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ORIGINAL ARTICLE

Effects of short videos on engaging citizens in disaster communications with the government on social media

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Abstract

Social media has proven effective in communicating situational information during crises. Although governmental agencies increasingly use social media platforms and leverage videos to engage with the public, the extent to which videos enhance information transmission and public communication remains unclear. This study addresses this gap through an evidence-based investigation. Analyzing 1,116 videos embedded in 7,659 Weibo posts by 1,554 government accounts during the 2019 Changning earthquake, it explores how video content and format influence citizen engagement (likes, retweets, and comments) within a dual-process theoretical framework. Results indicate that video topics significantly impact engagement. Preparedness-related videos drive higher citizen engagement, while videos from individual influencers prompt more comments and discussions than those from media outlets. Surprisingly, videos without background music are more engaging. The fit between video topics and formats also matter. Videos on misconduct, early warnings, and government's handling sourced from government organizations positively influence engagement. Meanwhile, sentiment- and education-related videos with music attract more retweets and likes. This study is among the first to examine how embedded videos affect citizen engagement through government accounts on text-based social media during crises. Findings highlight video format as a crucial moderator, revealing specific mechanisms underlying its effects. The results provide actionable insights for government agencies to design effective video strategies on social media, enhancing public engagement during natural disasters.

Keywords Short videos · Citizen engagement · Crisis communication · Heuristic-Systematic model · Media richness theory · Changning earthquake

Introduction

By enabling collaboration among governments, businesses, and communities, effective communication is fundamental to building resilient and sustainable societies. Disaster communication is a critical instrument of sustainability science, a field dedicated to helping societies confront crises from climate change to health pandemics (Lindenfeld et al. 2013). Due to the main characteristics that define social media are participation, openness, conversation, engagement and connectedness, the use of social media in government can improve communication, transparency, trust, citizen engagement and democracy (Graham et al. 2015; Haro-de-Rosario et al. 2016), which is especially important during a crisis when communication lines may be overloaded, and cellular networks overwhelmed. Social media offer particular opportunities for governments to communicate with citizens through conversation and interaction during crises

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(Graham et al. 2015; Nguyen et al. 2024) and provide a way to put citizen engagement into practice (Haro-de-Rosario et al. 2016). Increased citizen engagement with posted messages is demonstrated through acknowledging and appreciating content (via likes), mobilizing their networks (via retweets), and providing information or feedback (via comments), which can assist governments in more effectively fulfilling their crisis prevention duties (Leppert et al. 2022). Governments are seizing the opportunity to encourage interactive participation and thus enhance citizen engagement through social media (Haro-de-Rosario et al. 2016).

With the incredibly fast development of mobile internet and digital camera technologies, short videos on social media have gained increasing popularity (Dong et al. 2023; He et al. 2022). As the saying goes, "A picture is worth a thousand words." A team of neuroscientists from MIT has found that the human brain can process an image in just 13 milliseconds, and 90% of the information transmitted to the brain is visual (Trafton 2014). Compared to text-based messaging, not only are visuals easier for humans to understand at a glance, but they also make the content more accessible to those with disabilities (Barnhart 2022). When it comes to videos, their value is immeasurable, considering that they consist of a collection of visual, auditory, and textual elements, making them highly engaging and effective for conveying complex information quickly. According to *HubSpot's State of Marketing Report 2023*, video is the top content marketing strategy and videos for social media are great for educating the audience, acquiring new customers, demonstrating products and features, and much more (Bernard 2023). For government agencies, videos contribute to providing transparency, building trust, and increasing engagement between the government and the public. They align with user preferences for concise and dynamic content in this fast-paced world with shrinking attention spans, which can significantly influence audience engagement and communication effectiveness during crises. These features afford unique benefits for government communication during crises (He et al. 2022).

While government agencies at all levels are embracing social media platforms and leveraging video communication strategies (Reynolds 2020), contemporary research indicates that the intended potential for enhancing citizen engagement may not be fully realized (He et al. 2022). Not all videos are fashioned in a manner that the public is inclined to respond to. Hence, videos on social media possess the potential to enhance engagement capacity rather than exclusively promoting collaboration, contingent upon the construction of these tools (Zavattaro and Sementelli 2014), as social media instruments cannot inherently surmount people's passivity (Haro-de-Rosario et al. 2016). Most importantly, because multi-media video production is time-consuming, it is important to examine if and under what conditions multimedia is effective (Lim and Benbasat 2000), especially during times of crisis. Therefore, understanding how certain characteristics of short videos influence these different dimensions of engagement on social media is crucial. Moreover, as the consumption and sharing of videos are becoming increasingly important (Alamäki et al. 2019), identification of the efficacy of these factors would shed light on the value and impact of social videos used by government social media accounts and, more broadly, insights into the development of effective social media-based crisis communication strategies for governments.

Existing research has begun to examine the influence of short videos in crisis communication. However, there are still research gaps which deserve further investigation. First, few studies have focused on the influencing mechanisms of video content and video format on text-based social media. Most studies have regarded videos as one medium type, representing one level of media richness (Chen et al. 2020). Together with other influencing factors, videos were compared with other media types (i.e. text, image) in terms of the influences on citizen engagement on text-based social media. A few studies have addressed the effects of video content, video format, video type, and video length on citizen engagement on video-based social media platforms (Chen et al. 2021; Feroz Khan and Vong 2014; Li et al. 2021). Engagement in different social media platforms may have different characteristics, what works well on YouTube may not work well on TikTok or other channels (Munaro et al. 2021). Given the diversity of social media strategies, there is no universal approach; thus, no two social videos are identical. Understanding how short videos influence citizen engagement on text-based social media can assist government crisis communication more effectively.

Second, none, to date, have employed moderating variables to further explain the influencing mechanisms of video format and video content. While past research has extensively examined the independent impact of key variables on citizen engagement, their potential interaction effects have received far less attention. Despite this gap, a limited number of studies have pioneered the investigation. Chen et al. (2021) paid attention to the moderating role of emotional valence on citizen engagement and found the effects of media richness, dialogic loop, and content type were contingent upon the emotional valence of each Weibo post. Besides, Ngai et al. (2020) investigated the interaction effect between content and style of Weibo textual messages and found that the use of a narrative style in posts about disease prevention had a significant positive effect on citizen engagement. However, no studies have revealed the specific influencing mechanism of video format and video content.

To address existing research gaps, this study employed the dual process theoretical framework, which can integrate two types of potentially influential factors in short videos (i.e. systematically and heuristically processed information cues), to investigate their importance in affecting citizen engagement on text-based social media. Specifically, as one of the traditional text-based social media, Sina Weibo is one of the most popular social media platforms in China and has the first series of government social media accounts (Chen et al. 2020). Since launched, Weibo allows users to share videos by uploading a local video file or from other websites. Therefore, this study adopts a case study approach centered on Sina Weibo and the 2019 Changning earthquake in China to investigate how video content and format shape public engagement with government disaster communication. A key objective is to uncover the underlying mechanisms by examining the interaction effect between video content and format. It also seeks to provide actionable insights for developing effective social media-based crisis communication strategies for governments.

Literature review

Disaster communication and government social media

It is widely acknowledged that communication is fundamental to emergency management, critical for coordinating response efforts and disseminating vital information (Simon et al. 2015). Due to its ubiquitous nature and reliability, social media has become an indispensable tool for government agencies to communicate with citizens in a natural disaster crisis (Lovari and Bowen 2019). Crisis communication literature has highlighted the central role of social media in all phases of emergency management, especially during disasters (Fauzi 2023). As the use of social media for crisis communication in natural disasters is increasing and the amount of information threatens to overwhelm people, understanding how people engage with official social media content is vital (Atkinson and Lee 2023). Citizen engagement refers to the participation of citizens in political and social affairs, which could enhance understanding and promote transparent decision-making. Citizen engagement during crises is especially crucial for minimizing mass anxiety, understanding public concerns, developing citizens' self-resilience in crisis response, as well as increasing the capabilities of government agencies in providing public services (Chen et al. 2020). Compared to offline participation, social media-based participation including actions such as liking, retweeting, and commenting takes minimal effort and is more likely to occur (Zhang et al. 2022). Retweeting can be a sign of informational value, liking can be a sign of appreciation, and commenting allows the users to express their opinions (Siyam et al. 2020). Previous studies have evaluated citizen engagement using quantitative indicators of social media platforms, such as the number of shares or retweets, likes and comments (Chen et al. 2020).

