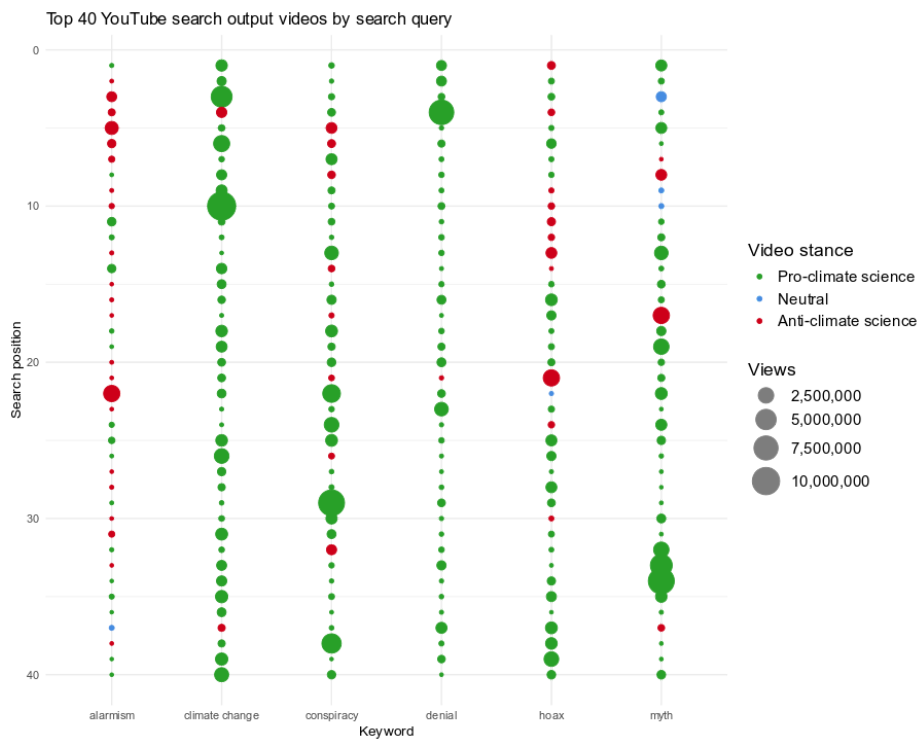


Figure 2. Top 40 YouTube videos by search query

Moreover, we can observe that the keyword *alarmism* consistently includes more anti-climate science videos throughout the entire timeline, even though these videos tend to have lower view counts compared to those associated with other keywords. We assume this keyword serves as a counter-narrative to the ones of pro-science, framing the warnings associated with climate change as exaggerated or politically motivated. However, it requires a qualitative examination to examine the anti-science narratives that are promoted in those videos.

3. Anti climate narratives

To understand anti-climate narratives, we have closely watched and analysed the most viewed anti-climate videos on YouTube, as categorised by the LLM. There were a few narratives that were prominent throughout our research. We categorised these narratives into three different stages of reacting to climate change as an issue:

Denial of the issue (where there was said to be not enough evidence or scientific consensus around climate change)

Undermining the problem of climate change (with narratives reducing the urgency of climate action)

Evading responsibility and blaming countries in power and big corporations for climate issues



Figure 3. Example stills of anti-climate content

As seen from Figure 3, these narratives were determined based on the context of these videos. The majority of the videos under anti-climate keywords consisted of political speeches, conferences, parodies and discussions. Through manually going through the top most engaged anti-climate science videos we have gathered some quotes that represents our choices of these 3 narratives:

“There is no evidence that it is different now than it has been for the last few thousand years”.

“There are more serious problems. A million people die from dysentery”.

“...the concept of global warming was created by and for the Chinese”

4. Users’ Stances in Comments

We choose one of the videos that has the most engagement from the alarmism keyword. Since we are interested in why YouTube curates more anti-climate science videos only from the alarmism keyword, we wondered what are the stances of those audiences that search for this keyword and their reaction after watching the anti-climate video by looking at their comments.

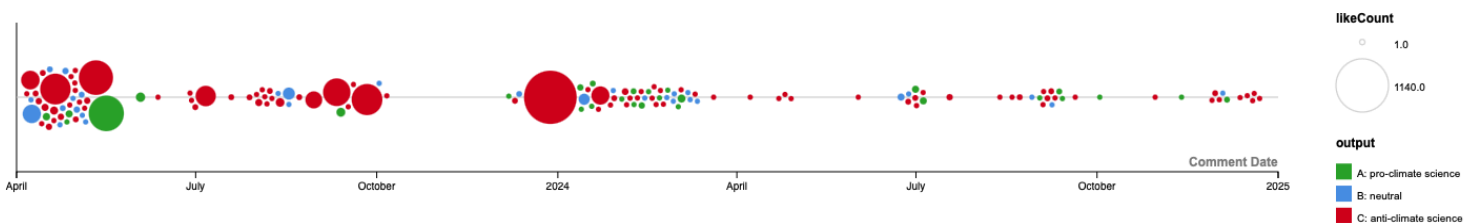


Figure 4. Beeswarm Plot of Comments from the most engagement climate change alarmism video
(RAWGraphs 2.0)

From Figure 4, all the bubbles gathered in the early comments are mostly anti-climate science and some neutral. Reasonably, anti-climate comments gather the most likes under an

anti-climate video. The anti comments remain persistent over 1.5 years. On the other hand, there were only a few pro-climate comments in the beginning but they died down over time. Overall, we can see most of the audiences are with the same stance of the video. Therefore, we conclude the alarmism keyword attracts more anti-climate audiences but we still don't know why YouTube curates more anti-climate videos from the alarmism keywords.

