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Communicating climate change to young adults in China: examining predictors of user engagement on Chinese social media

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Abstract

Purpose – This study aims to examine how the Chinese climate nongovernmental organization "Chinese Weather Enthusiasts" engaged youth through video strategies.

Design/methodology/approach – The research proposed a framework grounded in the 5W model and message sensation value (MSV) to analyze the relationship between video content and user interaction. It categorized Bilibili videos into outer and inner features and introduced rhetorical strategies as content elements. A hybrid video coding framework was used, combining machine learning and deep learning (computer vision) for analyzing formal features, while manual coding was used for content features.

Findings – The results revealed that video length, long shots and the number of scenes positively influenced coins and favorites, whereas personification had a negative impact. In addition, tone and language intensity were positively correlated with user engagement.

Originality/value – This study offers insights regarding video production for climate communication, broadening the focus from text and images to video content and providing evidence-based guidance for practitioners.

Keywords Climate change, Communication strategy, Bilibili, Video production, User engagement, Nongovernmental organization, Extreme weather, Deep learning, Message sensation value

Paper type Research paper

1. Introduction

As the world faces challenges like shifting weather patterns and rising sea levels, climate communication has become a crucial research field across disciplines (Takahashi, 2023). It

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bridges the gap between scientific knowledge and public understanding, helping convey complex findings, risks and mitigation strategies to stakeholders (Rajput and Sharma, 2023).

Although climate communication research is growing, most studies focus on text-based platforms like Twitter and Facebook or traditional media (Basch *et al.*, 2022; Qian *et al.*, 2024). Limited attention has been given to video platforms like Bilibili, especially regarding how video content affects user engagement. In addition, few studies explore how young audiences interact with climate change content (Goldberg *et al.*, 2019), limiting understanding on the relationship between video characteristics and engagement.

In China, younger adults, as "digital natives" (Liu, 2011), rely heavily on smartphones and social media for communication and information. Understanding how they engage with climate content online and translating this engagement into offline action is both theoretically and practically important (Hartley, 2022). However, the decline of international nongovernmental organizations (NGOs) due to policy conflicts has weakened public capacity to address climate change and reduced academic resources (Junkui, 2016). NGOs play a key role in shaping climate agendas and mobilizing youth (Lebel, 2013). This study examines the video strategies of Chinese NGOs, an underexplored area (Liu and Zhao, 2017; Riley *et al.*, 2016) with a specific focus on China's Generation Z (Gentina, 2020).

By analyzing Bilibili, this research provides insights into leveraging video platforms to engage youth in climate communication. Findings may inform strategies for tailoring climate messaging to video-oriented young users and fostering meaningful climate action.

The study uses a conceptual framework combining the 5W model of communication and message sensation value (MSV). Bilibili video posts are categorized into outer and inner features, with outer features including three rhetorical strategies. The analysis focuses on how Chinese Weather Enthusiasts (CWE; 中气爱) use video production to engage youth. A hybrid coding framework was used, combining machine learning for formal features and manual coding for content features.

2. Literature review

2.1 Climate communication for Chinese youth

Chinese youth display distinct patterns in their engagement with climate issues compared to their international peers (e.g. Fløttum *et al.*, 2016; Stanes and Klocker, 2016). Effective climate communication targeting this demographic should consider their unique characteristics and media consumption habits (Yang, 2023). Although most Chinese youth acknowledge climate change and its human causes (Jamelske *et al.*, 2013), their involvement in climate initiatives remains limited, as evidenced by their lack of participation in movements like "Fridays for Future" (Yu, 2022).

Chinese youth primarily use social media to access climate information and express their concerns (Hartley, 2022). Research indicates they may favor subtle, tangible environmental actions over more direct protests and strikes (Yu, 2022). For example, Zhang *et al.* (2021) found that Chinese youth significantly contributed to Ant Forest, an initiative by Alipay where users plant real trees in China through gamified activities. By earning "green points" for eco-friendly actions like walking or using bike-sharing services, users grow virtual trees, which Alipay converts into real trees upon reaching certain milestones. This gamified approach not only fosters low-carbon behaviors but also illustrates how Chinese youth engage with climate action through various digital platforms (Chen *et al.*, 2023).

2.2 Social media in climate communication toward youth

Social media are pivotal in enhancing climate awareness and motivating action among younger adults for several reasons. First, these platforms offer easy access to a wealth of

climate-related information through websites, news articles, blogs and online resources, allowing youth to stay informed about climate change at their convenience (Corner *et al.*, 2015). Second, platforms like TikTok, Facebook, Twitter, Instagram, Sina Weibo and WeChat enable users to share climate content with their peers, creating a snowball effect where a single post can quickly reach a wide audience and boost climate awareness (Basch *et al.*, 2022).

Moreover, social media have been instrumental in the rise of youth-led climate movements, such as Greta Thunberg's Fridays for Future (Yu, 2022). These movements leverage digital platforms to organize protests, raise awareness and advocate for policy changes. Peer influence also plays a crucial role; when climate issues gain traction on social media, they encourage more youth to engage in climate advocacy (Williams *et al.*, 2015). Finally, social media can facilitate crowdsourcing for climate challenges, enabling youth to collaborate on projects, collect meteorological data and document environmental changes, thus contributing valuable information for scientific research (Kirilenko *et al.*, 2017). In summary, social media are essential for climate communication aimed at youth, and effective strategies on these platforms can significantly enhance engagement with climate-related content.

2.3 Video content strategy in climate communication

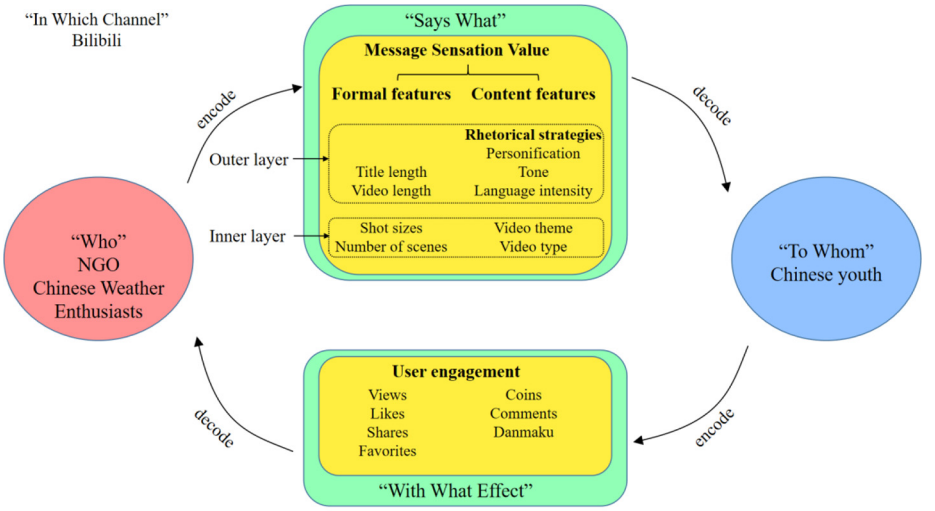
In an era where visual media dominate information dissemination, video content emerges as a potent medium for communicating climate change issues and fostering engagement (Chen, 2020). Research indicates that videos are effective in conveying the scientific consensus on global warming, thereby enhancing public belief and concern about climate change (Goldberg *et al.*, 2019). Educational videos, for instance, can significantly improve viewers' knowledge and behavioral intentions (Shahbazi and Nowaczyk, 2024). The inclusion of entertainment elements in videos can indirectly boost cognitive engagement with climate information, whereas positive messaging can instill hope and a sense of action, particularly among youth and minority groups (Topp *et al.*, 2019). Overall, these studies highlight the potential of video-based communication to increase awareness and engagement with climate change.

Despite evidence supporting the effectiveness of video content in raising climate change awareness, key factors influencing its impact remain unclear. For example, comparisons between comedic and authoritative video presentations found no significant differences in students' knowledge or attitudes about climate change (Carter and Wiles, 2016). Similarly, studies contrasting hopeful versus doomsday scenarios in climate change videos showed that, although participants experienced the anticipated emotions, neither approach significantly influenced risk perception, behavioral change likelihood or activism intentions (Ettinger *et al.*, 2021). These findings underscore the complexity of video content effectiveness in climate communication and suggest a need for further research to refine video creation strategies for enhanced impact.

3. Theoretical foundations

3.1 5W model of communication

This study draws on the 5W model of communication and literature on MSV to elucidate the dissemination process of text posts on social media (Paek *et al.*, 2010). Figure 1 outlines the framework for understanding the dissemination and user engagement of Bilibili video posts. The 5W model breaks down the communication process into five core components: who, says what, in which channel, to whom and with what effect. This model outlines how a communication process functions: the sender (who) conveys encoded information (says



Source(s): Authors' own creation

Figure 1. Theoretical foundation model of Bilibili video post communication and user engagement

what) through a specific channel (in which channel) to the receiver (to whom), who then decodes the message and provides feedback (with what effect). In this study, the sender is the NGO CWE, the channel is Bilibili, the receiver is Chinese youth and the focus is on analyzing the content (says what) and its impact (with what effect).

