International Institute for Applied Systems Analysis

Session IV: Driving Change- harnessing the power of data and innovation in the age of information Security

Daniel Kroos, Guest Research Scholar
Nadejda Komendantova, CAT Group Leader
Dmitriy Erokhin, Research Scholar
International Institute for Applied Systems Analysis

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Introduction

Overview: In the era of accelerating climate change, digital platforms like YouTube are not just sources of information, they are spaces where emotions, narratives, and ideologies collide. As climate adaptation becomes more urgent, understanding how online discourse shapes public sentiment is crucial.

Context: Social media platforms significantly shape public perceptions and attitudes toward climate change. They function as arenas of both collective solidarity and polarized debate.

Research Question: Does social media discourse around climate change foster societal solidarity or deepen polarization?

Aim of the Study: This research examines the emotional dynamics and stances on misinformation in YouTube comment sections. It seeks to uncover how public discourse around climate adaptation may either build collective engagement or trigger division, particularly through expressions of anxiety.

Structure

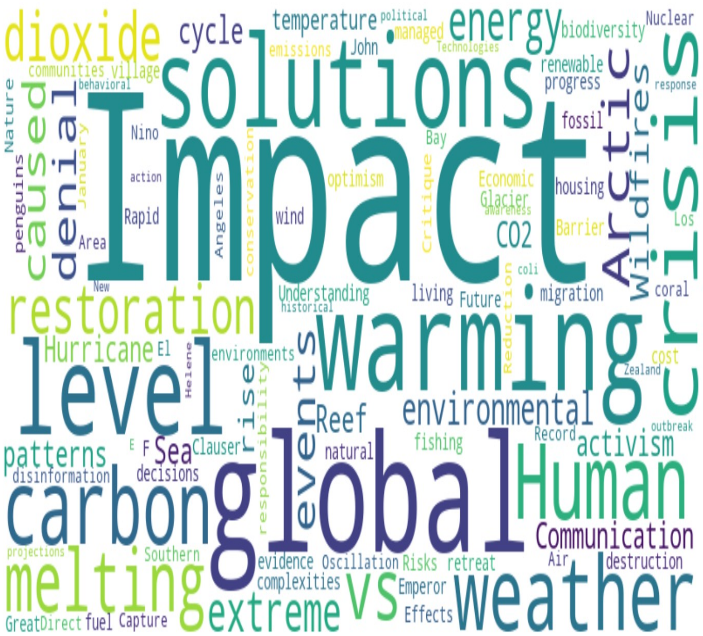
- **Part 1**: General overview of emotional patterns and polarization in climate discourse
- **Part 2**: A focused analysis of **anxiety-related comments** and their social meaning

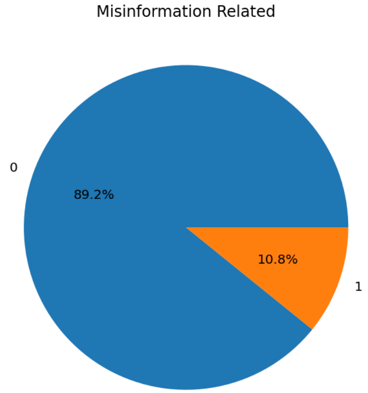
Methodology

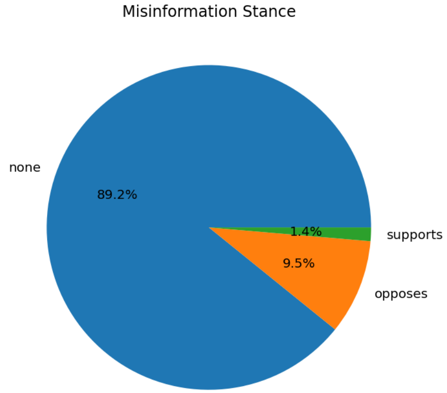
- 74 English language videos most relevant to the search query of "climate change" with comments extracted from YouTube on April 16, 2025 using YouTube API.
  - Views : 1 100 to 13 714 014 (mean: 1 460 616.54, std: 2 695 756.00);
  - Published from 2014-04-22 to 2025-03-25. Most videos published: 2024-10:7 videos; 2025-03: 7 videos.
- 334 708 comments extracted for these videos.
  - Likes: 0 to 69 416 (mean: 7.26, std: 255.68);
  - Responses: 0 to 756 (mean: 0.68, std: 7.40);
  - Published from 2014-04-22 to 2025-03-25. Top 5 months by comment count: 2021-09: 40 053 comments; 2022-04: 26 837 comments; 2020-06: 25 734 comments; 2024-01: 22 800 comments; 2023-09: 18 569 comments.
- OpenAI API model gpt-4o-mini used to process the comments.
- Potential limitations: representativeness of selected videos, platform-specific trends and algorithmic filtering, limitations of OpenAI API model.

