



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



More collaboration, less seriousness: Investigating new strategies for promoting youth engagement in government-generated videos during the COVID-19 pandemic in China

Changyang He ^a, Huan Liu ^b, Lu He ^c, Tun Lu ^{b,*}, Bo Li ^a

^a Department of Computer Science and Engineering, Hong Kong University of Science and Technology, Hong Kong SAR, China

^b School of Computer Science, Fudan University, Shanghai, China

^c Department of Informatics, Donald Bren School of Information and Computer Science, University of California, Irvine, Irvine, CA, United States

ARTICLE INFO

Keywords:

Government-generated crisis videos
Youth engagement
Crisis communication
Entertainment education
Collaborative governance

ABSTRACT

Effectively engaging citizens during crises is critical for governments to disseminate timely information and help the public to adjust to the constantly changing conditions. In particular, promoting youth engagement not only enhances crisis awareness and resilience among the young generation, but also has a positive impact on youths' social participation and responsibility. With the increasing popularity of online video services, leveraging online videos to disseminate authoritative information has become a method widely adopted by government. To enhance youth awareness and engagement, two new video-based crisis communication strategies have been utilized on a popular youth-targeted video platform Bilibili in China: creating recreational videos such as animation and music videos, and collaborating with individual video-uploaders in video making. However, their impacts and results are largely unknown, which motivates our study. Guided by Entertainment Education (EE) and Collaborative Governance (CG), we report, to our best knowledge, the first systematic study on how recreational video category and government-citizen collaboration would influence youth engagement focusing on 3347 COVID-19-related government-generated videos on Bilibili. This study reveals that recreational videos successfully promote youth engagement including interaction, feedback and sharing. Collaboration with individual uploaders in video making also has a substantially positive impact on youth engagement. Through an in-depth qualitative content analysis of user-generated commentaries, we further unpacked the unique values (e.g., trust work for youth participation) as well as latent limitations (e.g., imbalanced topic distribution) of the two new strategies. We discuss how the findings enrich EE and CG theoretically, and provide practical implications to effective and engaging communication strategies during crises.

1. Introduction

Citizen engagement during crises has gained increasing attention in recent years for its great significance to understand public concerns and civic needs, and in turn optimize crisis management strategies. Through engaging the public, governments can cultivate citizens' understanding and self-resilience in crisis response, as well as increase the capabilities of government agencies in processing crisis information and provide public services (Chatfield & Reddick, 2018; Q. Chen et al., 2020; Graham, Avery, & Park, 2015; Stark & Taylor, 2014). Youth engagement, in particular, not only enhances crisis awareness among young generations (Efuribe, Barre-Hemingway, Vaghefi, & Suleiman, 2020), but also promotes their sense of social responsibility and has a positive

developmental impact on youths' social participation in the long run (Irannejad Bisafar, Foucault Welles, D'Ignazio, & Parker, 2020). Understanding how to facilitate timely and engaging crisis communication to youths, and therefore promote youth engagement, is of substantial significance.

With the proliferation of mobile devices and the development of high-speed Internet, online video platforms have gained increasing popularity, making government-generated videos an ideal tactic for disseminating crisis-related information. For instance, in United States, Centers for Disease Control and Prevention (CDC) adopted a strategic use of videos posted on YouTube to address the public's need for information in a timely and accessible way during the 2009 H1N1 influenza epidemic (Walton, Seitz, & Ragsdale, 2012). However, though

* Corresponding author. School of Computer Science, Fudan University, 2005 Songhu Rd., YangPu District, Shanghai, 200438, China.
E-mail address: lutun@fudan.edu.cn (T. Lu).