There is a growing body of research investigating factors of citizen engagement on social media during crises using quantitative content analysis and (or) natural language processing. Factors include content, message style such as the use of imperative sentence style, message structure such as the inclusion of images and URLs, message sentiment, and the features of the sending account (Fan et al. 2020; Kim and Yang 2017; Sutton et al. 2015a). Due to limited data availability, previous studies have heavily relied on text-based social media, such as Twitter and Weibo, to investigate the mechanisms.

Short video crisis communication and engagement outcomes

The combination of short-form videos and social media platforms increases the richness and vividness of information and improves communication efficiency (Dong et al. 2023), providing great opportunities for crisis communication, which can engender citizen engagement. The richness of the medium of video, combining sight, sound, motion, and emotion, could reach our senses and psyche, and could be more engaging than other media types such as text or photo (Bednárová and Bonsón 2014).

Recently, how citizen engagement can be enhanced using short videos on social media in crisis communication has gained increasing attention. On one hand, some studies pay attention to the effect of embedded videos on text-based social media, such as Twitter (Son et al. 2019; Sutton et al. 2015a; Vos et al. 2018) and Weibo (Chen et al. 2020; Liu et al. 2012), where videos are regarded as one of media types (Bonsón et al. 2015), or operated as one level of media richness (Chen et al. 2020). Together with other influencing factors such as the sender-level characteristic, message content, message style, message structure and microstructural elements, videos are compared with other media types (i.e. text, image, link) in terms of the influences on citizen engagement. However, the findings reported are controversial. Some studies indicate posts with videos could achieve better citizen engagement on social media (Bhattacharya et al. 2017), while others show that videos cause no effect or even a negative predictor of citizen engagement (Bonsón et al. 2015; Chen et al. 2020). On the other hand, a few studies address the effects of video content, video format, video type, and video length on citizen engagement through video-based social media, such as YouTube (Feroz Khan and Vong

2014; Munaro et al. 2021), Bilibili (He et al. 2022), TikTok (Chen et al. 2021; Li et al. 2021). These studies mainly focus on the effect of each variable and some studies paid attention to the moderating role of emotional valence.

A survey of the literature on short videos for crisis communication clearly suggests that short videos have been used to engage the public. However, few studies focus on the influencing mechanisms of short videos on text-based social media. Even fewer studies explore moderating variables to further explain the influencing mechanisms of video format and video content during times of crisis. A pioneering study by Ngai et al. (2020) investigates the interaction effect between content and style, and further found that the use of a narrative style in posts about disease prevention had a significant positive effect on citizen engagement in Weibo. The study was conducted based on the 608 posts on the People's Daily Sina Weibo account during COVID-19 and analyzed the contents and styles of texts, rather than social videos. It attempts to address this gap by considering the interaction effect between video content and video format on citizen engagement during an earthquake using social videos on Weibo.

Research framework and hypotheses development

Theoretical foundation

Citizen engagement on social media can be elucidated in dual-process models of influence in attitude-behavior online (Hagemann and Abramova 2023; Munaro et al. 2021; Shi et al. 2018). Among them, the Heuristic-Systematic Model (HSM) has been widely adopted to explain individual information-related behaviors. According to the HSM, receivers process pervasive information using two distinctive modes: heuristic information processing and systematic information processing (Chaiken 1980). In heuristic processing, individuals rely on mental shortcuts and contextual cues present within the message to evaluate information. In contrast, systematic processing involves thorough examination of the content and integrating it critically with one's existing knowledge. Compared to heuristic processing, systematic processing usually requires more effort and resources (Liu et al. 2012). While heuristic and systematic processing can occur independently, they may also function concurrently (Watts and Zhang 2008).

The HSM model has been successfully applied to explain online behavior, including information dissemination behavior and engagement on social media. For example, Liu et al. (2012) reveal that some heuristic (e.g. source trustworthiness, expertise, and attractiveness) and systematic factors (e.g. the number of multimedia) result in more reposting on Weibo in emergency events. This is further explained by Huang and Yeo (2018) who find that the retweetability (the rate of reposting) of chief executive officers'(CEOs') posts was positively influenced by both contextual factors—like the CEOs' background—and content-related factors, including content types, usage of hashtags, and certainty of language. As for engagement on social media, Zhang et al. (2022) investigate the effects of the heuristic factors such as information richness and language features, and the systematic factors including content types, on citizen engagement with government social media across different stages of the COVID-19 pandemic. They observe the positive effects of social media capital on citizen engagement at all stages, while the effects of information richness, language features, dialogic loop and content types, and the moderating effect of emotional valence, varied across the different pandemic development stages. Besides, Hagemann and Abramova (2023) find that both heuristic cues (e.g. collective self-representation and tweet's emotionality) and cognitive cues (e.g. providing causes and effects and spotting discrepancies) could drive engagement on Twitter during a political event.

Therefore, most studies conclude that not only heuristic factors but also systematic factors have a significant impact on social media engagement. Hence, this study expects that for short video crisis communication, the HSM model allows the construction of a comprehensive picture of citizen engagement determinants. Building on this theoretical framework, this study intends to examine how the heuristic and systematic cues in embedded short videos affected citizen engagement through government social media. Here, the heuristic information mode is manifested as superficial information cues, including information presentation. And the systematic mode is manifested as central factors, including the content topic (Zhang et al. 2022). By combining the theories of media richness as well as prior research, the proposed hypotheses concern the content and format of short videos during an earthquake in China. Besides, the interaction effect is analyzed to unravel potential underlying mechanisms. The research model is illustrated in Fig. 1.

Topics of video content

"Content topic" is the subject of the information communicated by the video, which triggers individuals' central processing route and requires greater cognitive effort (Munaro et al. 2021). A follower who is uninterested in the topic is less likely to engage with the video by sharing, liking, or commenting. Literature suggests that different content topics of video have varied impacts on social media engagement. For example, an analysis of videos from 100 digital influencers

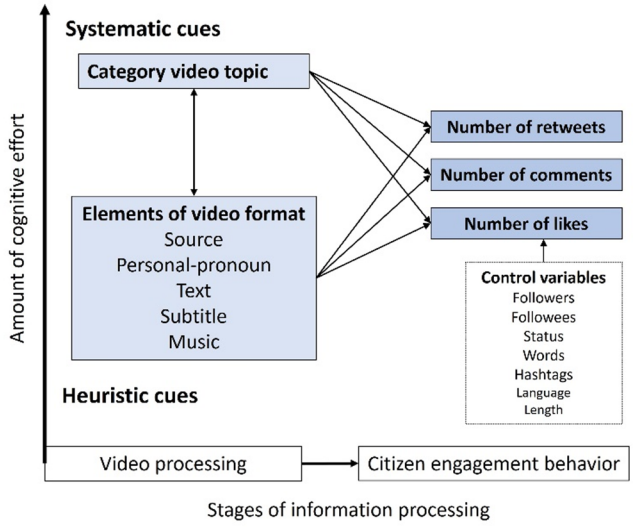


Fig. 1 The research model of the study

on YouTube reveals that content categories like entertainment, gaming, and food generate higher engagement than those like fashion and fitness (Munaro et al. 2021). Besides, according to a study on 700 top YouTube videos related to Lyme disease, it was observed that videos containing celebrity content and personal stories are most viewed, while videos with prevention information tend to be of less interest and videos with science and medical information tend to be less liked (Yiannakoulias et al. 2017). In addition, an analysis of government Tik Tok videos during the COVID-19 crisis reveals that in comparison to appreciative information, information about the government's handling of the situation and guidelines information are positively correlated with the number of shares, while the latest news is negatively related to the number of likes received (Chen et al. 2021). Notably, research on youth engagement in government-generated videos during the COVID-19 pandemic in China shows similar results that videos on people's life and response and government's handling of the crisis elicited most positive feedback, while videos related to knowledge popularization and guidance are most frequently shared by youth users (He et al. 2022).

Nonetheless, most existing works focus on how content topics influence engagement in video-based social media settings. However, whether and how these findings apply in the new scenario, namely in text-based social media remains unexplored. Hence, the following hypothesis is formulated based on existing literature:

H1. *Content topics of short videos have differential impacts on citizen engagement through government social media during a disaster.*

Elements of video format

The present study considers three elements of video format as heuristic cues that may influence citizen engagement. They are source types, personal pronouns, and media richness.