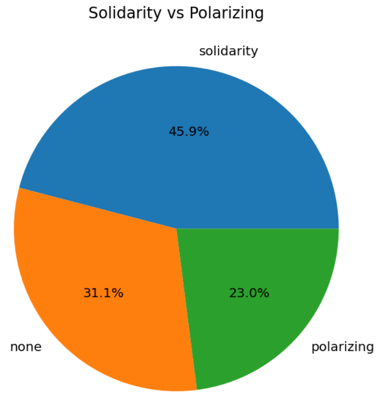
Part 1: General overview of emotional patterns and polarization in climate discourse

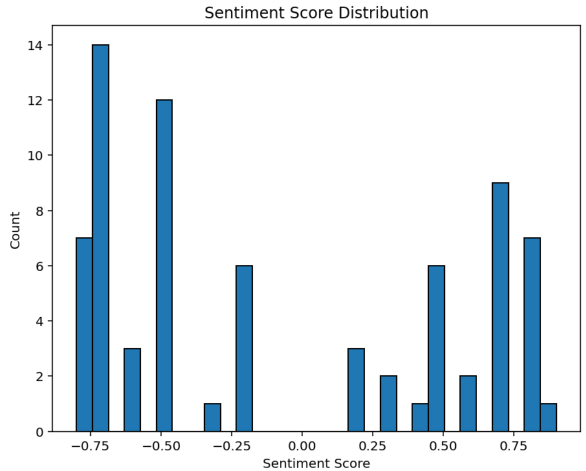
Videos


Impact
solutions
global
warming
level
carbon
Human
weather
crisis
Arctic
restoration
dioxide
melting
extreme
energy
environmental
Communication
wildfires
denial
caused
events
Hurricane
activism
vs