<https://doi.org/10.1016/j.chb.2021.107019>

Received 26 January 2021; Received in revised form 27 August 2021; Accepted 8 September 2021

Available online 18 September 2021

0747-5632/© 2021 Elsevier Ltd. All rights reserved.

using government-generated videos to disseminate crisis information has been widely adopted, youth engagement in government-generated videos is still not optimistic. Existing literature indicated that government agencies used their accounts to convey crisis information, but few aimed at youths met their preferences, or employed participatory strategies to promote youth engagement (Abbott, Askelson, Scherer, & Affifi, 2020). In consequence, during extraordinary situations such as pandemics, videos of official health authorities often did not gain enough popularity and engagement on online video websites, even though they were often of higher quality compared to individual user-generated videos (Atac et al., 2020). Unfortunately, how to promote youth engagement in government-generated videos, even with its great significance on effective crisis response and youth development, is still a less investigated problem. Though some recent work has explored the influencing mechanisms of engagement among citizens during crises (Q. Chen, Min, Zhang, Ma, & Evans, 2021; Q. Chen et al., 2020; Guo, Liu, Wu, & Zhang, 2021; Y. Wang & Yang, 2020), none particularly focused on strategic engaging approaches applied to youth groups, whose information needs and media preferences are substantially different from the general public (Abbott et al., 2020; Efuribe et al., 2020).

To cope with the challenge of limited youth engagement, governments and health agencies in different countries are making efforts to employ new strategies to better communicate crisis information through videos to youths. Focusing on the government-generated videos during the COVID-19 pandemic on Bilibili¹ in China, we observed two novel engaging strategies: (1) instead of only utilizing formal talks and live records to release information, recreational video categories such as animation and music were adopted by government accounts to convey authoritative guidelines and build public confidence, as shown in Fig. 1; (2) with the support of collaborative video making interface (Bilibili, 2019), government uploaders were collaboratively making videos with civic video uploaders in the community (e.g., vloggers and science-popularization video makers), as exhibited in Fig. 2. The two attempts opened up new opportunities to engage youths, yet whether recreational and collaborative videos would effectively promote youth engagement, and the underlying mechanisms of the effects, still remain unexplored, which is the focus of the study in this paper.

Focusing on the COVID-19 pandemic, this work makes the first systematic analysis of influencing factors, especially the new engaging strategies, on youth engagement in government-generated videos, shedding light on new opportunities for crisis communication. We turned to Entertainment Education (EE) and Collaborative Governance (CG) to guide our hypothesis development. To validate the hypotheses, we first collected 3347 COVID-19-related government-generated videos on Bilibili from January 2020 to May 2020. We then applied quantitative regression analysis to investigate the effects of new engaging strategies (i.e., recreational video category and government-citizen collaboration) and video content (content topic and emotion valence) on multiple dimensions of youth engagement including interaction, feedback and sharing. To deepen the understanding of the actual effect of new strategies in engaging youths, in-depth qualitative content analysis on the user-generated commentary of the recreational and collaborative videos was further conducted. This study advanced the existing research strand on crisis communication and youth engagement, and enriched EE and CG by providing their effects and influencing mechanisms in online crisis communication settings. Based on the findings, this study also provided practical implications on effective and engaging communication strategies through online videos during crises.

¹ Bilibili is the most popular youth-targeted video website in China, which has 197.2 million monthly users (Bilibili, 2020a) with an average age of about 21 (Bilibili, 2020b).

2. Related work

For effective crisis communication, existing studies largely focused on engagement of general public in text-based social media like Twitter and Weibo, yet few investigated **youth engagement in government-generated crisis video** settings, especially regarding novel youth engaging strategies. In this section, we cover the most relevant work in two categories: government-generated crisis videos, and promoting youth engagement during crises.

2.1. Government-generated crisis videos

Crisis is defined as a significant threat to operations that can have negative consequences if not handled properly (Coombs, 2007). Typical crisis events include natural and technical disasters, terrorist attacks, international conflicts, nuclear threats, civil unrest, and global pandemics (Pan & Meng, 2016; Rosenthal, Hart, & Kouzmin, 1991). COVID-19, first identified in December 2019 in Wuhan, China, has resulted in an ongoing global pandemic. As of 25 August 2021, more than 214 million cases have been reported across 220 countries and territories with more than 4 million deaths (Dong, Du, & Gardner, 2020). Crisis management is a process designed to prevent or lessen the damage a crisis can cause (Coombs, 2007), which requires timely communication and coordination between government agencies and stakeholders (Elbanna, Bunker, Levine, & Sleight, 2019; Reddy et al., 2009). Government agencies in different countries are taking action and have implemented countless policies in response to the COVID-19 pandemic (Cheng, Barceló, Hartnett, Kubinec, & Messerschmidt, 2020).