3.2 Message sensation value

To analyze "says what," we drew on the construct of MSV (Palmgreen *et al.*, 2002). MSV measures how media messages provoke sensory stimulation, emotional reactions and arousal through audiovisual elements. It consists of two dimensions: message characteristics and sensory responses. The former includes the form and content of the message, such as sound effects, visual effects, editing, lighting and camera angles. Sensory responses pertain to the audience's subjective experience of these characteristics, like sensory stimulation and emotional arousal. This study focuses on message characteristics, aiming to identify the form and content features in Bilibili videos that convey climate change messages to Chinese youth.

3.3 User engagement on social media platforms

"With what effect" refers to the impact or outcome of information dissemination, typically measured by user engagement metrics on platforms like Bilibili. In the digital media era, tracking user engagement is crucial for evaluating the effectiveness of information dissemination and the level of audience involvement (Zhang *et al.*, 2023a, b). However, with the diversity of information carriers and platforms, user engagement becomes more fragmented and nuanced. This complexity is reflected in various forms of interaction, such as comments, shares, likes, bookmarks, danmaku, online petitions and voting (Suherlan, 2023). To address these challenges, researchers must develop new metrics and methods for evaluating social media interactions. These metrics can help communicators better

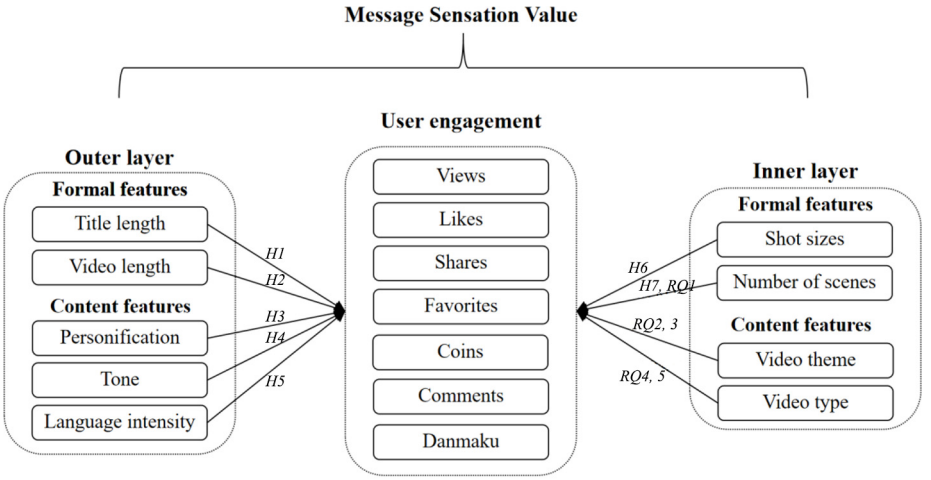
understand how information spreads online, how audiences engage with the information and how to refine communication strategies to enhance credibility, inspire public action and meet audience needs. For this study, we measured user engagement using metrics such as views, likes, shares, coins, comments, danmaku, and favorites.

4. Hypotheses

As depicted in Figure 2, this study drew on existing research and proposed a conceptual framework for understanding the relationship between Bilibili video posts and user interaction. The framework categorizes online video post characteristics into outer and inner features (Xu *et al.*, 2023), further subdivided into formal and content features based on MSV. Among the outer features, formal elements include title length and video length, while content features consist of rhetorical strategies such as personification, tone and language intensity. The inner features' formal elements include shot sizes and the number of scenes, with content features covering video theme and video type.

4.1 Outer and inner features

The process of interacting with an online video can be divided into two main stages: initial and in-depth engagement. The first stage is driven by outer features, such as the video title, which influence the user's decision to click. These preview elements convey the video's theme or main content, making their strategic design crucial for attracting viewers. Upon clicking, users enter the second stage, where inner features – such as shot composition, scene count, video theme and type – shape their viewing experience. These inner features determine the level of engagement, influencing whether users continue watching, interact with or share the video.



Source(s): Authors' own creation

Figure 2. Conceptual framework of the relationship between Bilibili post characteristics and user engagement

4.2 Outer features and message sensation value

4.2.1 Formal features. In the original MSV theory, formal features mainly referred to television editing techniques, such as sound effects, visual effects, cutting, lighting and camera angles, which played a crucial role in shaping viewers' sensory stimulation and emotional responses (Paek *et al.*, 2010). However, with the rise of video-centric social media platforms like TikTok, YouTube and Bilibili, both content dissemination and viewing habits have changed significantly (Kuyucu, 2019). Unlike traditional television, these platforms often feature short videos and fragmented user behavior, where users quickly browse, select and consume content (Lin *et al.*, 2023). As a result, formal features now extend beyond the video content itself to include auxiliary information, such as video titles, cover images and tags, which help convey the core content quickly and aid in user decision-making (Lee and Yu, 2020).

Title length, defined by the number of characters or words, is one such feature that can influence online user engagement (Halvey and Keane, 2007). Video titles act as summaries of content, with longer titles potentially offering richer information, capturing attention more effectively and enhancing user engagement (Lee and Yu, 2020). For example, Halvey and Keane (2007) found that longer titles on YouTube correlate with higher view counts, while Chen *et al.* (2021) observed that longer titles on TikTok increase the likelihood of likes, shares and comments. Based on this, we posit:

H1. The length of video titles is positively correlated with the online engagement of Chinese youth in climate communication videos.

Video length. We included title length as a message characteristic in the MSV, alongside video length, which refers to a video's duration. As short videos become a primary information source, understanding the impact of video length on user engagement is crucial for video production strategies (Zhu *et al.*, 2020). Research consistently shows a negative correlation between video length and user engagement. For instance, Chen *et al.* (2021) found that longer TikTok videos by Chinese public health authorities received fewer likes, shares and comments. This may be due to the need to convey content efficiently, necessitating concise and well-planned videos. Supporting this, Guo *et al.* (2014) found that shorter videos in massive open online courses typically had higher quality and greater engagement. Short videos, characterized by their brevity and fast pace, resonate with the quick, dynamic lifestyles of contemporary users (Yang *et al.*, 2024a, b). Therefore, we hypothesize:

H2. Video length is negatively correlated with the online engagement of Chinese youth in climate communication videos.

4.2.2 Content features. Video title is a critical outer feature, encapsulating the video's theme and main content. As a key informational characteristic, it drives user clicks and views, making the strategy behind title creation highly significant. Research highlights the impact of rhetorical strategies in video titles – such as personification, tone and language intensity – on capturing user attention, sparking interest and boosting click rates. These strategies shape users' perceptions and emotional responses through specific linguistic techniques, thereby influencing overall engagement with the video content.

Personification. Existing research indicates that personification on social media fosters positive user responses, including increased trust, satisfaction and engagement (Men and Tsai, 2015). This rhetorical device attributes human or group characteristics to abstract entities, making them more relatable and emotionally engaging (Nerlich and Jaspal, 2014). For example, Chen *et al.* (2015) analyzed brand personification strategies in Facebook

marketing posts of 100 global top brands. Specifically, the authors evaluated the impact of personified language on consumer engagement by coding the use of personal pronouns and imperative verbs in the posts, such as first-person pronouns ("I"), second-person pronouns ("you"), third-person pronouns ("she"), and imperative verbs ("come"). These findings revealed that personified language effectively encourages consumers to perceive brands as human-like social agents, eliciting positive emotions and significantly enhancing consumer engagement. In this study, CWE used numerous personified terms in its video titles. Therefore, we propose the following hypothesis:

H3. Personification enhances the online engagement of Chinese youth in climate communication videos.

Tone. Tone significantly affects user responses in climate communication, with variations such as positive, negative, enthusiastic or calm tones influencing engagement (Young and Soroka, 2012). Emotional language features are crucial for user engagement (Yu *et al.*, 2024), as tone conveys different intentions and emotions, impacting audience reception (Cardamone *et al.*, 2024). Bennett *et al.* (2021) found that neutral tones engage the public more effectively than highly emotional messages, which may cause fatigue or distract from key facts. Messages highlighting severity without negative emotions tend to be more effective.

Identifying tone from video titles is challenging, so punctuation is used as a proxy. Periods suggest a neutral tone (Li, 2023), question marks signal curiosity and exclamation marks denote high emotional intensity, though overuse can reduce seriousness (Scott and Jackson, 2020). Given the limited research on tone proxies in climate communication, this study explores how punctuation affects Chinese youth engagement with climate content. We hypothesize:

H4. Tone, as indicated by punctuation (periods, question marks and exclamation points), is negatively related to the online engagement of Chinese youth in climate communication videos.

Language intensity. Language intensity measures how much a message deviates from neutrality, often through the use of adjectives or adverbs like "very" or "really." Research indicates that higher language intensity enhances user engagement by highlighting the urgency and significance of information, which boosts curiosity and motivation to engage with the content (Craig and Blankenship, 2011). For example, Liebrecht *et al.* (2019) compared unmarked evaluations, pure intensifiers and meaningful intensifiers by examining their effects on the perceived strength of positive and negative evaluations. Unmarked evaluations were baseline evaluations with no intensifying adverbs (e.g. "good" or "bad"). Pure intensifiers (e.g. "very") were adverbs that only served to intensify the evaluation without adding any additional semantic meaning. Meaningful intensifiers (e.g. "deliciously") were adverbs that not only intensified the evaluation but also conveyed additional meaning, enhancing the emotional or descriptive impact of the evaluation. The participants rated the perceived strength of these three types of evaluations (unmarked, pure intensifiers and meaningful intensifiers). The results showed that both types of intensified evaluations (pure and meaningful) were perceived as stronger than unmarked evaluations. Despite these findings, the role of language intensity in climate communication remains underexplored. Therefore, we hypothesize:

H5. The language intensity of videos is positively correlated with the online engagement of Chinese youth in climate communication videos.