Source types

One heuristic cue that may be available in online community is source credibility, as an author's name (or screen name) is usually displayed together with a message (Watts and Zhang 2008). Source credibility refers to a message recipient's perception of the credibility of an information source (Chaiken 1980). The more credible the source of a message's content is perceived to be by a member, the more likely it is that this member will adopt that content (Dong et al. 2023; Watts and Zhang 2008). In short videos embedded in Weibo messages, the sources of short videos could be identifiable when a logo is present in the videos (Thorson et al. 2013). Therefore, users can apply the available cues as indicators of source credibility.

Previous studies also show that source credibility plays an important role in citizen engagement on social media. For instance, Liu et al. (2012) reveal that information from expert users, such as news media and emergency-related agencies, was more likely to be retweeted than those from amateur users in emergency situations. Cheng and Li (2023) show that the effects of negative sentiment and second-person view on audience engagement in terms of liking, commenting, and sharing differed between the TikTok videos created by news publishers and those created by other TikTok users (e.g., ordinary TikTok users, popular content creators, and journalists). These findings are understandable, as media outlets and government agencies have access to unique sources and can provide timely, professional information on specific events. Compared to information from individual users, the content provided by these agencies is more credible and, therefore, more favored by viewers (Liu et al. 2012). Interestingly, Hernandez-Garcia and Gimenez-Julvez (2021) find that videos made by health professionals about the influenza vaccine on YouTube, compared to user-generated content, produced less interaction between users in terms of likes, which could be explained by the phenomenon called confirmation bias. Considering these, the following hypothesis is proposed:

H2. *Source types of short videos with different levels of credibility have differential impacts on citizen engagement through government social media during a disaster.*

Personal pronouns

Personal pronouns are useful linguistic elements that can help identify the attentional focus, which in turn can reveal priorities, intentions, and processing (Tausczik and Pennebaker 2009). The language style of online reviews (i.e., how the content is conveyed) could significantly affect how they are received by readers (Liu et al. 2019). Pronoun choice in communication can enhance engagement through two key mechanisms that drive social media usage: (a) facilitating relationship connections, and (b) serving as a tool for self-presentation (Labrecque et al. 2020). Specifically, priming social identity through the use of the pronouns "we or us" activates a sense of social identity that can cause others to be perceived as more similar than those primed with the pronouns "they or them" (Labrecque et al. 2020). Self-focused individuals tend to use more singular pronouns (I, me, my) while other-focused self-monitors use more second-person pronouns (you, your).

Personal pronouns used in social media posts could influence citizen engagement activities (Labrecque et al. 2020). For instance, Cruz et al. (2017) demonstrate the positive effect of second-person pronouns (presence vs. absence) on consumer involvement by examining the number of likes, comments, and shares for actual brand posts on Facebook. In line with this, Labrecque et al. (2020) find that the use of the second-person pronoun ("you") has a positive effect on comments, and the use of the third-person plural ("they") even increases all three engagement actions with brand posts on Facebook. Besides, they also reveal that the use of the first-person plural pronoun ("we") has a positive effect on comments and shares, while the use of the first-person singular ("I") had a negative effect. Similarly to this, according to Hagemann and Abramova (2023), the collective self-representation expressed in a tweet, i.e., "we-talk", acted as a driver for likes and comments, but "I-talk" had the opposite effect during the 2020 United States presidential elections. Furthermore, in the context of crisis events, Lee and Yu (2020) also show that using inclusive pronouns such as the first-person plural (e.g. we, us and our) and the third-person plural (e.g. they and their) in disaster messages on Twitter positively influence resharing behavior during the 2013 Colorado floods. However, a study by Munaro et al. (2021) show that the overuse of the pronouns "you" and "they" in digital influencers' videos negatively affects engagement via likes and comments on YouTube.

The conflicting findings might be due to differences in social media platforms, where users on video-based platforms like YouTube may interact with personal pronouns differently than those on text-based platforms like Twitter and Facebook. All these findings indicate that personal pronouns affect citizen engagement. Overall, this study further explores their impact on video content on text-based platforms and proposes the following hypothesis:

H3. *Personal pronouns of short videos have differential impacts on citizen engagement through government social media during a disaster.*

Media richness

Media richness theory (Daft and Lengel 1986) could provide a theoretical framework for understanding how different types of media in short videos influence citizen engagement. Media richness refers to its capacity to facilitate shared meaning and understanding within a time interval (Sun and Cheng 2007). One criterion that determines the richness of the media is the capacity to transmit multiple cues, including physical presence, voice inflections, body gestures, words, numbers, and graphic symbols.

A video is a multimedia presentation that effectively conveys information and enhances understanding by utilizing a variety of symbolic systems (Lim and Benbasat 2000). According to Alamäki et al. (2019), richer media used in mobile marketing videos could positively affect the behavioral intention, as the visual cues and their better logical connection in the storyline could improve the media effects.

Indeed, many videos would include supplemental media types within the videos on social media. Existing studies have paid much attention to the relationship between media richness and citizen engagement on social media. For instance, a study by Li et al. (2021) shows that the COVID-19 videos with subtitles received more shares than those without subtitles on TikTok. Drawing on previous research, this study chooses to explore the effects of subtitles, text, and music in short videos. A piece of text added to a video could repeat, enhance, replace or spotlight the auditory, and subtitles used in videos could translate or transcribe the dialogue or narrative. In addition, background music used in the video might enhance emotional expression (Zhu et al. 2019). Lim and Benbasat (2000) point out that for less-analyzable tasks, in which there is no objective, computational procedure to perform the tasks, only multimedia representation was instrumental in reducing perceived equivocality levels. During crises, citizens expect governments to provide prompt and accurate information (Chen et al. 2020). The task of engaging with the public in disaster communication belongs to less-analyzable tasks. It lacks objective, computational procedures, especially under time-sensitive conditions. In such contexts, the high media richness in short videos might be more effective. Thus, the following hypothesis is formulated:

H4. *High media richness in a short video has a positive impact on citizen engagement through government social media during a disaster.*

H4a. *Subtitles in short videos have a positive impact on citizen engagement through government social media during a disaster.*

H4b. *Texts in short videos have a positive impact on citizen engagement through government social media during a disaster.*

H4c. *The presence of music in short videos has a positive impact on citizen engagement through government social media during a disaster.*

Interaction effect between video content and format

As discussed above, the two groups of factors might have direct effects on citizen engagement. Furthermore, these cues do not exist independently, and they may function synergistically to impact public engagement (Ngai et al. 2020). As has been found in Ngai et al.'s study, an interaction effect between the content and style of Weibo posts on public engagement was observed in government communication of COVID-19. They show that the pairing of disease prevention content with a narrative style generated a higher number of comments and likes. Besides, as discussed above, different sources play different roles in information publishing, and have been proven to have the possibility of moderating the effect of content objectivity on information retweeting (Liu et al. 2012). It is, therefore, likely that interaction effects might exist between video content and format on citizen engagement in disaster communication. Thus, the following hypothesis is proposed:

H5. *Video content and format interact synergistically to affect the levels of citizen engagement through government social media during a disaster.*

Research design

Study context: Changning earthquake

According to the China Earthquake Networks Center (CENC), an Ms 6.0 earthquake (Changning earthquake) hit Changning County, Yibin City, Sichuan Province, China, at 22:55 on 17 June 2019, with a focal depth of 16 km. This earthquake was located in the southeastern part of Sichuan Province. Different from the Wenchuan Ms 8.0 earthquake and the Lushan Ms 7.0 earthquake, which occurred in the Longmenshan fault zone, Changning earthquake occurred on secondary faults near the Changning anticline structure close to the edge of the Sichuan Basin (Wang et al. 2021). Multiple aftershocks occured following the Ms 6.0 earthquake. Among these aftershocks, there were 4 earthquakes of magnitude 5.0 to 5.9. The earthquake killed 13 people and injured more than 200 (Yi et al. 2019). More than 50,000 buildings collapsed and/or were seriously damaged and the direct economic loss was approximately 8.889 billion RMB (China National Radio 2019). After the earthquake, the Ministry of Emergency Management (MEM) of the People's Republic of China launched an immediate emergency response and Sichuan Province launched a grade II emergency response (Wang et al. 2021). The grade II emergency response period of the earthquake lasted 10 days and ended at 12:00 on 27 June 2019.