With online video platforms gaining increasing popularity, millions turn to them for crisis information. For instance, some COVID-19-relevant Youtube videos on March 2020 were viewed >355 million times (C. E. Basch, Basch, Hillyer, & Jaime, 2020). Different from traditional social media platforms like Twitter, online video websites are distinguished for the expedient use of audio and visual communication, and thus available to individuals from all demographic backgrounds (H. O.-Y. Li, Bailey, Huynh, & Chan, 2020). This feature affords unique benefits for crisis communication. However, crisis communication through individual-generated videos faces challenges of poor efficiency and misinformation. Basch et al. reviewed 100 most widely viewed YouTube videos uploaded throughout the month of January 2020 about COVID-19, and found that fewer than one-third of the videos covered any of the seven key prevention behaviors listed on the CDC website (C. H. Basch et al., 2020). Li et al. coded the top 75 viewed videos on Youtube using keywords 'coronavirus' and 'COVID-19', and revealed that over one-quarter of the most viewed YouTube videos on COVID-19 contained misleading information, reaching millions of viewers worldwide (H. O.-Y. Li et al., 2020). These limitations of individual-generated videos highlight the importance of expanding the influence of timely and accurate crisis information conveyed by the government or authoritative agencies in online video platforms during crises.

Social media has emerged as an important medium for governments to capture and explain crisis situations, make public decisions, and take action accordingly (Panagiotopoulos, Barnett, Bigdeli, & Sams, 2016). Among different types of information conveyed through social media, government-generated videos are playing an increasingly significant role in performing crisis communication and management, which have been adopted by government agencies in various countries (Graham et al., 2015; Moon & Lee, 2020; Pandey, Patni, Singh, Sood, & Singh, 2010; Walton et al., 2012). For instance, Pandey et al. found that among 142 youtube videos about H1N1 influenza, the CDC contributed about 12% of the useful videos with a significant viewership share of 47% (Pandey et al., 2010). Another research conducted by Walton et al. revealed that CDC took strategic use of videos posted to YouTube to address the public's need for information in a timely and accessible way in response to H1N1 (Walton et al., 2012). During COVID-19 pandemic, Moon et al. analyzed 200 of the most viewed YouTube videos from