4.3 Inner features and message sensation value

4.3.1 Formal features. Shot sizes. Shot size denotes the amount of setting or subject visible in a frame, categorized as long shots, medium shots and close-ups (Yu, 2023). These different shot sizes serve various narrative purposes and significantly impact audience reactions, such as emotional resonance and engagement (Savardi *et al.*, 2021). Research shows that shot size influences how viewers focus their attention and understand narratives. For example, Canini *et al.* (2011) found that varying shot sizes helps in recognizing key narrative elements and eliciting emotional responses. Long shots, which provide broader context, can reduce attention focus due to fewer visual cues, while close-ups enhance focus by highlighting facial expressions and character interactions (Benini *et al.*, 2019). Both shot types contribute to narrative comprehension: close-ups clarify character intentions and plot details, while long shots offer an overview of the scene layout.

In this study, Bilibili videos include three shot sizes – 3D Earth's eye view (long shot), 2D continental top view (medium shot) and first-person perspective (close-up) – to examine their effects on user engagement. Therefore, we hypothesize:

H6. Shot size is correlated with the online engagement of Chinese youth.

Number of scenes. The information processing theory examines how individuals manage and comprehend information (Soroya *et al.*, 2021). In scenarios where information overload or complexity occurs, user engagement may diminish due to difficulties in processing (Cheng *et al.*, 2020). In short videos, the number of scenes reflects content complexity and the variety of ideas presented by creators (Frydenberg and Andone, 2016). More scenes can increase the video's density and cognitive load, potentially affecting user engagement negatively. Mayer and Moreno (2003) suggest that higher scene counts may enhance information complexity, which could reduce engagement as users struggle with cognitive overload:

RQ1. What is the distribution of the number of scenes in the video released by CWE?

H7. The number of scenes is negatively correlated with the online engagement of Chinese youth.

4.3.2 Content features. Video theme. Video themes are descriptors of the core content or main ideas presented in a video (Zhang *et al.*, 2021). They significantly influence user engagement, as seen in various fields. For example, Li *et al.* (2021) found no significant difference in engagement metrics across TikTok video themes during the COVID-19 pandemic, though some variation in engagement persisted. Che *et al.* (2022) observed that themes in post-pandemic NHCC videos on TikTok significantly affected user engagement, with personal protection themes generating the most shares and comments.

Despite these insights, the impact of climate communication video themes on Chinese youth's engagement remains underexplored. Given Chinese youth's growing environmental awareness and media engagement (Voltmer and von Salisch, 2023), understanding which climate themes resonate with them is crucial. Themes related to climate change effects, sustainable living and youth activism are likely to drive higher engagement on platforms like Bilibili (Li *et al.*, 2024; Che *et al.*, 2024). This leads us to propose the *RQ2* and *RQ3*:

RQ2. What themes are included in the climate communication video released by CWE?

RQ3. Are the themes of climate communication videos related to the online engagement of Chinese youth?

Video type. Video type refers to the category or genre of a video, encompassing its content and stylistic features (Liikkanen and Salovaara, 2015). Previous studies have highlighted the impact of video type on user engagement. For example, videos presenting scientific information are often more effective in prompting audience action due to their perceived utility (Cone and Winters, 2013). In addition, user-generated videos, such as covers and imitations, generally receive more engagement compared to traditional videos (Liikkanen and Salovaara, 2015).

However, research on how different types of climate communication videos affect engagement, especially among Chinese youth, is sparse. Given the importance of engaging this demographic, we proposal:

RQ4. What are the types of videos released by CWE?

RQ5. Are the types of climate communication videos related to the online engagement of Chinese youth?

5. Method

5.1 Selection of social media account

Bilibili, a popular platform among youth, hosts diverse scientific content on climate science and environmental advocacy. Its features, such as danmaku (comment subtitles) and user comments, foster interactive engagement, allowing users to participate actively in discussions and share insights (Li *et al.*, 2024). This interactivity enhances user involvement and contributes to a sense of community around climate issues (Zhang *et al.*, 2023a, b).

The platform's engagement is exemplified by local NGO CWE, which has achieved significant reach with 190 million views, 12 million likes and 1.6 million fans as of October 1, 2023. CWE's content, which includes detailed analyses and visuals on climate and weather, aligns well with the preferences of Chinese youth for engaging and informative content in shorter formats.

5.2 Data collection

In this study, Python was used to collect and process metadata from CWE's videos on Bilibili. The "requests" library was used to send HTTP requests to Bilibili's API, retrieving metadata such as video titles, views, likes, shares, favorites, coins, comments and danmaku. The "pandas" library was then used to organize and store this data for ease of analysis.

For the period from January 1, 2020, to September 30, 2023, CWE released 319 videos. Videos were screened based on the following criteria: exclusion of the first 12 videos released between January 1, 2020, and June 30, 2022, which had extended publication intervals and low engagement; removal of one commercial advertisement video; and exclusion of a 29-min video due to its significantly different length. Ultimately, 305 videos were included for analysis.

5.3 Coding

This study proposed a hybrid video coding framework incorporating:

- automated analysis using machine learning and deep learning (computer vision) to assess formal features such as title length, video length, shot sizes and number of scenes; and
- machine coding to annotate content features including personification, tone, language intensity, video theme and video type.

5.3.1 Automated analysis. Title length. This study used Python to measure video title lengths. A "for" loop iterated through the list of video titles, counting characters and the results were stored in a list.

Video length. Video lengths were calculated using the MoviePy library in Python. After importing the necessary modules (e.g. os, pandas), the "for" loop processed each video file by loading it with VideoFileClip, retrieving the duration in seconds, and storing the length in a list.

Shot sizes. CWE's videos primarily feature long shots, medium shots and close-ups. To classify these shot sizes, we used ResNet50, a deep residual network known for its ability to efficiently learn features through residual connections that prevent performance degradation in deep networks (Shabbir *et al.*, 2021). The process involved five steps: First, using OpenCV, we extracted frames from 30% of the video files, saving one frame every 30 s. Then, we applied Support Vector Machine (SVM) to classify 579 images into the three shot types, because it performs better on this small data set than deep learning methods (Wang *et al.*, 2021), achieving an F1-score of 0.90 after splitting the data set into 30% training and 70% testing. The images were categorized into training and validation sets (90:10 ratio) and stored in appropriate folders. ResNet50, with preprocessing methods like random cropping and normalization, was used for classification, achieving an F1-score of 0.92 after training. Finally, the trained model was applied to classify the remaining 70% of the data set (Figure 3).

Number of scenes. We counted each shot type for every video in the previous step and then calculated the number of scenes for each video using Python.

5.3.2 Machine coding. Machine coding was performed using the Divominer platform. The process involved three steps:

(1) Initial Coding Book Development: We compiled a list of keywords for different coding categories based on a review of video titles.

(2) Coding Book Iteration: We manually coded 20% of samples, aiming for a Holsti's coefficient of 0.9. Adjustments were made to the coding book until the reliability reached 0.91.

(3) Machine Coding: We compared manual and machine coding for another 20% of samples, making further adjustments until the reliability exceeded 0.9, finalizing the coding book and keyword list (final Holsti's coefficient = 0.92).

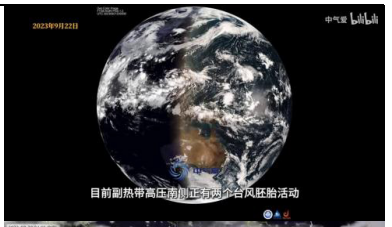
The final coding book and keyword list are presented in Table 1 and Appendix Table A1.

Personification. Video titles and content were coded for personification. Titles or content using personifying language were coded as "yes," and others as "no." For example, "Super rainstorm raided the Middle East desert" was coded as personification, while "Many northern provinces will skyrocket the temperature" was not.

Tone. Tone was assessed based on punctuation in video titles. Exclamation marks indicated high emotional intensity (e.g. surprise or excitement), periods indicated low intensity (calm or definitive) and question marks conveyed medium intensity (doubt or inquiry).

Language intensity. Language intensity was coded based on the presence of terms like "most," "strongest" or "largest." Titles with these terms were categorized as high intensity, and those without as low intensity.

Video theme. Weather types were categorized using the IPCC definitions, with adjustments for CWE's terminology. The final codebook identified six weather types: high temperature, rainstorm, typhoon, blizzard, low temperature and sandstorm.

Lens type	Operational definition	Sample size	Example
Long shots	The picture contains the complete form of the earth	155	
Medium shots	The pictures mainly show some continents, countries and regions	216	
Close-ups	The pictures are mainly live pictures of extreme weather	208	

Source(s): Authors' own creation

Figure 3. Operational definition and sample information of lens type

Video type. Four video formats were identified: weather forecast, popularization, 4K video and global status.