The Changning earthquake became a major topic of national discussion on social media due to its sudden intensity and the dramatic success of China's earthquake early warning system, which sent alerts via television, mobile apps, and public loudspeakers moments before shaking arrived. This life-saving technological moment quickly ignited social media, particularly on Weibo, where videos of alarms triggering, countdowns, and reactions spread widely. From a disaster communication standpoint, public officials needed to release official disaster information and response updates on social media platforms like Weibo. This allows them to directly address public concerns, dispel rumors, and demonstrate transparency and efficiency in their emergency management efforts.

Data collection

The unit of analysis is a single Weibo message embedded with a video. To systematically investigate the impact of video features (i.e., content topic and format feature) and their interactions on citizen engagement in crisis communication with the government, this study considers the set of a sufficiently large Changning-earthquake-related Weibo messages with embedded videos from Weibo Search (s.weibo.com) that were published from 22:55:00 on June 17, 2019 until 00:00:00 on June 27, 2019 (the day when grade II emergency response ended) (Wang et al. 2021).

Three steps were implemented to accomplish the data collection process. First, using advanced search function provided by Sina Weibo, this study collected messages containing the words "Earthquake (地震)" and "Sichuan (四川), Yibin (宜宾), Changning (长宁) or Gongxian (珙县)" and meanwhile set a condition of including a video using "AND" operator. A total of 48,020 Weibo messages with a video published between June 17 and 26, 2019 were collected and

each message included *Weibo URL*, *user's name*, *content*, *publishing time and links to the embedded video*. All these messages were sent by a total number of 15,903 users. Second, from the 15, 903 users, this study selected accounts which were verified as government agencies. In total, 1,828 government Weibo accounts and their 8,657 Weibo messages with embedded videos were picked out. Third, using web crawling, this study crawled the list of the 8,657 Weibo URLs and extracted data about *the embedded video's length*, *number of likes*, *number of shares*, *number of comments*, *number of user's followers*, *number of user's followees*, *number of past messages the user has posted*, *and information of the verified agency*. Besides, based on the links to the embedded videos in these Weibo messages, the corresponding videos were downloaded manually.

Data collection was carried out from August 5 to 12, 2020. During this period, some links were invalid due to deletion or removal from servers. Additionally, as different Weibo users could share the same video from external websites, the data contained duplicate links. After removing invalid and duplicate links, 1,116 short videos were manually downloaded. The final research dataset consists of 7,659 Weibo messages posted by 1,554 government accounts and their corresponding 1,116 short videos (see the examples in Appendix Table 6).

Variables and operationalization

Dependent variable

Based on previous research (Chen et al. 2020), citizen engagement through the government Weibo account includes three dimensions: sharing, liking, and commenting behaviors. Considering these engagement behaviors fall into discrete levels according to the cost of cognitive efforts and were influenced by different mechanisms (Kim and Yang 2017; Leppert et al. 2022), these three behaviors should be treated separately. Following the practice of these studies, the current study measures engagement using three dimensions of the engagement respectively, i.e., the number of likes, retweets, and comments of each Weibo post. This study used Python to capture these objective data.

Independent variables

This study performed a manual content analysis and coded videos for intrinsic features related to content and format (Feroz Khan and Vong 2014; Ruzza et al. 2020).

First, this study examined video content by coding the major topics presented in the videos. this study utilized the categories in previous studies (Chen et al. 2021; Sutton et al. 2015a), as motivating concepts rather than as directly applicable categories, and employed an open coding approach (Ruzza et al. 2020) to identify video topics that best reflected the properties of the Changning earthquake corpus. What should be noted is that videos themselves are multimodal, integrating various media types such as text, images, sound, subtitles, and more. The content analysis synthesizes the results based on this multimodal information, providing a comprehensive understanding of the video content. Before coding the analytical videos, an informal video scan was independently conducted by two researchers to identify emergent thematic content. The initial instrument was then piloted on a separate sample of 100 (about 10%) randomly selected videos from the 1,116 videos used in the analysis. Two authors then independently coded the 100 videos to construct the possible categories and two category systems were constructed accordingly. This process continued through several iterations until the research team converged on a comprehensive set of categories and initial codes. Then, 300 videos (about 25%) were randomly selected and blind coded by the two researchers. This comparison of codes across coders was used to verify reliability. This review also involved two other students who majored in emergency management and have pre-existing knowledge of natural disasters. Disagreements were resolved by consensus, following discussion of problematic cases by the whole team. Coders ultimately identified seven primary topics, i.e., earthquake early warning, expressions of sentiment, hazard impacts, individual heroism, earthquake education, government's handling, and misconduct/unlawful behavior. Coders assigned each video to a specific content category that captured its most prominent content. Since these categories might not be mutually exclusive, some videos could relate to more than one category. Thus, the category of 'multi-topics' was added into the final set (see Table 1 and Fig. 2). If a video included more than one topic with almost equal significance, it was classified under the 'multi-topics' category.

Second, this study coded information on video format, including source, personal-pronoun, text, subtitle, and music. The source refers to the type of user who creates the video and is classified into 5 categories, namely the following: mainstream media outlets (for example, CCTV News, People's Daily), digital media outlets (for example, Netease news, Toutiao), We Media, government organizations and unknown (Thorson et al. 2013). Personal pronoun refers to the vantage point from which events are filtered and then relayed to the audience. Personal-pronoun contains 4 categories, namely first-person (I, me, we, us, etc.), third-person (he, she, his, her, they, theirs, etc.), multiple-person (multiple pronouns), and without-narration (Munaro et al. 2021). Text, subtitle, and music are operationalized by whether the video contained text, subtitle and music, respectively. These

Table 1 Video coding scheme

Independent Variables	Explanation
Topics	
Earthquake early warning	Videos presenting the knowledge about earthquake early warning or earthquake early warning system
Expressions of sentiment	Videos about expressing gratitude for rescue workers, paying tribute to victims, or praying for the victims and survivors
Hazard impacts	Videos including information about the earthquake itself such as location, date/time, magnitude, aftershocks, etc., or information on the impacts such as damage, casualties, and other consequences
Individual heroism	Videos presenting the acts of bravery, courage, and altruism demonstrated by individuals during the earthquake
Earthquake education	Videos containing educational contents about the causes of earthquakes, their effects, and safety measures to be taken before, during, and after an earthquake
Government's handling	Videos focusing on the actions, policies, and responses implemented by government authorities in the aftermath of the earthquake
Misconduct/ Unlawful behavior	Videos about inappropriate or unacceptable behavior that goes against ethical standards or legal regulations, for example, using insults towards the victims
Multi-topics	Videos including more than one topic with almost equal significance
Elements of Format	
Source	Source refers to the type of user who creates the video and is not necessarily the poster
Personal pronoun	Personal-pronoun describes the relationship between the speaker and audience
Media richness	
Text	Whether a piece of text is added to the video that repeats, enhances, replaces or spotlights the auditory messages
Subtitle	Whether a video includes a piece of text that translates or transcribes the dialogue or narrative
Music	Whether background music is used in the video

are dummy variables and coded as present (1) or absent (0)

Table 2 Control variables

Control Variables	Explanations	Analytical method
Followers	The number of followers (Vos et al. 2018)	Captured by web scraping (python)
Followees	The number of followees (Son et al. 2019)	Captured by web scraping (python)
Status	The total number of past messages the user has posted (Stieglitz and Dang-Xuan 2014)	Captured by web scraping (python)
Words	The number of words in a message (Son et al. 2019)	Textual analysis (python)
Hashtags	The number of hashtags a message contains (Sutton et al. 2015a)	Textual analysis (python)
Language	As the spoken language used in the video (Li et al. 2021), language is measured by five categories: mandarin, local dialect, foreign language, mixed language and none (Basch et al. 2021; Zhu et al. 2019).	Manually coding
Length	The length of the video (Chen et al. 2021; Dong et al. 2023; Li et al. 2021)	Captured by web scraping (python)

(Basch et al. 2021; Zhu et al. 2019). The coding of these variables was genuinely intuitive.

Control variables

Studies have shown that there are several other factors that also have an impact on citizen engagement on social media, such as a user's number of followers, the number of followees, posting activity, the quantity of hashtags, as well as the number of words. Besides, research has already confirmed that video length and the spoken language used in the video also influence citizen engagement on social media during crises. Therefore, the following variables are included as controls (see Table 2).