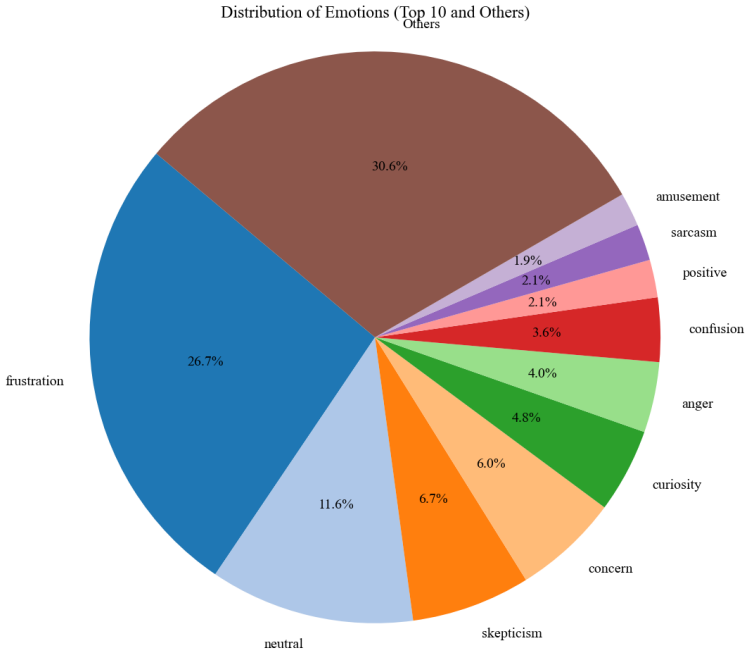

Misinformation Related
0
89.2%
10.8%
1

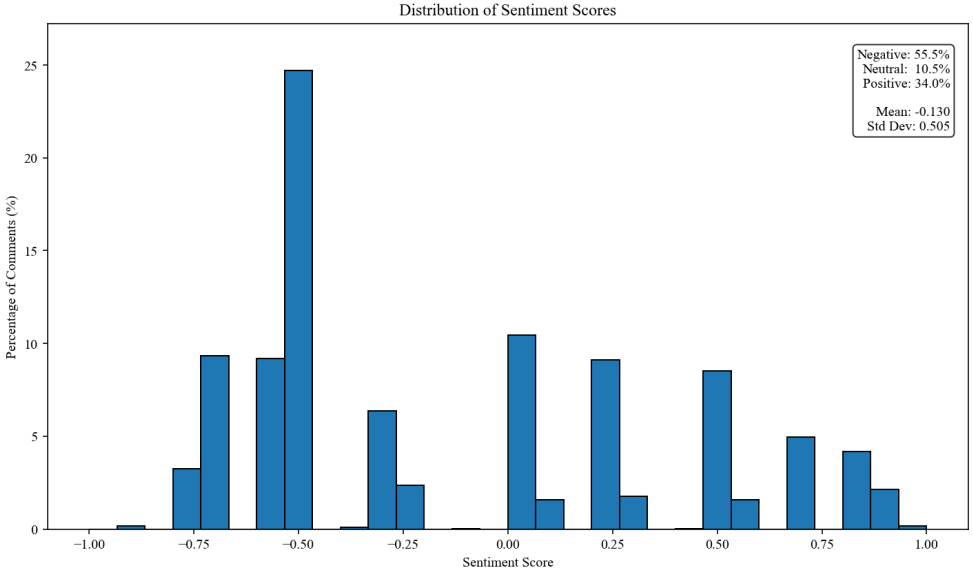

Misinformation Stance
none
89.2%
1.4%
supports
9.5%
opposes


Solidarity vs Polarizing
solidarity
45.9%
31.1%
23.0%
none
polarizing


Sentiment Score Distribution
Count
Sentiment Score
0
2
4
6
8
10
12
14
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75

Sentiment score and emotions





Correlation between video sentiment and average comment sentiment: (ρ = 0.368, p = 0.001)

Most frequent emotions in polarizing and solidarity comments (in %)

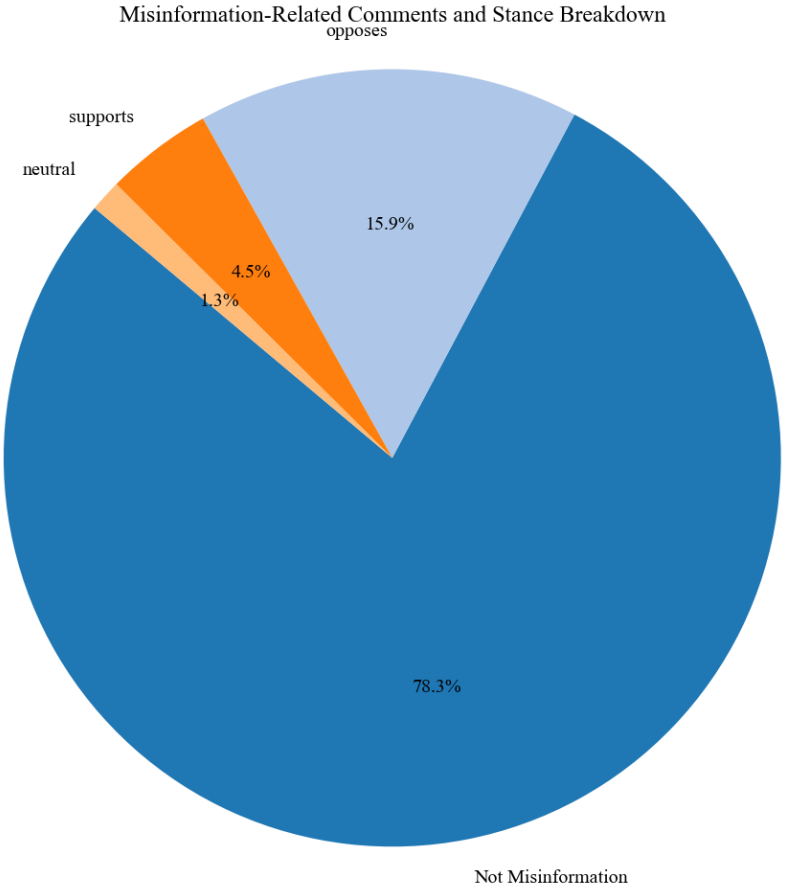
	frustration	skepticism	anger	concern	sarcasm	cynicism	fear	dismissive	discontent	suspicion
polarizing	50.9	15.1	11.1	2.7	3.4	1.9	1.4	1.3	1	0.9