5.3.3 Engagement metrics. In this study, all quantifiable numerical data from the metadata, including views, likes, shares, favorites, coins, comments and danmaku, were used as key indicators.

6. Results

6.1 Descriptive statistics

Table 2 provides the frequency distribution of independent variables. *RQ1* focused on the distribution of scenes in CWE videos, revealing that most videos (80.66%) contain 5–14 scenes, while those with fewer than 5 scenes (10.49%) or more than 14 scenes (8.85%) are less common.

RQ2 explored the themes in CWE videos. High temperature (27.97%), rainstorm (26.44%) and typhoon (23.37%) were the predominant themes, with blizzard (14.18%) and low temperature (6.13%) following, while sandstorm (1.92%) was the least represented.

RQ4 examined video types, identifying four categories: weather forecast, popularization, 4K video and global status. Weather forecast videos dominated at 84.59%.

Table 3 outlines the descriptive statistics (mean, standard deviation, maximum, minimum and median) for the dependent variables (DVs). The wide variability in data, indicated by

Table 1. Coding book

Variables	Categories	Operational definitions
Outer layer		
Title length	Short	Title length less than 24 characters
	Medium	Title length greater than 23 characters and less than 33 characters
	long	Title length greater than 32 characters
Video length	Short	Video length less than 178 s
	Medium	Video length between 178 s and 224 s
	long	Video length greater than 224 s
Personification	No	Video titles or content did not use human-related terms to describe extreme weather events
	Yes	Video titles or content used human-related terms to describe extreme weather events, such as “make a comeback,” “reborn”
Tone	High level	Video titles ending with an exclamation mark
	Low level	Video titles ending with a period
	Medium level	Video titles ending with a question mark
Language intensity	Low level	Video titles or content did not use superlative terms such as “strongest,” “most severe,” or “largest”
	High level	Video titles or content used superlative terms such as “strongest,” “most severe,” or “largest”
Inner layer		
Shot sizes	Close-ups	The pictures are mainly live pictures of extreme weather
	Medium shots	The pictures mainly show some continents, countries and regions
	Long shots	The picture contains the complete form of the earth
Number of scenes	Few	The number of scenes is less than 5
	Moderate	The number of scenes ranges from 5 to 14
	Many	The number of scenes exceeds 14
Video theme	High temperature	Videos featuring weather conditions characterized by abnormally high temperatures, typically leading to heatwaves or extreme heat events, including forecasts of high temperature
	Rainstorm	Videos depicting heavy rainfall or precipitation accompanied by strong winds, thunder, and lightning, including forecasts of rainstorm
	Typhoon	Videos depicting powerful tropical cyclones or hurricanes originating in the Western Pacific Ocean region, including forecasts of typhoon paths
	Blizzard	Videos showcasing severe snowstorms characterized by strong winds, low temperatures, and reduced visibility, including forecasts of blizzard
	Low temperature	Videos featuring weather conditions characterized by abnormally low temperatures, often leading to cold waves or extreme cold events, including forecasts of low temperature
	Sandstorm	Videos depicting intense dust or sand storms, including forecasts of sandstorm
Video type	Weather forecast	Weather forecast refers to videos that feature a voice-over narration, primarily analyzing recent extreme weather phenomena and providing forecasts and recommendations for upcoming weather events
	Popularization	Popularization involves the interpretation of a single extreme weather event that breaks historical records in some meteorological indicators, including an analysis of its causes and subsequent consequences
	4K video	4K videos do not have voice-over narration and primarily focus on meteorological system changes captured in 4K resolution using satellite imagery
	Global status	Global status videos compile recent global weather events, regardless of the country or weather type. These videos do not include voice-over narration and consist of real-time footage of events

Source(s): Authors’ own creation

Table 2. Coding results

Variables	Categories	Count	%
Outer layer			
Title length	Short	32	10.49
	Medium	216	70.82
	long	57	18.69
Video length	Short	20	6.56
	Medium	207	67.87
	Long	78	25.57
Personification	No	162	53.11
	Yes	143	46.89
Tone	High level	229	75.08
	Low level	51	16.72
	Medium level	25	8.20
Language intensity	Low level	224	73.44
	High level	81	26.56
Inner layer			
Shot sizes	Close-ups	1010	35.92
	Medium shots	1065	37.87
	Long shots	737	26.21
Number of scenes	Few	32	10.49
	Moderate	246	80.66
	Many	27	8.85
Video theme	High temperature	73	27.97
	Rainstorm	69	26.44
	Typhoon	61	23.37
	Blizzard	37	14.18
	Low temperature	16	6.13
	Sandstorm	5	1.92
Video type	Weather forecast	258	84.59
	Popularization	27	8.85
	4K video	17	5.57
	Global status	3	0.98

Source(s): Authors' own creation

maximum values exceeding three times the standard deviation from the mean, suggests that the median is a more reliable measure to describe the overall data levels, being less influenced by outliers.

6.2 Results for negative binomial regression

Given the overdispersion of count data, negative binomial regression was used to test the hypotheses and address *RQ3* and *RQ5* (Table 4). Odds ratios (OR) >1 indicate positive effects, while OR < 1 suggest negative effects (please refer to Appendix Table A2 for details).

H1 proposed that video title length would positively correlate with online engagement among Chinese youth. However, the results showed no significant association, and thus, *H1* was not supported.

H2 suggested that video length would negatively correlate with online engagement. Contrary to expectations, video length was positively correlated with the number of coins and favorites. Specifically, for each unit increase in video length (178–224 s, <178 s, >224 s), the number of coins increased by 1.329 times and favorites by 1.409 times. No significant

Table 3. Descriptive statistics for the dependent variables

Variables	Mean	SD	Max.	Min.	Median
Views	606065.423	429131.042	3560111.000	48181.000	494701.000
Likes	34817.075	21454.829	182087.000	2179.000	30746.000
Shares	5780.348	8560.299	91700.000	87.000	3690.000
Coins	3261.889	5459.693	85722.000	98.000	2353.000
Comments	2885.282	2267.098	20449.000	112.000	2236.000
Danmaku	1952.577	1568.755	18630.000	58.000	1698.000
Favorites	1898.128	3178.204	46700.000	137.000	1146.000

Source(s): Authors' own creation

Table 4. Results for negative binomial analysis

	Odds ratio						
Variables	Views	Likes	Shares	Coins	Comments	Danmaku	Favorites
Outer layer							
Title length	−0.963	−0.925	−0.974	−0.085	1.014	−0.972	−0.910
Video length	−0.991	1.036	−0.926	1.329**	−0.971	1.024	1.409**
Personification	−0.941	−0.914	−0.914	−0.644**	0.938	0.971	−0.587**
Tone	−0.977	1.035	−0.908	1.380**	−0.997	−0.938	1.526**
Language intensity	1.279	1.153	1.718**	−0.950	1.353*	1.226	1.047
Inner layer							
Shot sizes	1.002	1.068	−0.920	1.066	1.011	−0.985	−0.987
(close-ups, medium	1.002	–0.949	1.103*	–0.938	1.014	1.035	–0.945
shots, long shots)	1.091*	1.091*	1.096*	1.171**	1.038	1.107**	1.147**
Number of scenes	−0.990	1.011	−0.974	1.592**	−0.946	1.019	1.532**
Video theme	1.009	−0.975	1.029	1.024	1.029	1.039	1.039
Video type	1.213*	1.212*	1.165	1.565**	1.175	1.198*	1.431**

Note(s): *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$
Source(s): Authors' own creation

correlations were found between video length and views, likes, shares, comments or danmaku, providing partial support for *H2*.

H3 hypothesized that personification would enhance online engagement. However, the results indicated that personification was negatively correlated with the number of coins (decreasing by 0.644 times) and favorites (decreasing by 0.587 times), with no significant correlation with other engagement indicators, thus rejecting *H3*.

H4 hypothesized a negative association between tone and online engagement among Chinese youth. Contrary to this, tone was positively correlated with coins and favorites. An increase of one unit in tone (exclamatory, interrogative, declarative) resulted in a 1.380 times increase in coins and a 1.526 times increase in favorites. No significant correlation was found with other engagement metrics, partially supporting *H4*.

H5 posited that video language intensity would be positively related to online participation. Results revealed a significant positive impact on shares: a one-unit increase in language intensity led to a 1.718 times increase in shares. Similarly, a one-unit increase in language intensity was associated with a 1.353 times rise in comments. However, language intensity did not affect other engagement measures, indicating partial support for *H5*.

H6 proposed that shot sizes would correlate with online engagement. Long shots were positively related to almost all engagement metrics (excluding comments), with increases of 1.091 times (views), 1.091 times (likes), 1.096 times (shares), 1.171 times (coins), 1.107 times (danmaku) and 1.147 times (favorites) for each unit increase. Medium shots were positively correlated only with shares (1.103 times increase), while close-ups showed no significant correlation with engagement metrics, providing partial support for *H6*.

H7 hypothesized a negative correlation between the number of scenes and online engagement of Chinese youth. The results showed a positive correlation: each additional scene increased the number of coins by 1.592 times and favorites by 1.532 times. Despite significant associations, the results contradicted the hypothesis. Therefore, *H7* was negated.

RQ3 explored the relationship between video themes and online engagement, finding no significant correlation.