Fig. 2 Two Examples of embedded videos in Weibo posts during Changning earthquake

(a) A frame from a video about Government's handling without any source identification.

(b) A frame from a video about Earthquake early warning from SichuanGuancha.

Intercoder reliability and data analysis

As mentioned above, in order to assess reliability for manual coding of video contents, two authors separately coded 300 videos. Reliability was assessed with Holsti's Reliability Coefficient:

$$Reliability = \frac{2M}{N_1 + N_2}$$

Where M is the number of agreements, N_1 is the number of units coded by coder 1, and N_2 is the number of units coded by coder 2. Intercoder reliability for video contents was 91.4% (M=265, N_1=280, N_2=300), which satisfies the consistency test (greater than 0.9) (Lombard et al. 2002). After assessing reliability, a single author coded the remaining videos and the others collaboratively cross-validated the videos. Finally, the whole team discussed the differences in coding to reach a consensus.

After the coding process, this study utilizes a quantitative regression model to investigate how video content topic, elements of video formats (Source, Personal pronoun, Text, Subtitle, Music), and the control variables influence the multidimensional citizen engagement through government social media during a disaster. Because the dependent variables are count data (i.e., nonnegative and integer based) and their standard deviations are larger than their respective means, the assumption of a normal distribution was violated. To deal with this over-dispersed count data, this study modelled the number of shares, likes, and comments using negative binomial regression (Stieglitz and Dang-Xuan 2014; Sutton et al. 2015a; Vos et al. 2018). All analyses were conducted using STATA version 13.1.

This study first estimated the impact of video content (topics), elements of video formats, and the control variables on different types of citizen engagement. For example, for the dependent variable number of retweets (Retweets), the model was estimated as follows:

$$\begin{aligned}\log\left(E\left(Retweets|*\right)\right) = {} & \beta_0 + \beta_1 Topics + \beta_2 Source \\ & + \beta_3 Personal - pronoun + \beta_4 Text \\ & + \beta_5 Subtitle + \beta_6 Music + \gamma\left[control\right]\end{aligned}$$

where E ($Retweets$|*) is the expectation of Retweets conditional on the set of predictors. β_0 denotes the parameter estimate of a constant term and β_{1-6} denotes the parameter estimates of the core predictor variables, i.e. video content and format. The vector γ denotes the parameter estimates of all control variables.

In addition to testing the significance of these variables, the interactions between the video content and format were also examined. For example, for the dependent variable number of retweets (Retweets), the model was estimated as follows:

$$\begin{aligned}\log\left(E\left(Retweets|*\right)\right) = {} & \beta_0 + \beta_1 Themes + \beta_2 Source + \beta_3 Personal \\ & - pronoun + \beta_4 Text + \beta_5 Subtitle \\ & + \beta_6 Music + \gamma\left[control\right] + \mu\left[Interaction\ effects\right]\end{aligned}$$

where E ($Retweets$ | *) is the expectation of Retweets conditional on the set of predictors. β_0 denotes the parameter estimate of a constant term and β_{1-6} denote the parameter estimates of the core predictor variables, i.e., video content and format. The vector γ denotes the parameter estimates of all control variables and the vector μ denotes the estimates of the interaction effects of the content and format.

Results

Descriptive statistics

Tables 3 and 4 summarize the information and descriptive statistics for the study's variables. On average, a single Weibo message embedded with a video in sample receives 6 retweets, 7 comments and 34 likes. Standard deviations for all these dependent variables are high.

Among all the messages, 2,144 (27.99%) containvideos related to the earthquake awareness and education, followed by government's handling of the disaster (24.86%, n=1, 904), as well as information about earthquake early warning (18.12%, n=1, 388). Regarding video sources, 3,201 (41.79%) messages contain videos created by mainstream media outlets, followed by digital media outlets (29.31%, n=2, 245). Additionally, 1, 539 (20.09%) messages contain videos without identification information in the videos. What's more, the video lengths range from 4.945s to 898s.

Regression results

Table 5 shows the results for the negative binomial regression for each type of engagement with government social media accounts during this Changning Earthquake. The negative binomial coefficients are interpreted as affecting the expected log count of the number of retweets, comments and likes (Vos et al. 2018).

H1 posits that the level of citizen engagement is contingent upon the video content topic. With content topic being

Table 3 Descriptive statistics of three citizen engagement dimensions

Dependent variables	Minimum	Maximum	Mean	Standard Deviation
Retweets	0	4,249	6.80	87.76
Comments	0	7, 071	7.41	112.34
Likes	0	46,595	34.06	669.32

Table 4 Descriptive statistics of independent variables

Independent variables	Category	Number of messages	Percent (%)
Topics	Earthquake education	2,144	27.99
	Government's handling	1,904	24.86
	Earthquake early warning	1,388	18.12
	Hazard impacts	671	8.76
	Individual heroism	655	8.55
	Expressions of sentiment	470	6.14
	Misconduct/Unlawful behavior	253	3.3
	Multi-topics	174	2.27
Source	Mainstream media outlets	3,201	41.79
	Digital media outlets	2,245	29.31
	Unknown	1,539	20.09
	Government organizations	621	8.11
	We media	53	0.69
Personal-pronoun	Without-narration	5,294	69.12
	First-person	1,365	17.82
	Third-person	825	10.77
	Multiple-person	175	2.28
Text	Present	5,128	66.95
	Absent	2,531	33.05
Subtitle	Absent	4,648	60.69
	Present	3,011	39.31
Music	Present	3,954	51.63
	Absent	3,705	48.37

a categorical variable, videos about the Government's Handling serve as the reference group. The results reveal that videos on Earthquake Education ($p<0.001$) and Hazard Impacts ($p<0.05$) positively impact retweets, compared to videos about Government's Handling. Conversely, several content topics negatively impact engagement. Misconduct/Unlawful Behavior, Earthquake Early Warning, and Earthquake Education exhibite a negative impact on both comments and likes. Besides, Expressions of Sentiment negatively affect retweets ($p<0.01$) and comments ($p<0.001$). In addition, videos about individual heroism negatively affect comments ($p<0.05$) and videos with multi-topics demonstrate a negative effect on likes ($p<0.05$). Given that the influence of content topics was both metric-dependent and not universally significant across all engagement types, H1 is partly supported.

H2 posits that source types of short videos have differential impacts on citizen engagement. The result shows that videos of unknown source exhibit a significant positive effect across all metrics ($p<0.001$), compared to digital media outlets. Videos from We Media also positively affect retweets ($p<0.05$), comments ($p<0.05$), and likes ($p<0.001$). Conversely, videos from mainstream media outlets show a negative effect on retweets ($p<0.05$), comments ($p<0.001$), and likes ($p<0.001$). Videos from government organizations do not exhibit significant differences in engagement. Thus, H2 is partly supported.

H3 proposes that personal pronouns of short videos would have impacts on citizen engagement. The analysis indicates that videos with multiple-person pronouns show a negative effect on comments ($p<0.01$) and likes ($p<0.01$), with "first-person" as the reference group. In contrast, videos without narration positively affect retweets ($p<0.001$) and likes ($p<0.001$). However, the relationship between videos with third-person and citizen engagement is not significant. Therefore, H3 is not supported.

H4 posits that high media richness in a short video is likely to attract citizen engagement. The results show that the presence or absence of texts and subtitles in videos does not play a statistically significant role in determining the levels of citizen engagement. However, videos with background music negatively influence the number of comments ($p<0.001$) and likes ($p<0.05$), compared with videos without music. Thus, H4 is not supported. H4a, H4b and H4c are not supported.

Besides, the control variables also offer additional insight. The analysis of language diversity shows that videos in local dialect or mixed-language have a negative effect on retweets compared to videos in Mandarin. Videos with no specified language also negatively influence retweets ($p<0.001$) and likes ($p<0.001$). However, foreign language videos have a positive impact on likes ($p<0.001$). Video length negatively influences the number of comments ($p<0.001$) and likes ($p<0.001$). What's more, key characteristics of the account sending the message also influence the degree of citizen engagement. The number of followers is a statistically significant, positive predictor for each type of citizen engagement ($p<0.001$). Both the number of followees and the status of the user positively predict the number of retweets and comments. Moreover, Message style features also affect the degree of citizen engagement. The number of words in a Weibo message is positively related to the number of retweets ($p<0.05$), comments ($p<0.01$), and likes ($p<0.01$). The number of hashtags is positively associated with likes ($p<0.001$).