	hope	gratitude	positive	frustration	joy	concern	optimism	agreement	determination
solidarity	18.9	9.5	7.6	6.6	6.2	5.3	5	3.3	3.1

Misinformation stance

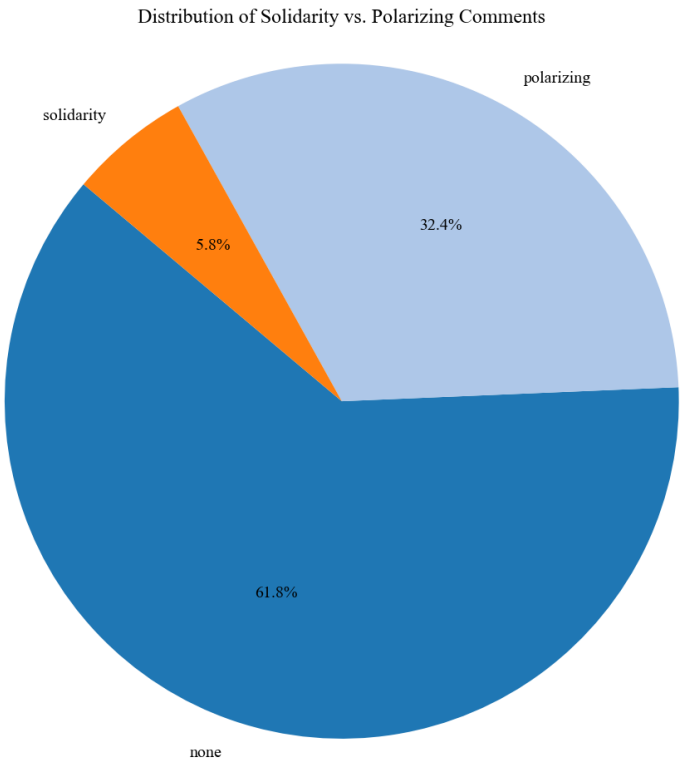
Examples of comments (altered for the purpose of anonymity):

- Supporting: Remember climate change is created by CERN.
- Opposing: You should listen to real scientists.



Most frequent misinformation narratives

Narrative category	Example claim	%
Attribution & causality misrepresentation	Climate shifts are entirely natural (sun-cycles, volcanoes, Milanković cycles).	**27.83**
	CO_2 is plant food; more of it is good and can't warm the planet anyway.	
Climate change denial	There is no climate crisis – global warming is a hoax.	**25.77**
Conspiracy theories	Climate is being engineered by chemtrails / HAARP / weather weapons.	**24.04**
Impact denial / minimization	The claimed impacts (sea-level rise, reef death, extreme weather) aren't happening.	**12.78**
Delegitimization of science & institutions	Scientists and agencies fake the data.	**7.70**
	Climate change is a political scam to tax and control the public.	
Others		**1.88**



Solidarity vs. polarizing

Examples of comments (altered for the purpose of anonymity):

- Solidarity: Humanity should protect the ecosystem now!🌎.
- Polarizing: Climate change is a fake problem created by the UN. It has always changed.