RQ5 examined the impact of video types on engagement. Results revealed that increasing video type by one unit (4K video, weather forecast, global status, popularization) led to 1.565 times more views, 1.212 times more likes, 1.565 times more coins, 1.198 times more danmaku and 1.431 times more favorites. No correlation was found with shares or comments.

7. Discussion and conclusion

The motivation for this study arose from the observation that younger adults in China prefer to engage with climate issues through social media rather than offline. We used the 5W model of communication and MSV theory to classify Bilibili video posts into external and internal features and introduced three rhetorical strategies as content characteristics to evaluate NGO video production strategies targeting Chinese youth on climate issues. Key findings include:

- *Formal features*: Video length and the number of scenes were positively correlated with coins and favorites. Long shots were linked to higher user engagement across various metrics, including views, likes, shares, coins, danmaku and favorites, while medium shots were only positively associated with shares.
- *Content features*: Personification in video content or titles was associated with fewer coins and favorites, whereas a stronger tone resulted in more coins and favorites. Higher language intensity led to increased shares and comments.
- *Video types*: Different video types were positively related to engagement metrics such as views, likes, coins, danmaku and favorites, but not to shares or comments.

Theoretical and practical implications of these findings are discussed in detail below.

7.1 Discussion of results

First, video length positively correlated with coins and favorites, contradicting Chen *et al.* (2021). Longer videos likely enhance engagement by providing comprehensive coverage, in-depth analysis and emotional narratives, making the content more valuable and relatable (Moss *et al.*, 2016; Park *et al.*, 2016). They also address misconceptions and provide actionable insights, further motivating interaction (Jones and Metzger, 2019).

Second, the positive correlation between the number of scenes and engagement counters Cheng *et al.* (2020), who warned of information overload. While more scenes increase complexity, they also enhance visual diversity and narrative depth, maintaining viewer interest (Liu *et al.*, 2021). Extreme weather videos often feature varied scenes, offering

stimulating experiences and emotional resonance, which boost coins and favorites (Spezialetti, 2018; Shepherd, 2020).

Third, the study found a significant association between long shots and user engagement (excluding comments), whereas medium shots were linked only to shares, and close-ups showed no correlation with engagement. This variation likely stems from the different impacts of shot sizes on audience perception (Canini *et al.*, 2011; Dobson, 2018). Long shots are effective for displaying expansive scenes and landscapes, such as panoramic views of extreme weather events, which can provide a deeper explanatory effect and engage viewers more profoundly (Branco, 2018). These shots offer broader visual contexts, enriching the viewer's understanding and encouraging interaction (Hertenstein *et al.*, 2009). In contrast, medium shots focus on specific areas with limited visual impact, potentially reducing their engagement influence (Knoche *et al.*, 2006). Close-ups, while detailed, may lack the broader context necessary to foster significant viewer interaction.

Fourth, personification of extreme weather reduced engagement. While often used to frame weather as an antagonist, creating narratives of human struggle (León *et al.*, 2022; O'Neill and Smith, 2014), personification may implicitly blame humanity for climate change, leading to disengagement (Kramar, 2023). Future research could explore conditions under which personification might be effective or alternative communication strategies.

Fifth, tone influenced behaviors like giving coins and bookmarking. Neutral tones attracted more attention than emotional content, supporting Bennett *et al.* (2021). Unlike prior studies classifying tone as positive, negative or neutral (Lu and Shen, 2023; Trilling *et al.*, 2017), this study used punctuation-based categories: declarative, interrogative and exclamatory. Future research could examine how different tones affect climate communication across topics and populations.

Sixth, language intensity in titles and content positively impacted shares and comments, aligning with Hamilton and Stewart (1993). Despite potential desensitization from frequent extreme weather coverage (Ashworth and Witt, 2023), terms like "most" effectively increased engagement, highlighting the persuasiveness of intense language in climate communication.

Finally, we identified four video types: weather forecast, popularization, 4K video and global status. While "weather forecast" accounted for 84.59% of CWE videos, popularization content was more effective in engaging Chinese youth, as it provides deeper insights into extreme weather mechanisms (Engblom *et al.*, 2019). This suggests that youth prefer videos that enhance their understanding of climate issues. Although video type positively correlates with metrics like views, likes, coins, danmaku and favorites, it does not significantly impact shares and comments, reflecting a preference for individualistic, less visible forms of activism (Yu, 2022).

7.2 Theoretical implications

This study offers two key theoretical contributions. First, it combines the 5W model of communication with MSV to enhance our understanding of climate communication videos and youth engagement in China. Integrated these two theoretical perspectives, this study offers a novel reference for understanding the dissemination process of climate communication videos and how various message elements can boost user engagement. By examining video type, length, shot size, scene count, personification, tone and language intensity, we provide a useful framework that highlights how these factors influence user interaction.

Second, this study extends MSV's formal characteristics from the internal elements of videos to external features, thereby increasing its applicability to platforms like Bilibili.

Although prior research applied MSV to platforms such as TikTok and YouTube, it predominantly focused on internal editing techniques and content settings and not so much on the potential impact of external informational features on user engagement (Paek *et al.*, 2010; Yang *et al.*, 2024a, b).

Video-based social media platforms can be classified into two types: single-video display models, like TikTok, which rely on recommendation systems and present one video at a time, and multi-video display models, like Bilibili, which also use recommendation systems but display multiple video thumbnails on a single page. In the latter model, external informational features, such as titles and cover images, significantly influence user engagement before video selection (Che *et al.*, 2024). Our study contributes to theoretical understanding of MSV's formal characteristics and underscores the importance of external informational features in driving user engagement.

7.3 Practical implications

Creating longer, more comprehensive videos with varied scenes and long shots can sustain viewer attention and engagement. Neutral and objective titles enhance credibility, fostering shares and comments. Avoiding overly personified content ensures relevance and trustworthiness.

While CWE's factual approach builds credibility (Henke *et al.*, 2020), it may lack the emotional engagement crucial for online interaction. Emotional appeals, such as fear, hope or empathy, have been shown to enhance engagement by making climate issues relatable (Zhao and Zhan, 2019; Tao *et al.*, 2024). Platforms like Twitter and Instagram can use emotional storytelling and visuals to elicit likes, comments and shares (Qian *et al.*, 2024).

Incorporating emotional elements, such as personal stories of those affected by extreme weather or urgent calls to action, could complement CWE's strategy without compromising reliability (Gustafson *et al.*, 2020). Future studies could examine the effectiveness of emotional appeals in CWE's content and their potential to enhance user interaction and climate discussions. Striking a balance between factual accuracy and emotional resonance could help CWE craft impactful communication, broadening audience reach and fostering climate awareness and action.

7.4 Limitations

Findings of this study should be viewed with several limitations. First, CWE was selected for its influence on Bilibili, but its fact-based and concise communication style may not reflect the diversity of strategies in climate communication. Notably, CWE rarely uses emotional appeals. Future research should explore other NGO accounts and strategies to better engage young social media users in climate-related topics.

Second, while we included all available CWE videos, the limited sample size may affect the generalizability of the findings. Expanding sample sizes in future research could provide more robust analysis. Despite this, our study offers theoretical insights into the impact of MSV and rhetorical strategies on engagement and practical implications for reaching Chinese youth with climate information on social media.

Third, engagement metrics may differ significantly across platforms due to variations in features, demographics and content formats. For instance, Twitter's character limits and hashtag model focus on rapid dissemination and public discourse (Ceh *et al.*, 2024), while Facebook's older user base engages more with articles and opinion posts (Oz *et al.*, 2024). Future research should conduct cross-platform studies to compare how platform-specific factors influence engagement and refine strategies tailored to diverse audiences and social media platforms.

References

Ashworth, P. and Witt, K. (2023), "'Psychic numbing' and the environment: is this leading to unsustainable energy outcomes in Australia?", in Nadesan, M.H. Pasqualetti, M.J. and Keahey, J. (Eds), *Energy Democracies for Sustainable Futures*, Elsevier Academic Press, pp. 279-283, doi: 10.1016/B978-0-12-822796-1.00029-2.

Basch, C.H., Yalamanchili, B. and Fera, J. (2022), "#climate change on TikTok: a content analysis of videos", *Journal of Community Health*, Vol. 47 No. 1, pp. 163-167, doi: 10.1007/s10900-021-01031-x.

Benini, S., Savardi, M., Balint, K., Kovacs, A.B. and Signoroni, A. (2019), "On the influence of shot scale on film mood and narrative engagement in film viewers", *IEEE Transactions on Affective Computing*, Vol. 13 No. 2, pp. 592-603, doi: 10.1109/TAFFC.2019.2939251.

Bennett, M., Volsche, S. and Capaldo, S. (2021), *Rhetorical Framing and Climate Change Engagement*, ID Conference on Undergraduate Research.

Branco, P. (2018), "The long take: art cinema and the wondrous", *Visual Studies*, Vol. 33 No. 4, pp. 401-402, doi: 10.1080/1472586X.2018.1558540.

Canini, L., Benini, S. and Leonardi, R. (2011), "Affective analysis on patterns of shot types in movies", *2011 7th International Symposium on Image and Signal Processing and Analysis (ISPA)*, *IEEE*, pp. 253-258.