Interaction effect between video content and format features

Finally, H5 posits that video content and format interact synergistically to affect the levels of citizen engagement. The interaction effects between video content and format (the variables that were significant in the regression analysis) were examined by entering interaction variables into the negative binomial regression models. Since content topic is a categorical variable, it is not necessary to include both main effects; the coefficient for a specific "interaction"

Table 5 Negative binomial regression results

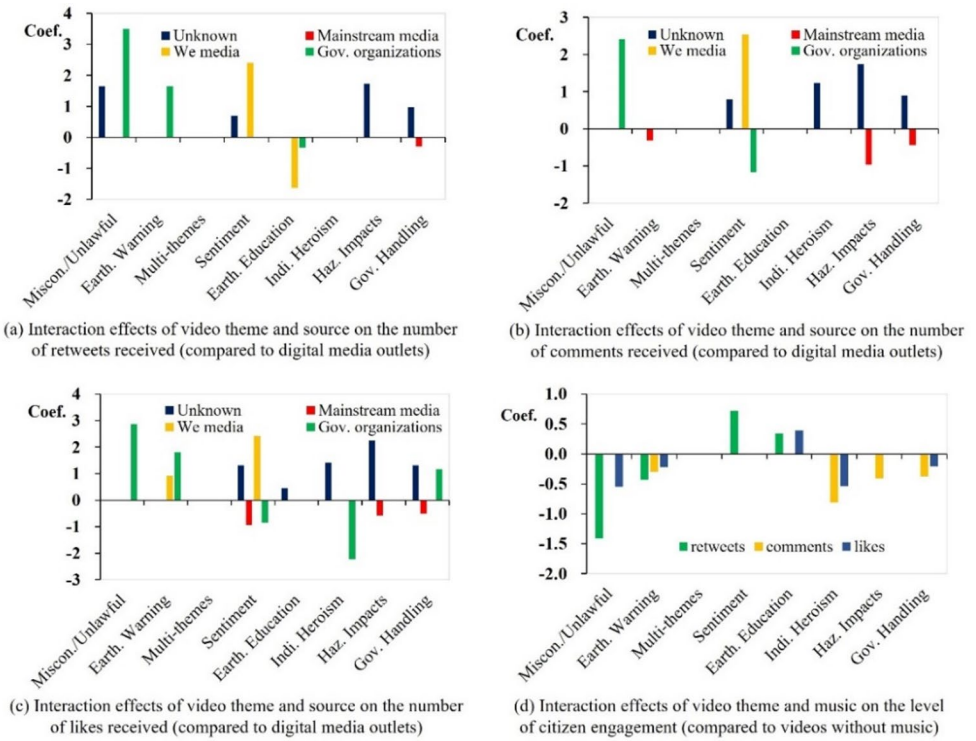
	retweets		comments		likes	
Variable	Coef	SE	Coef	SE	Coef	SE
Topics (Reference Group: Government's handling)						
Misconduct/Unlawful behavior	0.084	0.143	-0.338*	0.162	-0.438***	0.117
Earthquake early warning	0.118	0.087	-0.454***	0.099	-0.249***	0.071
Multi-topics	-0.110	0.168	-0.186	0.188	-0.338*	0.136
Expressions of sentiment	-0.360**	0.107	-0.487***	0.126	-0.129	0.090
Earthquake education	0.655***	0.091	-0.333**	0.108	-0.164*	0.076
Individual heroism	0.053	0.104	-0.254*	0.113	0.002	0.081
Hazard impacts	0.187*	0.089	0.010	0.101	-0.140	0.072
Source (Reference Group: Digital media outlets)						
Unknown	0.771***	0.083	0.851***	0.094	1.266***	0.067
Mainstream media outlets	-0.137*	0.062	-0.310***	0.072	-0.178***	0.050
We media	0.607*	0.268	0.651*	0.317	0.950***	0.219
Government organizations	-0.002	0.100	0.099	0.119	0.090	0.083
Personal-pronoun (Reference Group: First-person)						
Third-person	-0.144	0.098	-0.060	0.113	-0.018	0.079
Multiple-person	-0.233	0.176	-0.588**	0.202	-0.365**	0.140
Without-narration	0.304***	0.071	0.047	0.085	0.299***	0.059
Text (reference group: Absent)						
Present	0.025	0.070	-0.036	0.080	0.024	0.058
Subtitle (reference group: Absent)						
Present	-0.070	0.068	0.071	0.078	0.033	0.054
Music (reference group: Absent)						
Present	-0.064	0.069	-0.271***	0.077	-0.121*	0.054
Language (Reference Group: Mandarin)						
Local dialect	-0.227**	0.078	-0.042	0.092	-0.026	0.065
Mixed language	-0.422***	0.114	0.089	0.127	0.027	0.088
Foreign language	0.156	0.192	0.277	0.233	0.820***	0.165
None	-0.311***	0.077	0.162	0.091	-0.248***	0.065
Video-length	-0.0004	0.0003	-0.0016***	0.0003	-0.0019***	0.0002
Logged Followers	0.473***	0.012	0.358***	0.014	0.486***	0.009
Logged Followees	0.079*	0.032	0.170***	0.039	0.030	0.025
Logged Status	0.144***	0.034	0.222***	0.039	-0.045	0.028
Words	0.001*	0.001	0.002**	0.001	0.002**	0.000
Hashtags	-0.016	0.024	0.045	0.028	0.079***	0.020

Coef: coefficient; SE: Standard Error; ***$p<0.001$; **$p<0.01$; *$p<0.05$; No. of observations = 7, 659

represents the simple effect of a format at a topic compared to the reference format. Running the regression including just the main effect for video topic allows us to explore the differences between various video format features within a specific content topic. For example, a significant interaction between video topic and source would highlight differences between sources for the same video topic. Beyond aligning with the regression analysis results, the interaction test reveals distinct findings.

Regarding the interaction between topics and sources, various content topics display statistically significant variations in citizen engagement levels across different sources (see Fig. 3 (a), (b), and (c)). Videos addressing misconduct/unlawful behavior, earthquake early warning, or the government's handling, when paired with government organization sources, act as positive predictors for retweeting, commenting, or liking. Conversely, videos about expressions of sentiment, earthquake education, or individual heroism, when associated with government organization sources, negatively predict these engagement metrics. Furthermore, the pairing of video topics related to earthquake education with We Media sources negatively predicts retweets, compared to digital media outlets.

In exploring the interaction between video topics and media richness, Text and Subtitle are not analyzed as they show no statistically significant effect. The interaction test reveals statistically significant differences in the degree of citizen engagement for certain video topics between videos with and without music (see Fig. 3 (d)). Videos focusing on expressions of sentiment or earthquake education with music gain more retweets or likes than those without music. Conversely, videos about misconduct/unlawful behavior,



(a) Interaction effects of video theme and source on the number of retweets received (compared to digital media outlets)

(b) Interaction effects of video theme and source on the number of comments received (compared to digital media outlets)

(c) Interaction effects of video theme and source on the number of likes received (compared to digital media outlets)

(d) Interaction effects of video theme and music on the level of citizen engagement (compared to videos without music)

Fig. 3 Interaction effects of video topic and two elements of video format (i.e., source and music). This figure illustrates the significant coefficients of interaction terms and the direction of their influence on rates for each type of citizen engagement. (Only showing significant results at a significance level lower than 0.05)

earthquake early warning, individual heroism, hazard impacts, or government's handling, with music gain less retweets or likes than those without music. All in all, the H5 is partly supported.

Discussion

Summary of findings

Guided by the dual-process theoretical framework, this study was designed to address existing research gaps by investigating the impact of video content (systematic cues) and video format (heuristic cues) on citizen engagement within the specific context of Weibo, a dominant text-based social media platform in China. The findings reveal how these cues, both independently and interactively, shape citizen engagement on this platform.