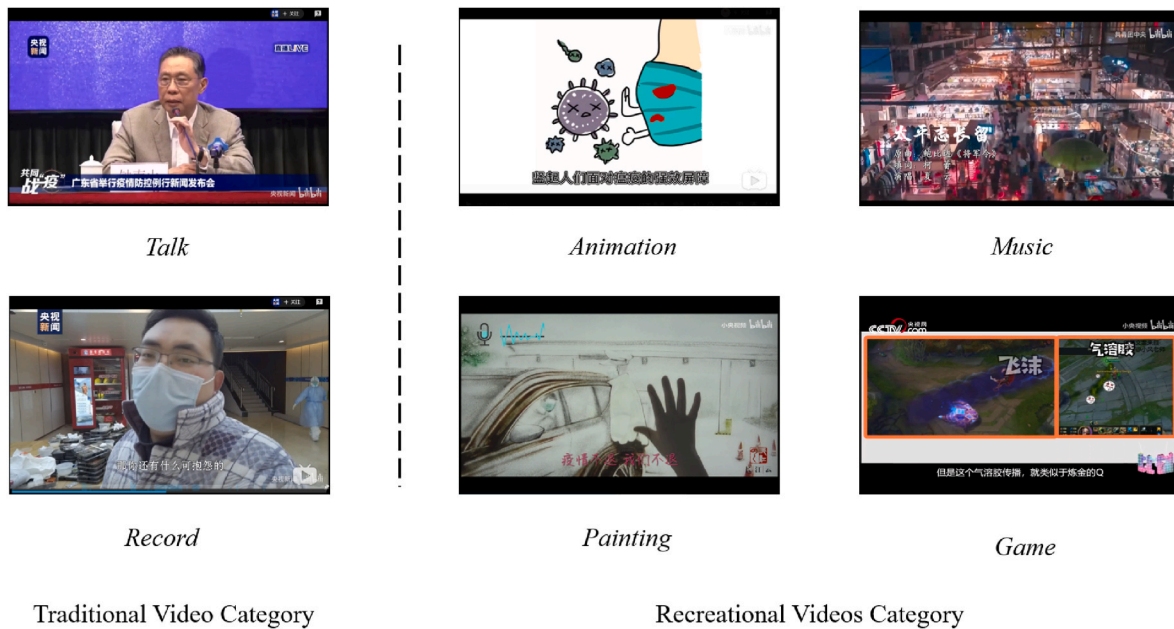


Fig. 1. Government-Generated Video Categories on Bilibili during the COVID-19 Pandemic: Talks, Records and Recreational videos. As a new strategy to engage youths, recreational videos include animation, music video, painting video, game video, etc.

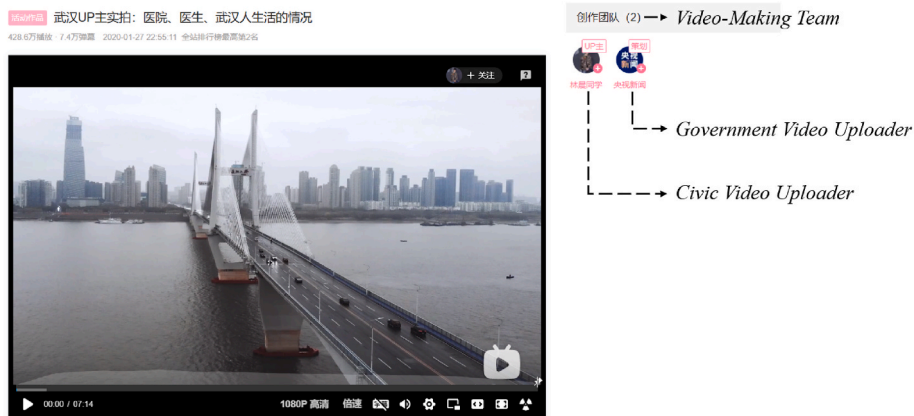


Fig. 2. An Example of Government-citizen Collaboration in Video Making on Bilibili. In the example, the video “Wuhan Record: The living conditions of hospitals, doctors and people in Wuhan” was collaboratively made by government account China Central Television (CCTV) and a popular individual vlogger.

January 1, 2020 to April 30, 2020 related to COVID-19, and found that all of the government-generated videos were useful (Moon & Lee, 2020).

Though government-generated videos for crisis information are emerging and proved to be beneficial, the audience is still not wide and engaged enough (Atac et al., 2020), and how to better engage citizens including youths in these videos still remains less investigated. This work systematically investigates the influencing factors of youth engagement in government-generated videos especially the two new engaging strategies (i.e., recreational video category and government-citizen collaboration in video-making), aiming to promote the efficiency and effectiveness of crisis communication through government-generated videos.

2.2. Promoting youth engagement during crises: A significant yet challenging problem

In recent years, Social Networking Sites (SNS) have played a crucial role in facilitating youth engagement (Farnham, Keyes, Yuki, & Tugwell, 2012; Marchi & Clark, 2021). Youth engagement can positively affect the personal development process of young generations, as well as

increase the likelihood that youth will engage with civic issues after they become adults (Irannejad Bisafar, Foucault Welles, D’Ignazio, & Parker, 2020; Irannejad Bisafar, Foucault Welles, & Parker, 2020; Tilton, 2010). During time of crises which are often characterized by ambiguity, confusion and feelings of disorientation (Stieglitz et al., 2017), promoting youth engagement has additional values. First, engaging youths can raise youths’ awareness of the crisis and thus reduce the risk of physical and mental damage (Liang et al., 2020). In addition, it can promote youths’ sense of social responsibility, which may trigger them to make contributions in crisis response.