6. Discussion

The top results of each keyword on Youtube has shown that the algorithm does not line the videos up by view. Although we have selected the option to see videos based on relevance, it was surprising to see the top viewed videos towards the bottom. Our graph has shown that there is an overall good reception towards climate science from the uploaders. There were little to no videos that were neutral which was expected since Prompt Compass detected even the informative “unbiased” videos as pro due to the lack of negative perception of the issue. Most videos that were shown at the top were pro-stances which proved that the algorithm is highlighting overall the positive videos despite using negative keywords associated with climate change.

Research question 2 findings revealed a variety of anti-climate narratives which paint a more nuanced picture than anti-climate science videos outright denial of the issue. Indeed, a closer manual look at the video content related to climate-denial were found in pro-climate science videos. Thus, the search engine recognises that ‘denial’ is more objectively a negative term and the video's narratives delve into topics like the climate deniers playbook. However, a closer inspection of the narratives formed in the anti-climate videos and in particular, with the ‘alarmism’ keyword, suggest that outright denial of the issue may no longer be a credible reaction but that poking holes in uncertainty of climate science, undermining the issue and evading responsibility are part of a new playbook. This is consistent with other research showing how anti-climate science narratives have changed over the years (de Nadal, 2024) . However, the generated narratives may further be compared to models of emotional responses to difficult situations (Kubler-Ross, 1969) often used in grief counselling from denial, anger, to bargaining, to depression and finally acceptance. Unfortunately, given the context of study we did not find any users who went from climate denial to climate acceptance.

The first narrative we found was denial, not of the issue itself but of consensus on the issue. Some videos suggested that 97% scientific consensus is not enough and until climate-science can 100% agree on the issue, we should not act. However, within the realms of science, complete certainty does not exist. So the narrative itself may never be disproven, despite the doubts it creates on climate action. The other main narrative that we have found which is undermining the problem was the most consistent narrative throughout all the anti-climate videos. These videos were attempts to sway the attention to other problems that people need to focus on “now” rather than issues that will become important in the future which they believed to be climate change. These videos were also not a denial of climate change but rather dismissing the urgency claiming it has been around for years which means there is no need for being alarmed, hinting at climate change alarmists. And lastly evading responsibility was a big theme since most of the actors on these videos were putting the blame on countries with higher populations. This theme has been found consistent and so is a lot of political speeches which showed us how Youtube favoured content of conferences or politicians. We found that this could be related to the accuracy of the content, meaning which content Youtube thinks is the most accurate or of importance. These have been found to be majority white political figures in the US.

Our 3rd research question, which is related to users' sentiments regarding the issue, was answered through the comments on various youtube videos. We have collected in total 150 comments under the alarmism keyword and asked *Prompt Compass* (Borra & Plique, 2024) to detect the commentators' sentiments. Through this we have found that many commentators had an anti view on climate change which we thought might be related to the anti-alarmism narrative that emerged from the videos we collected. Although alarmism and climate-alarmists emphasise on the importance of the issue, the keyword might have negative connotations due to the perception of the word “alarmism” which is closely associated with extremists. Therefore, although our results were surprising, since anti-climate comments were quite persistent, we have connected our findings to the narratives of the first few videos that Youtube recommends.

7. Conclusion

Our initial findings have shown some implications that are counterintuitive to our original assumption which paves the way for future large scale research to answer the main question: What kind of videos does YouTube recommend when searching for climate-change content? Our findings also highlight some methodological strengths and weaknesses in using prompt design, and LLMs to categorise and analyse digital media.

First, our findings suggest that based on our keywords YouTube's algorithm overwhelmingly returns pro-climate science content. However, this does not necessarily mean that those with anti-climate science stances view the videos and perceive them as such. 19.4% of our videos were anti-climate science, with more than half of these coming from the keyword *alarmism*. This suggests that for climate science to be taken seriously by anti-climate science viewers it might display content which shows climate actions which does not create panic but does so with a sense of urgency. Regarding the LLM's categorization, our findings have a high-level implication that YouTube provides a certain stance of video depending on the keywords. However, we do not know how YouTube curates videos and how the algorithm interprets the keyword yet. This could be interesting for future research when analysing other social science cases to see if it is possible to map out stances of how other topics are formatted by YouTube.

Second, our findings suggest there are various narratives that can be found even within the same keyword searches. With the help of LLM sentiment detection we find three consistent anti climate narratives around denial, undermining and evading responsibility. However, we manually checked these narratives not relying solely on the LLM interpretation. Initial sentiment detection output was somewhat generic. This could be due to neutrality bias in LLM's, or perhaps due to our analysis of transcripts only. Future research on narratives that extract images could yield different results, especially as many of the anti-climate videos were presented by older, white, men whose agenda on the issue remains questionable.

Third, from looking at the comments, our findings also suggest that most of the audience are agreeing with the same stance of the video, which implies that YouTube is feeding the same stance video and creating the echo chamber. However, we wonder if this would be the case for the *alarmism* keyword but identified as pro-climate videos by LLM, or videos from the other five keywords. In future research, mapping out all the audience stances and comparing

them with the video stances of each keyword, prompting LLM with a designed persona replicating the audience's video watching and ideology forming journey provided by YouTube when detecting the stances could potentially picture the serious problem that we aimed to map out with the issue making on YouTube.

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