Our first objective was to delineate the impact of video content and format on text-based social media. The results confirm that video content topic, a key factor for systematic processing, is a significant, yet metric-dependent, driver of engagement (partly supporting H1). The results are similar to the findings from recent studies that show that the impacts of content topics in textual messages vary across the different engagement dimensions (Kim and Yang 2017; Leppert et al. 2022). Specifically, the positive effect of Earthquake Education and Hazard Impacts on retweets suggests that users on Weibo deliberately process and share videos deemed informative and practically useful, treating them as valuable resources to be disseminated across their networks. This result aligns with the inferences by Sutton et al. (2015b), who note that textual messages containing advisory information hold high importance among the public during imminent threat on Twitter. One plausible explanation for the positive effect on the number of retweets could be that the nature of retweets relates to the user's image and self-presentation and sharing valuable or educational content with others is useful to increase the image (Leppert et al. 2022). Thus, such videos or textual messages, which contain practical crisis-prevention information, are highly valuable to strengthen individuals' awareness of prevention during crises and are perceived as worthy of being shared (He et al. 2022).

Conversely, compared with videos about government's handling, videos related to all the other topics—such as misconduct/unlawful behavior, earthquake early warning, expressions of sentiment, earthquake education and individual heroism (except those showing no significant effect)—negatively influence the number of comments or likes. Videos on government's handling show the ongoing governmental efforts in disaster relief, playing an important role in reducing distress for both victims and the broader society. The findings could be explained by the previous studies on the behavior of Chinese social media users during crises, which indicate that information on governments' handling concerns the users most, thereby enhancing citizen engagement (Chen et al. 2020; He et al. 2022). Additionally, videos

featuring multiple topics significantly negatively predict the number of likes. This result corresponds to previous findings that short videos with multi-topics, often a combination of text, pictures, and video, are rougher and less interactive on TikTok, a video-based social media platform (Chen et al. 2021). Such videos typically comprise various clips, making them less engaging for the public. Thus, videos with multiple topics on both video-based and text-based social media are associated with lower levels of citizen engagement. Notably, previous research on Twitter also finds that disaster tweet with multiple topics increases uncertainty and reduces retweet counts (Son et al. 2019).

This demonstrates that systematic processing of short videos on Weibo does not always lead to positive engagement but can also result in deliberate disengagement from certain content topics, which is partly similar to previous research on video-based social media or textual messages.

Regarding video format, which is often processed heuristically, our findings challenge conventional assumptions. The findings for H2 (partly supported) reveal a critical insight that the perceived source of the video itself could override the authority of the government account that posted it. The most striking result was the significant positive effect of videos from an "Unknown Source" across all engagement metrics. Given that these videos were embedded in official government posts, this finding is counterintuitive yet highly significant. When the government shared a video without a clear institutional brand, the audience might interpret it as raw, unmediated, and therefore more trustworthy evidence from the ground, leading to higher engagement. This interpretation is bolstered by the non-significant effect of videos from Government Organizations. It indicates that the double authority of a government source in the video and a government account posting it does not provide an additional engagement boost. The government account's identity might already be the dominant heuristic and reinforcing it within the video itself did not further stimulate interaction.

Like unknown sources, We Media sources also show a positive effect on all forms of engagement. This suggested that videos from We media sources, often featuring individual influencers, might be perceived as more relatable and seen as a valuable supplement to official communication. Such observations have been made in previous research as well, showing that individual experts led to higher predicted retweet counts (Syed et al. 2018). Conversely, sharing videos from Mainstream Media had a significant negative effect. This stark difference indicates that the public heuristically processes this act not as a valuable curation, but as the government passively "borrowing" news reports. This might fail to meet the audience's expectation for direct, firsthand information from the authority itself, making the government appear less proactive and transparent, thereby suppressing engagement.

Furthermore, the findings for H3 indicate that the use of personal pronouns in short videos does not serve as a consistently influential heuristic for driving citizen engagement on government social media during a disaster. The analysis reveals no significant effect for third-person narration, while the use of multiple-person pronouns negatively impacts comments and likes compared to a first-person baseline. The most notable finding was that videos without any narration positively influenced retweets and likes. This aligns with existing literature suggesting that spoken language in videos can sometimes suppress engagement compared to content relying on non-verbal cues (Li et al. 2021). A plausible explanation is that delivering information primarily through non-verbal cues could circumvent potential barriers related to dialect, speech clarity, or personal narrative style, potentially making the content more accessible or appealing for a mass audience. The negative effect associated with multiple-person pronouns mirrors the finding for multi-topic videos, hinting at a potential underlying mechanism of cognitive overload or narrative dilution. Just as covering multiple topics can fragment a video's focus, shifting perspectives between multiple individuals may disrupt narrative coherence and weaken the emotional connection with the viewer, ultimately discouraging engagement like commenting and liking. Overall, the results suggest that the theoretical premise of personal pronouns as a key heuristic cue may be less potent than anticipated in this setting, and their nuanced impact on disaster communication engagement requires more investigation in future research.

In addition, the findings regarding media richness (H4) challenge the assumption that richer media cues inherently enhance engagement, revealing instead that their function as heuristics is highly context-dependent. First, the results indicate that the presence of text and subtitles does not exert a statistically significant impact on any measure of citizen engagement. This is partly consistent with the findings of Li et al. (2021) and suggests that on a platform where text is already the primary medium, the addition of textual cues within a video may not provide a sufficiently novel or useful heuristic to alter engagement behavior. However, they found TikTok videos with subtitles received more shares than those without subtitles. This difference might be caused by the difference between the two platforms or the two crises, which should be further explored. More notably, the analysis reveals that background music exerts a significant negative influence on the number of comments and likes, directly contradicting H4c. This further expands on the conclusion of Zhu et al. (2019), who indicate that videos which contain complicated music or too many visual effects can easily distract the audience and might do no help in citizen

engagement on TikTok. Thus, the lack of support for H4 demonstrates that the heuristic value of media richness elements is not absolute and their impact may be contingent upon the platforms or the situational context.

The second objective was to explore the interaction between video content and format, testing whether systematic and heuristic cues might function synergistically. Our findings provide robust evidence for this synergy, demonstrating that the impact of what is shown (systematic processing of content) is fundamentally shaped by how it is presented (heuristic cues of format). A key finding is the significant interaction between content topics and source types. For instance, videos on critical topics like Misconduct/Unlawful Behavior, Earthquake Early Warning, and the Government's Handling became positive predictors for engagement when issued by government organizations. This alignment creates a powerful persuasive match: the systematic need for authoritative information on these topics is validated by the heuristic cue of an official source.

Conversely, a "source-content mismatch" was observed for topics like Expressions of Sentiment, Earthquake Education, and Individual Heroism when posted by government sources, which negatively predicted engagement compared to sources from digital media outlets. This suggests that for narrative-driven or educational content, the official, institutional heuristic of a government account may be perceived as less engaging. This finding validates prior work, indicating that for such topics, digital media outlets—with their professional skills in storytelling and production—could promote the video quality (He et al. 2022). This also aligns with the finding of Liu et al. (2012) that source expertise moderates the effect of content objectivity, where "expert" sources (like government) are best suited for objective facts, while other sources may be more effective for subjective or narrative content.

Furthermore, the significant interaction between content and background music provides further evidence for cue synergy. The finding that music enhanced engagement for Expressions of Sentiment and Earthquake Education but suppressed it for action-oriented topics (e.g., misconduct/unlawful behavior, earthquake early warning, individual heroism, hazard impacts, or government's handling) demonstrates that the heuristic cue of music is not uniformly positive or negative. Instead, its effect is contingent on the systematic processing of the content's purpose. Music serves as an "affective amplifier," enriching emotional or educational narratives while hindering the reception of action-oriented information. This extends the findings on text-based social media (Ngai et al. 2020) to the domain of short videos. It also supports previous studies on the moderating role of media richness in citizen engagement during crises. For example, Zhou et al. (2021) found that the richness of COVID-19 related misinformation strengthened the effect of health caution and advice misinformation on dissemination behavior on Weibo. Likewise, Li et al. (2022) reveal that information richness strengthens the effect of information retrospectiveness and prospectiveness on public engagement during the pandemic on Weibo. Our novel findings on the interaction between video content and format provide important insights for future research.