Solidarity claims

Expressions of gratitude and encouragement
- Thank you so much
- Keep up the good/great work
- Thank you for making this video
- I really needed this / I needed to hear this
- Thank you for giving me hope

Calls for collective action
- We all need to fix it
- We can do this / We can fix it
- Need to work together
- Do something about climate change
- We need more people to act

Affirmations of climate science
- Climate change is real
- Scientific consensus on climate change
- Human activity is driving climate change

Solidarity and unity
- We're all in this together
- Every nation on Earth must act
- Part of the solution
- The world a better place

Hope and optimism
- Hope for the future
- Make a difference
- It's not too late
- Breath of fresh air

Polarizing claims

Climate denial and hoax narratives
- Climate change is a hoax/myth/scam
- There is no climate crisis/change
- Climate change isn't real
- Man-made climate change is fake

Natural climate change arguments
- Climate has always been changing
- Climate change is natural
- Coming out of an ice age
- CO_2 is plant food / natural

Rejection of human responsibility
- Has nothing to do with humans
- Man-made climate change isn't real
- Humans aren’t responsible
- Nothing to do with CO_2/fossil fuels

Conspiracy and mistrust
- Sponsored by Bill Gates
- Fossil fuel industry propaganda
- Do your own research

Skepticism and cynicism
- End of the world hysteria
- It's all about money/control
- Sky is falling panic
- Don't believe in climate change

Dismissal of climate activism
- They don't care / We don't care
- Not the other way around
- We don’t need to do anything
- Nothing we can do about it

Likes and replies

Misinformation stance			
Outcome	F	p	Group means (highest → lowest)
Likes	6.54	0.001	**Opposes > Neutral > Supports**
Replies	14.13	< 0.001	**Supports > Opposes > Neutral**
Sentiment	2704.90	< 0.001	**Neutral (–0.12) > Supports (–0.46) ≈ Opposes (–0.47)**

Solidarity vs. polarizing			
Outcome	F	p	Group means (highest → lowest)
Likes	13.96	< 0.001	**Solidarity (9.35) ≫ None (4.12) > Polarizing (1.74)**
Replies	6.67	0.001	**Solidarity > Polarizing > None**
Sentiment	16262.18	< 0.001	**Solidarity (+0.26) > None (–0.11) ≫ Polarizing (–0.53)**

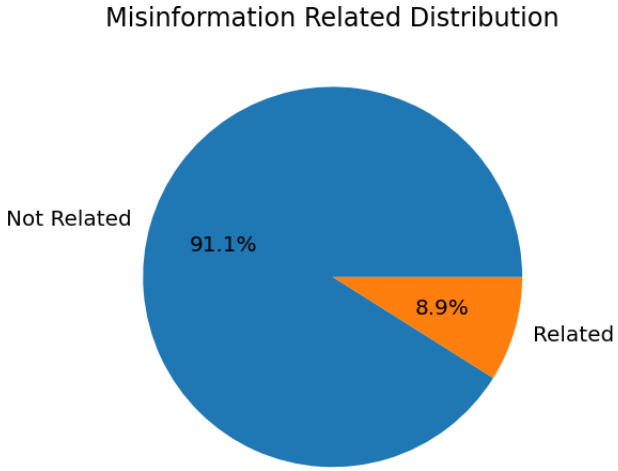
Part 2: A focused analysis of anxiety-related comments and their social meaning

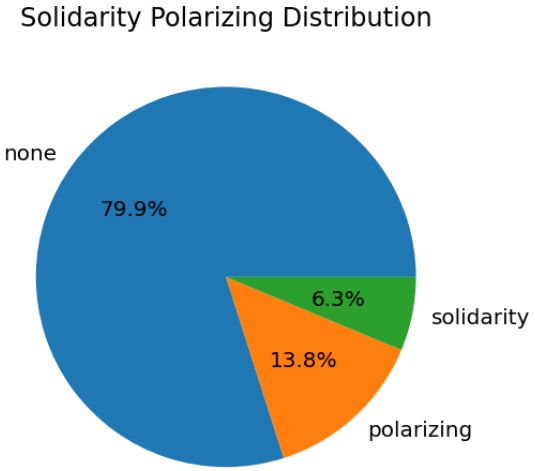
✅ Is Anxiety Clearly Distinguishable from Other Emotions?