Cardamone, E., Miceli, G. and Raimondo, M.A. (2024), "Better abstract or concrete, narrating or not: optimal strategies for the communication of innovation", *European Journal of Innovation Management*, Vol. 27 No. 9, pp. 73-93, doi: 10.1108/EJIM-10-2023-0856.

Carter, B.E. and Wiles, J.R. (2016), "Comparing effects of comedic and authoritative video presentations on student knowledge and attitudes about climate change", *Bioscene: Journal of College Biology Teaching*, Vol. 42 No. 1, pp. 16-24.

Ceh, S.M., Christensen, A.P., Lebuda, I. and Benedek, M. (2024), "# creativity: exploring lay conceptualizations of creativity with Twitter hashtags", *Creativity Research Journal*, Vol. 36 No. 4, pp. 640-655, doi: 10.1080/10400419.2023.2214472.

Che, S., Kuang, K. and Liu, S. (2024), "Climate communication with Chinese youth by Chinese nongovernmental organizations: a case study of Chinese weather enthusiasts on Bilibili", *Weather, Climate, and Society*, Vol. 16 No. 3, pp. 467-479, doi: 10.1175/WCAS-D-23-0131.1.

Chen, N.H. (2020), "Exploring the cognitive and emotional impact of online climate change videos on viewers", *Sustainability*, Vol. 12 No. 22, p. 9571, doi: 10.3390/su12229571.

Chen, K.J., Lin, J.S., Choi, J.H. and Hahm, J.M. (2015), "Would you be my friend? An examination of global marketers' brand personification strategies in social media", *Journal of Interactive Advertising*, Vol. 15 No. 2, pp. 97-110, doi: 10.1080/15252019.2015.1079508.

Chen, S., Li, B., Zhou, Q. and Liu, H. (2023), "From virtual trees to real forests: the impact of gamification affordances on green consumption behaviors in ant forest", *Environmental Communication*, Vol. 18 No. 5, pp. 1-25, doi: 10.1080/17524032.2023.2213850.

Chen, Q., Min, C., Zhang, W., Ma, X. and Evans, R. (2021), "Factors driving citizen engagement with government TikTok accounts during the COVID-19 pandemic: model development and analysis", *Journal of Medical Internet Research*, Vol. 23 No. 2, p. e21463, doi: 10.2196/21463.

Che, S., Zhang, S. and Kim, J.H. (2022), "How public health agencies communicate with the public on TikTok under the normalization of COVID-19: a case of 2022 Shanghai's outbreak", *Frontiers in Public Health*, Vol. 10, p. 1039405, doi: 10.3389/fpubh.2022.1039405.

Cheng, P., Ouyang, Z. and Liu, Y. (2020), "The effect of information overload on the intention of consumers to adopt electric vehicles", *Transportation*, Vol. 47, pp. 2067-2086, doi: 10.1007/s11116-019-10001-1.

Cone, J. and Winters, K. (2013), "Planning and evaluating science video programs using communication science", *Journal of Applied Communications*, Vol. 97 No. 4, p. 9, doi: 10.4148/1051-0834.1131.

Corner, A., Roberts, O., Chiari, S., Voller, S., Mayrhuber, E.S., Mandl, S. and Monson, K. (2015), "How do young people engage with climate change? The role of knowledge, values, message framing, and trusted communicators", *WIREs Climate Change*, Vol. 6 No. 5, pp. 523-534, doi: 10.1002/wcc.353.

Craig, T.Y. and Blankenship, K.L. (2011), "Language and persuasion: linguistic extremity influences message processing and behavioral intentions", *Journal of Language and Social Psychology*, Vol. 30 No. 3, pp. 290-310, doi: 10.1177/0261927X114071.

Dobson, N. (2018), "Creating (artificial) emotion in animation through sound and story", in Uhrig, M. (Ed.), *Emotion in Animated Films*, Routledge, pp. 123-140.

Engblom, A., Timm, K., Mazzone, R., Perkins, D., Myers, T. and Maibach, E. (2019), "Local TV news viewer reactions to weathercasters reporting the local impacts of climate change", *Weather, Climate, and Society*, Vol. 11 No. 2, pp. 321-335, doi: 10.1175/WCAS-D-18-0066.1.

Ettinger, J., Walton, P., Painter, J. and DiBlasi, T. (2021), "Climate of hope or doom and gloom? Testing the climate change hope vs. fear communications debate through online videos", *Climatic Change*, Vol. 164 Nos 1/2, p. 19, doi: 10.1007/s10584-021-02975-8.

Fløttum, K., Dahl, T. and Rivenes, V. (2016), "Young Norwegians and their views on climate change and the future: findings from a climate concerned and oil-rich nation", *Journal of Youth Studies*, Vol. 19 No. 8, pp. 1128-1143, doi: 10.1080/13676261.2016.1145633.

Frydenberg, M. and Andone, D. (2016), "Creating micro-videos to demonstrate technology learning and digital literacy", *Interactive Technology and Smart Education*, Vol. 13 No. 4, pp. 261-273, doi: 10.1108/ITSE-09-2016-0030.

Gentina, E. (2020), "Generation Z in Asia: a research agenda", in Gentina, E. and Parry, E. (Eds), *The New Generation Z in Asia: Dynamics, Differences, Digitalisation*, Emerald Publishing, pp. 3-19, doi: 10.1108/978-1-80043-220-820201002.

Goldberg, M.H., van der Linden, S., Ballew, M.T., Rosenthal, S.A., Gustafson, A. and Leiserowitz, A. (2019), "The experience of consensus: video as an effective medium to communicate scientific agreement on climate change", *Science Communication*, Vol. 41 No. 5, pp. 659-673, doi: 10.1177/1075547019874361.

Guo, P.J., Kim, J. and Rubin, R. (2014), "How video production affects student engagement: an empirical study of MOOC videos", *Proceedings of the first ACM conference on Learning@ scale conference*, pp. 41-50, doi: 10.1145/2556325.2566239.

Gustafson, A., Ballew, M.T., Goldberg, M.H., Cutler, M.J., Rosenthal, S.A. and Leiserowitz, A. (2020), "Personal stories can shift climate change beliefs and risk perceptions: the mediating role of emotion", *Communication Reports*, Vol. 33 No. 3, pp. 121-135, doi: 10.1080/08934215.2020.1799049.

Halvey, M.J. and Keane, M.T. (2007), "Analysis of online video search and sharing", *Proceedings of the Eighteenth Conference on Hypertext and Hypermedia* pp. 217-226, doi: 10.1145/1286240.1286301

Hamilton, M.A. and Stewart, B.L. (1993), "Extending an information processing model of language intensity effects", *Communication Quarterly*, Vol. 41 No. 2, pp. 231-246, doi: 10.1080/01463379309369882.

Hartley, J. (2022), "Pathetic earthlings! who can save you now?' science fiction, planetary crisis and the globalisation of Chinese culture", *Global Media and China*, Vol. 7 No. 1, pp. 3-23, doi: 10.1177/20594364211067872.

Henke, J., Leissner, L. and Möhring, W. (2020), "How can journalists promote news credibility? Effects of evidences on trust and credibility", *Journalism Practice*, Vol. 14 No. 3, pp. 299-318, doi: 10.1080/17512786.2019.1605839.

Hertenstein, M.J., Holmes, R., McCullough, M. and Keltner, D. (2009), "The communication of emotion via touch", *Emotion*, Vol. 9 No. 4, pp. 566-573, doi: 10.1037/a0016108.

Jamelske, E., Barrett, J. and Boulter, J. (2013), "Comparing climate change awareness, perceptions, and beliefs of college students in the United States and China", *Journal of Environmental Studies and Sciences*, Vol. 3 No. 3, pp. 269-278, doi: 10.1007/s13412-013-0144-x.

Jones, B.T. and Metzger, S.K. (2019), "Different words, same song: advice for substantively interpreting duration models", *PS: Political Science and Politics*, Vol. 52 No. 4, pp. 691-695, doi: 10.1017/S104909651900060X.

Junkui, H. (2016), (Ed.). "International NGOs in China: current situation, impacts and response of the Chinese government", in Li, Y.W. (Ed.), *NGOs in China and Europe*, Routledge, pp. 23-52.

Kirilenko, A.P., Desell, T., Kim, H. and Stepchenkova, S. (2017), "Crowdsourcing analysis of Twitter data on climate change: paid workers vs. volunteers", *Sustainability*, Vol. 9 No. 11, p. 2019, doi: 10.3390/su9112019.

Knoche, H., McCarthy, J. and Sasse, M. (2006), "A close-up on mobile TV: the effect of low resolutions on shot types", *Proceedings of EuroITV*, Vol. 6.

Kramar, N. (2023), "Construction of agency within climate change framing in media discourse: a corpus-based study", *Respectus Philologicus*, Vol. 43 No. 48, pp. 36-48, doi: 10.15388/RESPECTUS.2023.43.48.106.

Kuyucu, M. (2019), "The transformation of traditional TV to YouTube with social media and its reflections in Turkey", *Archives of Business Research*, Vol. 7 No. 1, doi: 10.14738/abr.71.5968.