This study enhances our understanding of public engagement with disaster communication through government social media by examining short videos on the Weibo platform. It contributes to the field of disaster communication on social media in the following three ways. First, most studies related to factors that influence citizen engagement focus on textual message contents and styles on text-based social media, while studies on short video content are relatively few. This study uses short videos on text-based social media platforms as the research object and enriches theories of disaster communication by employing a broader perspective. Second, this study organizes the research framework based on the paths of HSM. Our application of this theoretical framework to study the effects of short videos on citizen engagement behavior proves to be a viable theoretical foundation. The overarching theoretical framework allows us to integrate various factors into the model and classify them into two influence routes. Informativeness and informational social influence have moderate effects on individual retweeting decisions. The interaction between video content and format is shown to have an impact on citizen engagement and these interaction effects are central to our theoretical contribution. They move beyond a main-effects model to show that citizen engagement is a product of the dynamic fit between the systematic processing of a video's content and the heuristic processing of its presentational cues. The model's strong explanatory power confirms its potential for application in future disaster communication research. Finally, this study explored the impact of media richness in short videos on citizen engagement. In an information overloaded and network overwhelmed world, the public is unable to browse short videos equally, and some short videos may be ignored, especially during a disaster. By exploring the effect of media richness, this study captures what media type in short videos may have the best effects. This result provides a reference for other researchers to further explore this field.

Implications and limitations

Findings of this study have some implications for government practices in engaging citizens through social media videos during natural disasters. First, just as the contents of text used for disaster communication, the contents of social

media videos should also be carefully selected when they are applied for engaging the public. Video contents about earthquake education or hazard impacts may help to satisfy the information needs, address negative emotions, increase self-efficacy, and highlight feelings of control over reducing disaster risk. Second, while having well-edited videos is important, it should make sure that the focus stays on the content of videos and avoid over-editing social media videos. The public seems to prefer original videos without background music, and adding texts or subtitles shows no effect on citizen engagement during natural disaster. Therefore, during emergencies, disseminating raw footage promptly may be more effective for public engagement than extensive editing. Third, the matching between the content and format when creating social media videos should also be fully considered. The formats could moderate the effect of contents on citizen engagement. For crisis communicators, this underscores that a one-size-fits-all strategy is ineffective; success depends on strategically pairing specific message topics with the most suitable source and production style.

This study has several limitations. First, it focused solely on the impact of embedded videos on text-based social media, leaving the interaction between text and video unexplored, which is a valuable area for future research (Hao and Wang 2020; Mohanty et al. 2021). Second, it would be worthwhile to investigate the effects of videos across different social media platforms, comparing text-based platforms (e.g., Weibo or Twitter) with video-based ones (e.g., TikTok or YouTube). Third, the potential interactions among the format variables themselves were not examined, so future research should consider whether these variables interact. Lastly, this study focused on a single disaster event (the Changning earthquake), which may limit the generalizability of the findings. Future research should explore multiple disaster contexts and expand the dataset to capture more diverse engagement patterns.

Conclusions

The study aims to investigate the relationship between embedded videos and the level of citizen engagement on text-based social media. Leaning on the dual process theory, it sheds light on the effectiveness of video content (systematic cue) and video format (heuristic cues) cues on citizen engagement on Weibo during a disaster.

The findings from this study show that both the systematic processing of video content and the heuristic processing of video format are critical, independent drivers of engagement on text-based social media platforms. The systematic processing of video content topics reveals a metric-dependent logic similar to other social media platforms. For example, informational and instructional content (e.g., Earthquake Education, Hazard Impacts) is actively shared, while emotionally charged or complex topics (e.g., Expressions of Sentiment, Misconduct/Unlawful Behavior) often suppress active engagement in the form of comments and likes. Simultaneously, the heuristic processing of format cues reveals a complex result. The powerful positive effect of We Media and Unknown Source videos, contrasted with the negative effect of Mainstream Media, points to a preference for authentic and grassroots-originated, rather than borrowed news reports. Furthermore, the negative impact of background music reveals its role as a negative heuristic in serious crises. It is perceived as incongruous or distracting, thereby suppressing public engagement.

Furthermore, this study provides evidence for the synergistic relationship between systematic and heuristic processing. The interaction effects between content topics and source types reveal that government credibility enhances official information (like Misconduct/Unlawful Behavior, Earthquake Early Warning, and the Government's Handling) but diminishes emotional or narrative content (such as Expressions of Sentiment, Earthquake Education, and Individual Heroism). Similarly, background music enhances engagement for expressive and educational content while suppressing it for other information (e.g., misconduct/unlawful behavior, earthquake early warning, individual heroism, hazard impacts, or government's handling), demonstrating that the same heuristic cue can produce opposite effects depending on the content context.

In essence, this study advances our theoretical understanding by demonstrating that the dual-process model provides a powerful framework for understanding citizen engagement with embedded videos on text-based platforms. It serves as a foundational study for future investigations into government video communication strategies. For practitioners, these results emphasize the need for strategic alignment between content choices and presentational features of embedded videos to effectively engage citizens during disaster situations.

Appendix

See Table 6.

Table 6 Examples of government posts embedded with short videos

#	Weibo_urls	Text	Video_urls	Retweets	Username	Post_time	Verification
1	http://weibo.com/1523766213/HznrcyKi7	#Sichuan Yibin Changning Earthquake# At 23:27, the 20-member light earthquake rescue team from Yibin Xingwen Fire Department has assembled! (Chengdu Release - Chengdu Evening News, Li Chen) Video by Chengdu Release on Miaopai.	https://m.weibo.cn/s/video/show?object_id=1034:4384315757244855&fromWap=1	4249	Chengdu Release	2019-06-17 23:36:42	News Office of the Chengdu Municipal People's Government
2	http://weibo.com/3549916270/HznBCaB1p	#Yibin Earthquake# The Sichuan Yibin Fire Rescue Brigade has dispatched 13 fire trucks and 63 firefighters to the earthquake epicenter for rescue operations. The Sichuan Provincial Fire Rescue Corps has activated a Level 2 emergency response, and the full-duty command team is on its way from Chengdu to Yibin. Don't be afraid, we are on our way! Video by China Fire on Miaopai.	https://m.weibo.cn/s/video/show?object_id=1034:4384322136778741&fromWap=1	4168	China Fire Rescue	2019-06-18 00:02:22	Official Weibo of the Fire and Rescue Bureau, Ministry of Emergency Management
3	http://weibo.com/3323927000/HAhklv32t	#Sichuan Changning 6.0 Magnitude Earthquake# We have noticed that many netizens reported seeing a lot of swallows flying near the Zizhuyuan Douhua Restaurant. We have dispatched experts to verify the situation. Please stay tuned [bow][bow][bow]. Video by Sichuan Earthquake Administration on Weibo.	https://m.weibo.cn/s/video/show?object_id=1034:4386464100773173&fromWap=1	693	Sichuan Earthquake Administration	2019-06-23 21:53:38	Official Weibo of the Sichuan Earthquake Administration
4	http://weibo.com/3815664603/HznwTmwkD	#Sichuan Changning 6.0 Magnitude Earthquake# The epicenter is 22 km from Gongxian County, 27 km from Changning County, 33 km from Xingwen County, 39 km from Gao County, 43 km from Junlian County, 52 km from Yibin City, 261 km from Chengdu, and 211 km from Chongqing. Currently, local police officers are conducting rescue operations in the earthquake area! Please follow traffic police instructions and clear the emergency routes! @China Police Online @Sichuan Public Security Yibin Yibin Public Security Video on Weibo.	https://m.weibo.cn/s/video/show?object_id=1034:4384319251355396&fromWap=1	543	Yibin Public Security	2019-06-17 23:50:44	Sichuan Province Yibin City Public Security Bureau Official Weibo
5	http://weibo.com/2501519087/HzrT9wgsM	#Sichuan #Yibin Changning 6.0 Magnitude Earthquake# @Sichuan Traffic Police worked through the night to clear and reopen routes. The disaster relief route from Chengdu to the earthquake zone has been fully opened. Drivers are reminded to avoid obstructing emergency and disaster relief vehicles and not to use the emergency lanes. Video from the Ministry of Public Security Traffic Safety Microblog.	https://m.weibo.cn/s/video/show?object_id=1034:4384486821964481&fromWap=1	390	Ministry of Public Security Traffic Management Bureau	2019-06-18 10:56:34	Official Weibo of the Traffic Management Bureau, Ministry of Public Security

All posts have been translated into English. Data collection was conducted from August 5th to 12th, 2020. It should be noted that the Weibo and video links presented in this table may no longer be accessible due to content deletion or server-side removal. It includes only a subset of the posts and variables analyzed in the study. The actual dataset contains a broader range of posts, engagement metrics, and additional variables that were used in the comprehensive analysis

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