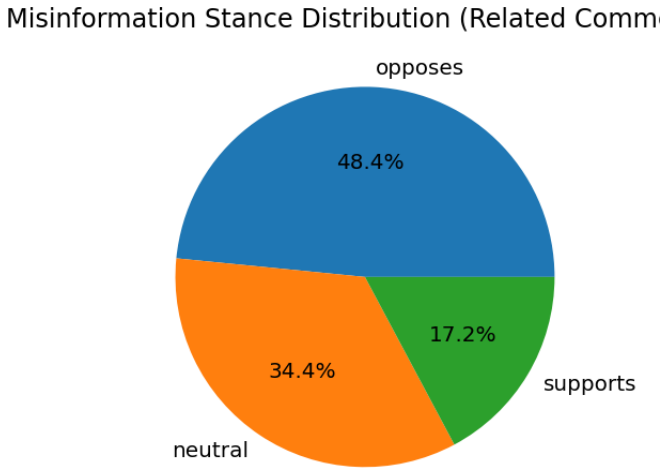
Theoretical clarity

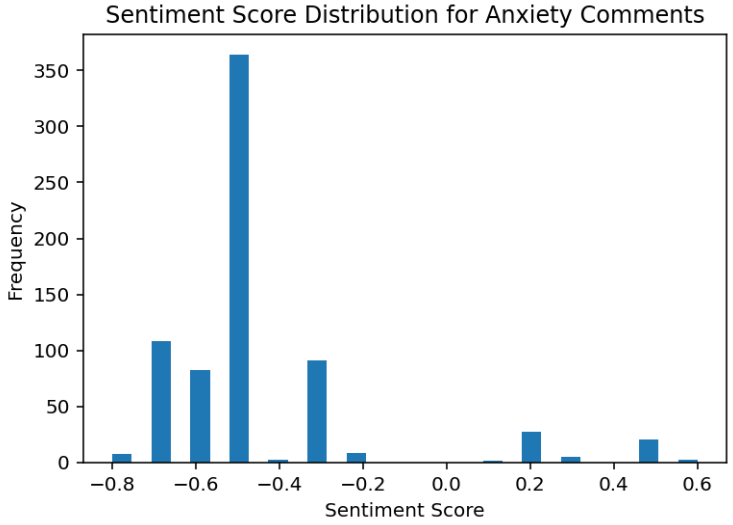
- Anxiety is **conceptually** distinct from other negative emotions:
- **Fear** is more immediate and specific (e.g., "I'm scared of wildfires this summer").
- **Anger** involves a sense of injustice or blame (e.g., "Politicians are doing nothing!").
- **Frustration** stems from blocked goals (e.g., "Why is this taking so long to fix?").
- **Anxiety**, in contrast, is more **diffuse, future-oriented, and internalized**, often expressing worry, dread, or a sense of helplessness (e.g., "I can't stop thinking about how bad things might get").

- **2. In practice**
- In real-world, noisy, user-generated text **anxiety is often blended** with fear and frustration, making it tricky to isolate.
- People may not use the word *anxiety* directly, but instead use **signals** like:
  - "I can't sleep at night thinking about this."
  - "This gives me a pit in my stomach."
  - "I'm constantly worried about the future."









0.21% of all comments.

Like count (from 0 to 1881) with mean 8.37 and std. 91.64.

Response count (from 0 to 57) with mean 0.74 and std. 3.83.

Anxiety comments vs. other comments

Sentiment score

- Group comparison: The Mann–Whitney U test is highly significant ($p < .001$), telling us the distribution of sentiment scores for anxiety comments is different from that of all others.
- Effect size: Cohen's $d = -0.639$ is a moderate-to-large effect, indicating anxiety comments are on average notably more negative in sentiment than other comments.

Like count

- Group comparison: Mann–Whitney $p = .065$ so we do not have evidence of a reliable difference in like counts between anxiety comments and other comments.
- Effect size: Cohen's $d \approx 0.004$, essentially zero, confirms there's no meaningful difference in how much these two groups get liked.

Number of responses

- Group comparison: Mann–Whitney $p = .041$ is just under .05, technically significant.
- Effect size: Cohen's $d \approx 0.009$, basically zero.

Misinformation related

- Contingency: Anxiety comments are misinformation-related in 64/717 ≈ 8.9% of cases; the rest of the corpus is misinfo-related at 72 421/333 991 ≈ 21.7%.
- Chi-square: $\chi^2 \approx 67.9$, $p < .001$ confirms a real difference in proportions.
- Effect size: Cramér's $V = 0.014$ is extremely small.

Misinformation stance

- Chi-square: $\chi^2 \approx 105.8$, $p < .001$ indicates a group difference in stance distributions.
- Effect size: Cramér's $V = 0.018$ — still vanishingly small.