Lebel, L. (2013), "Local knowledge and adaptation to climate change in natural resource-based societies of the Asia-Pacific", *Mitigation and Adaptation Strategies for Global Change*, Vol. 18 No. 7, pp. 1057-1076, doi: 10.1007/s11027-012-9407-1.

Lee, C.H. and Yu, H. (2020), "The impact of language on retweeting during acute natural disasters: uncertainty reduction and language expectancy perspectives", *Industrial Management and Data Systems*, Vol. 120 No. 8, pp. 1501-1519, doi: 10.2139/ssrn.3446718, available at: https://ssrn.com/abstract=3446718

León, B., Negredo, S. and Erviti, M.C. (2022), "Social engagement with climate change: principles for effective visual representation on social media", *Climate Policy*, Vol. 22 No. 8, pp. 1-17, doi: 10.1080/14693062.2022.2077292.

Li, D.Q. (2023), "A systemic functional typology of declarative mood", *A Systemic Functional Typology of MOOD*, Springer Singapore, pp. 89-149, doi: 10.1007/978-981-19-8821-9_5.

Li, Y., Guan, M., Hammond, P. and Berrey, L.E. (2021), "Communicating COVID-19 information on TikTok: a content analysis of TikTok videos from official accounts featured in the COVID-19 information hub", *Health Education Research*, Vol. 36 No. 3, pp. 261-271, doi: 10.1093/her/cyab010.

Liebrecht, C., Hustinx, L. and Van Mulken, M. (2019), "The relative power of negativity: the influence of language intensity on perceived strength", *Journal of Language and Social Psychology*, Vol. 38 No. 2, pp. 170-193, doi: 10.1177/0261927X18808562.

Liikkanen, L.A. and Salovaara, A. (2015), "Music on YouTube: user engagement with traditional, user-appropriated and derivative videos", *Computers in Human Behavior*, Vol. 50, pp. 108-124, doi: 10.1016/j.chb.2015.01.067.

Lin, J., Swart, J. and Zeng, G. (2023), "Theorising TikTok cultures: neuro-images in the era of short videos", *Media, Culture and Society*, Vol. 45 No. 8, pp. 1550-1567, doi: 10.1177/01634437231202167.

Liu, F. (2011), *Urban Youth in China: Modernity, the Internet and the Self*, Routledge.

Liu, C., Yu, H., Shen, Z., Dixon, I., Yu, Y., Gao, Z., Wang, P., Ren, P., Xie, X., Cui, L. and Miao, C. (2021), "Enhancing viewing experience of generated visual storylines for promotional videos",

2021 IEEE International Conference on Multimedia and Expo (ICME), pp. 1-6, doi: 10.1109/ICME51207.2021.9428292.

Liu, J.C.-E. and Zhao, B. (2017), "Who speaks for climate change in China? Evidence from Weibo", *Climatic Change*, Vol. 140 Nos 3/4, pp. 413-422, doi: 10.1007/s10584-016-1883-y.

Li, Y., Yu, B. and Dai, J. (2024), "Climate change' or 'global warming'? The (un) politicization of climate in chinese social media platform", *Environmental Communication*, Vol. 18 No. 7, pp. 1-18, doi: 10.1080/17524032.2024.2327069.

Lu, Y. and Shen, C. (2023), "Unpacking multimodal fact-checking: features and engagement of fact-checking videos on Chinese TikTok (Douyin)", *Social Media+ Society*, Vol. 9 No. 1, p. 20563051221150406, doi: 10.1177/205630512211504.

Mayer, R.E. and Moreno, R. (2003), "Nine ways to reduce cognitive load in multimedia learning", *Educational Psychologist*, Vol. 38 No. 1, pp. 43-52, doi: 10.1207/S15326985EP3801_6.

Men, L.R. and Tsai, W.H.S. (2015), "Infusing social media with humanity: corporate character, public engagement, and relational outcomes", *Public Relations Review*, Vol. 41 No. 3, pp. 395-403, doi: 10.1016/j.pubrev.2015.02.005.

Moss, F.M., Yeh, C.T., Zhang, F., Baddeley, R. and Bull, D.R. (2016), "Support for reduced presentation durations in subjective video quality assessment", *Signal Processing: Image Communication*, Vol. 48, pp. 38-49, doi: 10.1016/j.image.2016.08.005.

Nerlich, B. and Jaspal, R. (2014), "Images of extreme weather: symbolising human responses to climate change", *Science as Culture*, Vol. 23 No. 2, pp. 253-276, doi: 10.1080/09505431.2013.846311.

O'Neill, S.J. and Smith, N. (2014), "Climate change and visual imagery", *WIREs Climate Change*, Vol. 5 No. 1, pp. 73-87, doi: 10.1002/wcc.249.

Oz, M., Shahin, S. and Greeves, S.B. (2024), "Platform affordances and spiral of silence: How perceived differences between Facebook and Twitter influence opinion expression online", *Technology in Society*, Vol. 76, p. 102431, doi: 10.1016/j.techsoc.2023.102431.

Paek, H.J., Kim, K. and Hove, T. (2010), "Content analysis of antismoking videos on YouTube: message sensation value, message appeals, and their relationships with viewer responses", *Health Education Research*, Vol. 25 No. 6, pp. 1085-1099, doi: 10.1093/her/cyq063.

Palmgreen, P., Stephenson, M.T., Everett, M.W., Baseheart, J.R. and Francies, R. (2002), "Perceived message sensation value (PMSV) and the dimensions and validation of a PMSV scale", *Health Communication*, Vol. 14 No. 4, pp. 403-428, doi: 10.1207/S15327027HC1404_1.

Park, M., Naaman, M. and Berger, J. (2016), "A data-driven study of view duration on Youtube", *Proceedings of the international AAAI conference on web and social media* Vol. 10, No. 1, pp. 651-654, doi: 10.1609/icwsm.v10i1.14781

Qian, S., Lu, Y., Peng, Y., Shen, C.C. and Xu, H. (2024), "Convergence or divergence? A cross-platform analysis of climate change visual content categories, features, and social media engagement on Twitter and Instagram", *Public Relations Review*, Vol. 50 No. 2, p. 102454, doi: 10.1016/j.pubrev.2024.102454.

Rajput, A.S. and Sharma, S. (2023), "Importance of communicating science to the general public: an empirical study of top Indian scientists", *Weather*, Vol. 78 No. 2, pp. 50-55, doi: 10.1002/wea.4214.

Riley, P., Wang, R., Wang, Y. and Feng, L. (2016), "Global warming: Chinese narratives of the future", *Global Media and China*, Vol. 1 Nos 1/2, pp. 12-31, doi: 10.1177/2059436416654770.

Savardi, M., Kovács, A.B., Signoroni, A. and Benini, S. (2021), "CineScale: a dataset of cinematic shot scale in movies", *Data in Brief*, Vol. 36, p. 107002, doi: 10.1016/j.dib.2021.107002.

Scott, K. and Jackson, R. (2020), "When everything stands out, nothing does", in Piskorska, A. (Ed.), *Relevance Theory, Figuration, and Continuity in Pragmatics*, John Benjamins Publishing Company, pp. 167-192.

Shabbir, A., Ali, N., Ahmed, J., Zafar, B., Rasheed, A., Sajid, M. and Dar, S.H. (2021), "Satellite and scene image classification based on transfer learning and fine tuning of ResNet50", *Mathematical Problems in Engineering*, Vol. 2021, pp. 1-5843816, doi: 10.1155/2021/5843816.

Shahbazi, Z. and Nowaczyk, S. (2024), "Effective elements of climate change videos on the YouTube platform", *European Conference on Social Media*, Vol. 11 No. 1, pp. 243-250, doi: 10.34190/ecsm.11.1.2134.

Shepherd, T. (2020), "Storyline approach to extreme event characterization", *EGU General Assembly Conference Abstracts*, p. 4896, doi: 10.5194/egusphere-egu2020-4896.

Soroya, S.H., Farooq, A., Mahmood, K., Isoaho, J. and Zara, S.E. (2021), "From information seeking to information avoidance: understanding the health information behavior during a global health crisis", *Information Processing & Management*, Vol. 58 No. 2, p. 102440, doi: 10.1016/j.ipm.2020.102440.

Spezialetti, M. (2018), "Innovative thinking: encouraging creative diversity with video scenarios", *2018 IEEE Frontiers in Education Conference (FIE)*, pp. 1-4, doi: 10.1109/FIE.2018.8658577.

Stanes, E. and Klocker, N. (2016), "Young people in the global north: environmental heroes or pleasure-seeking consumers", in Ansell, N., Klocker, N. and Skelton, T. (Eds), *Geographies of global issues: Change and threat*, Springer, pp. 553-574, doi: 10.1007/978-981-4585-54-5_2.

Suherlan, S. (2023), "Digital technology transformation in enhancing public participation in democratic processes", *Technology and Society Perspectives (TACIT)*, Vol. 1 No. 1, pp. 10-17, doi: 10.61100/tacit.v1i1.34.

Takahashi, B. (2023), "Towards inclusive international environmental communication scholarship: the role of Latin America", *International Journal of Cultural Studies*, Vol. 26 No. 4, pp. 372-391, doi: 10.1177/13678779221146302.