Solidarity / Polarizing

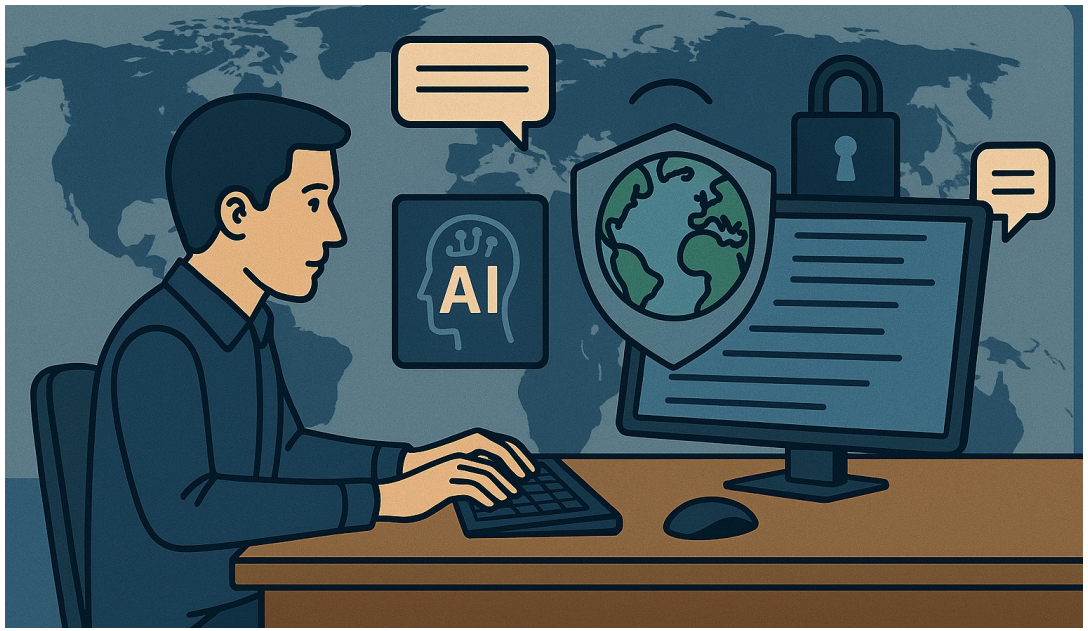
- Anxiety comments are coded as "none" \~80%, "polarizing" \~14%, "solidarity" \~6%; for other comments it's \~62%/32%/6%.
- $\chi^2 \approx 115.2$, $p < .001$ shows a significant distributional difference, but Cramér's $V = 0.019$ again tells us the magnitude is trivial.

Conclusion

Clear need to tackle the issue in the OSCE Area to promote solidarity and overcome divisions and polarity

- **Sentiment is the lone standout:** Anxiety-labeled comments are markedly more negative than others, whereas every other dimension shows negligible effect sizes.
- **Polarization outweighs solidarity:** Polarizing comments constitute 32.4% of the discourse, compared to only 5.8% solidarity comments.
- **Engagement favors solidarity:** Despite being fewer, solidarity comments receive more likes, replies, and higher sentiment scores, indicating stronger positive audience engagement.
- **Voices are concentrated:** A smaller group of users drives more polarizing content.
- **Echo chambers confirmed:** The solidarity share shows a flat, stationary trend, suggesting a stable echo chamber – those who express solidarity keep doing so at consistent rates, bouncing back when their presence dips.
- **Polarizing behavior also stable:** The polarizing share is similarly flat and even less volatile, pointing to a core group of persistent polarizers.
- **No drift, no convergence:** Over time, the relative sizes of the solidarity and polarizing groups remain constant, neither converging nor diverging oscillating around fixed means.
- **Key takeaway:** Climate discussions show no sign of becoming more unifying or divisive. Instead, they reflect enduring filter bubbles where each camp maintains its position – a persistent dual-bubble dynamic.

Thank you!



For more information please contact:

Daniel Kroos
Guest Research Scholar
Cooperation and Transformative Governance Group (CAT)
International Institute for Applied Systems Analysis (IIASA)
kroos@iiasa.ac.at
+436645478654