Tao, W., Tian, S., Sunny Tsai, W.H. and Seelig, M.I. (2024), "The power of emotional appeal in motivating behaviors to mitigate climate change among Generation Z", *Journal of Nonprofit and Public Sector Marketing*, Vol. 36 No. 1, pp. 37-64, doi: 10.1080/10495142.2022.2133058.

Topp, K., Thai, M. and Hryciw, D.H. (2019), "The role of entertainment in engagement with climate change", *Environmental Education Research*, Vol. 25 No. 5, pp. 691-700, doi: 10.1080/13504622.2019.1572072.

Trilling, D., Tolochko, P. and Burscher, B. (2017), "From newsworthiness to shareworthiness: How to predict news sharing based on article characteristics", *Journalism and Mass Communication Quarterly*, Vol. 94 No. 1, pp. 38-60, doi: 10.1177/1077699016654682.

Voltmer, K. and von Salisch, M. (2023), "Promoting subjective well-being and a sustainable lifestyle in children and youth by strengthening their personal psychological resources", *Sustainability*, Vol. 16 No. 1, p. 134, doi: 10.3390/su16010134.

Wang, P., Fan, E. and Wang, P. (2021), "Comparative analysis of image classification algorithms based on traditional machine learning and deep learning", *Pattern Recognition Letters*, Vol. 141, pp. 61-67, doi: 10.1016/j.patrec.2020.07.042.

Williams, H.T.P., McMurray, J.R., Kurz, T. and Lambert, F.H. (2015), "Network analysis reveals open forums and echo chambers in social media discussions of climate change", *Global Environmental Change*, Vol. 32, pp. 126-138, doi: 10.1016/j.gloenvcha.2015.03.006.

Xu, Y., Chen, W. and Ow, T.T. (2023), "The effects of social media posts' characteristics on customer engagement: evidence from WeChat", *Information and Management*, Vol. 60 No. 7, p. 103854, doi: 10.1016/j.im.2023.103854.

Yang, R. (2023), "Embracing Western values while cleaving to traditions: experiments of the Chinese idea of a university at Peking and Tsinghua", *Discourse: Studies in the Cultural Politics of Education*, Vol. 44 No. 3, pp. 348-363, doi: 10.1080/01596306.2023.2200074.

Yang, B., Li, Y., Terán, L., Choi, E. and Choi, Y. (2024a), "COVID-19 vaccines# ForYou: analyzing COVID-19 vaccine videos on TikTok during the early phase of the vaccine rollout in the US", *Health Communication*, Vol. 39 No. 8, pp. 1594-1605, doi: 10.1080/10410236.2023.2227431.

Yang, Y., Liu, R.D., Ding, Y., Lin, J., Ding, Z. and Yang, X. (2024b), "Time distortion for short-form video users", *Computers in Human Behavior*, Vol. 151, p. 108009, doi: 10.1016/j.chb.2023.108009.

Young, L. and Soroka, S. (2012), "Affective news: the automated coding of sentiment in political texts", *Political Communication*, Vol. 29 No. 2, pp. 205-231, doi: 10.1080/10584609.2012.671234.

Yu, L. (2022), "Chinese attitudes toward greta thunberg and the history of climate change research in China", *The American Journal of Economics and Sociology*, Vol. 81 No. 2, pp. 271-286, doi: 10.1111/ajes.12458.

Yu, Z. (2023), "Shot size narration in the mobile media era: characteristics and evolution", *Journal of Research in Social Science and Humanities*, Vol. 2 No. 11, pp. 17-23.

Yu, J., Dickinger, A., So, K.K.F. and Egger, R. (2024), "Artificial intelligence-generated virtual influencer: examining the effects of emotional display on user engagement", *Journal of Retailing and Consumer Services*, Vol. 76, p. 103560, doi: 10.1016/j.jretconser.2023.103560.

Zhang, S., Che, S., Nan, D. and Kim, J.H. (2023a), "How does online social interaction promote students' continuous learning intentions?", *Frontiers in Psychology*, Vol. 14, p. 1098110, doi: 10.3389/fpsyg.2023.1098110.

Zhang, Y., He, C., Wang, H. and Lu, Z. (2023b), "Understanding communication strategies and viewer engagement with science knowledge videos on Bilibili", *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* pp. 1-18, doi: 10.1145/3544548.3581476.

Zhang, Y., Chen, J., Han, Y., Qian, M., Guo, X., Chen, R., Xu, D. and Chen, Y. (2021), "The contribution of fintech to sustainable development in the digital age: Ant Forest and land restoration in China", *Land Use Policy*, Vol. 103, p. 105306, doi: 10.1016/j.landusepol.2021.105306.

Zhao, X. and Zhan, M.M. (2019), "Appealing to the heart: how social media communication characteristics affect users' liking behavior during the Manchester terrorist attack", *International Journal of Communication*, Vol. 13, p. 22.

Zhu, C., Xu, X., Zhang, W., Chen, J. and Evans, R. (2020), "How health communication via Tik tok makes a difference: a content analysis of Tik tok accounts run by Chinese provincial health committees", *International Journal of Environmental Research and Public Health*, Vol. 17 No. 1, p. 192, doi: 10.3390/ijerph17010192.

Further reading

Nerlich, B., Koteyko, N. and Brown, B. (2010), "Theory and language of climate change communication", *WIREs Climate Change*, Vol. 1 No. 1, pp. 97-110, doi: 10.1002/wcc.2.

Appendix

Table A1. Keyword list

Coding category	Subcategory	Keyword
Personification	Yes	卷土重来 (come back with a vengeance) 酝酿 (brewing) 憋大招 (holding back a big move) 突袭 (surprise attack) 大举南下 (marching south in force) 拉扯 (tug-of-war) 发飙 (lose control) 长驻 (stay for a long time) 出击 (launch an attack) 重生 (rebirth) 寄了 (send off, give up on) 错过 (miss out) 挺身而出 (step up) 归来 (return) 虎视眈眈 (lie in wait) 搞事 (stir trouble) 收尾 (wrap up) 推迟出手 (delay action) 撤退 (retreat) 接踵而至 (follow one after another)
Tone	High level	!
	Low level	。
	Medium level	?
Language intensity	High level	超级 (super) 最强 (strongest) 特大 (extra-large) 特离谱 (extremely outrageous) 极端 (extreme) 巨型 (giant) 激烈 (intense) 猛烈 (fierce) 大 (large) 酷 (cool) 超强 (super strong) 强 (strong) 狂 (frenzied) 暴 (violent) 极端化 (extremization)
Video theme	High temperature	高温 (high temperature) 热 (hot) 酷热 (scorching heat) 40度 (40 degrees) 35度 (35 degrees) 干热 (dry heat) 炎热 (sweltering heat) 热浪 (heat wave) 暑 (hot summer) 桑拿 (sauna)

(*continued*)

Table A1. Continued

Coding category	Subcategory	Keyword
		蒸煮 (steaming)
		烧 (burning)
		极端化 (extremization)
	Rainstorm	暴雨 (rainstorm)
		大雨 (heavy rain)
		特大暴雨 (torrential rain)
		狂风暴雨 (violent storm)
		暴力梅雨 (violent plum rain)
		暴雨带 (rainband)
		洪水 (flood)
	Typhoon	台风 (typhoon)
		风暴 (storm)
		风 (wind)
		风王 (king of winds)
		风沙 (wind and sand)
		龙卷 (tornado)
		旋转风 (spinning wind)
		超强台风 (super typhoon)
		风暴 (storm)
	Blizzard	暴风雪 (blizzard)
		寒潮 (cold wave)
		雪 (snow)
		冷空气 (cold air)
		极寒气团 (polar air mass)
		严寒 (severe cold)
		冷 (cold)
	Low temperature	低温 (low temperature)
		降温 (temperature drop)
		寒 (chill)
		酷寒 (extreme cold)
		降温 (cooling down)
	Sandstorm	沙尘暴 (dust storm)
		沙尘 (dust and sand)
Video type	Popularization	防灾减灾 (disaster prevention and mitigation)
		回顾 (review)
		数据 (data)
		为什么 (why)
		底层逻辑 (underlying logic)
		为何 (why)
		怎么 (how)
		科普 (popular science)
		为啥 (why)
		中气爱 (Chinese meteorology love)
		吗 (question particle)
		真实情况 (real situation)
		什么 (what)
		纪录片 (documentary)
		有关 (related)

(*continued*)

Table A1. Continued

Coding category	Subcategory	Keyword
	4K video	4K (4K) HDR (HDR) 真实记录 (real record) 记录 (record) 全过程 (whole process) 地球旋转 (earth rotation) 灾后受损情况 (post-disaster damage) 进口台风 (imported typhoon) 台风结界 (typhoon barrier) 前所未有 (unprecedented)
	Global status	盘点 (inventory) 概览 (overview)

Source(s): Authors' own creation

Table A2. Overdispersion O test

Metrics	Mean	Variance	O-value	*p*-value
Views	606065.423	184153451036.995	3746111.668	0.000
Likes	34817.075	460309668.603	162984.668	0.000
Shares	5780.348	73278722.892	156282.905	0.000
Coins	3261.889	29808247.613	112652.698	0.000
Comments	2885.282	5139734.690	21949.790	0.000
Danmaku	1952.577	2460993.699	15526.709	0.000
Favorites	1898.128	10100981.711	65596.142	0.000

Source(s): Authors' own creation

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