Nevertheless, youth engagement during crises faces non-negligible challenges. Abbott et al. revealed that authoritative recommendations of CDC during COVID-19 pandemic were not taken seriously by youth populations (Abbott et al., 2020). A potential reason was that messaging efforts aimed at youths failed to meet youths’ messaging needs, preferences as well as communication channel considerations (Abbott et al., 2020). Also, Efuribe et al. claimed that there was little evidence of strategically engaging youths through governmental crisis communication (Efuribe et al., 2020). As such, intentionally taking strategic use of SNS to engage youths is in urgent need for governments.

In this paper, we focus on the influencing factors of youth engagement of government-generated videos on the largest youth-targeted video platform *bilibili.com* in China, especially on the two new youth-engaging strategies guided by EE and CG. Based on the widely-adopted engagement index measured as the sum of popularity, commitment and virality (Bonsón & Ratkai, 2013), we comprehensively investigated fine-grained youth engagement in government-generated videos in three dimensions: interaction, feedback and sharing. Apart from quantitatively measuring the effects, we also revealed the values and limitations of the new strategical practices through in-depth qualitative content analysis on users' commentary of recreational and collaborative videos, which theoretically enriched EE and CG in online crisis communication settings and shed light on effective and engaging crisis communication strategies.

3. Theoretical foundations and hypothesis

To systematically understand the potential effects of the two youth-engaging strategies during crises, we first review relevant theoretical foundations, and develop research hypotheses based on them.

3.1. Theoretical foundations

To explain how and why recreational video category and government-citizen collaboration in video making influence youth engagement during crises, we turn to Entertainment Education (EE) and Collaborative Governance (CG) respectively and consider how they may provide insights into youth-engaging strategies.

3.1.1. Entertainment Education

EE is a communication concept in the field of mass communication theory paradigm, which aims to alleviate a social issue or educate the public through a custom-tailored piece of entertainment (Singhal & Rogers, 2002). It suggests purposefully embedding educational and social issues through entertainment program, so as to achieve desired individual, community, institutional, and societal changes among the intended media user population (H. Wang & Singhal, 2009). EE has been widely adopted by traditional media, e.g., the Peruvian telenovela "Simplemente Maria" in 1969 which influenced social change (Singhal, Rogers, & Brown, 1993), and proved to be advantageous for various social and educational purposes. Recent work proved that EE approach was also successful on social media, especially on online video platforms. For example, Lim et al. investigated the use of EE on Youtube videos and discovered that more than half of videos on hand hygiene were educationally useful across the dimensions of attractiveness, comprehension, and persuasiveness (Lim, Kilpatrick, Storr, & Seale, 2018). Also, Davies et al. provided implications on using entertaining and educational web-based video series to reduce HIV among emerging adults (Davies et al., 2020). Generally, the major advantages of EE include its superiority in reaching and engaging large audiences, and its well-documented ability to articulate debate. However, to maximize the effectiveness and sustainability of communication through EE, it is necessary to strengthen its alignment with social media best practice principles in the given context (Lim et al., 2018). In this work, we explored EE's practice, effects and influencing mechanisms on youth engagement in a new scenario, i.e., crisis communication.

3.1.2. Collaborative Governance

CG is the innovation and breakthrough under public management theory paradigm (Sun, 2017). The concept of CG, first introduced by Dohahue in 2004, is most broadly defined as a process involving state and non-state actors jointly addressing an issue (Donahue, 2004). From the narrow sense, Ansell and Gash defined it as a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative, which aims to make or implement

public policy or manage public programs or assets (Ansell & Gash, 2008). From the broad sense, Emerson et al. considered it as the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished (Emerson, Nabatchi, & Balogh, 2012). As such, the broad view of CG does not emphasize a formal decision-making or management process, and is not limited to state-initiated arrangements (Sun, 2017). CG has been widely applied in crisis management (Kapucu, 2015), such as during Nargis cyclone in Myanmar, Sichuan earthquake in China (Kapucu, 2011) and COVID-19 pandemic (Criado & Guevara-Gómez, 2021; I. Y.-F. Huang, 2020). Based on Wanna's considerations (Wanna, 2008), CG had advantages such as the innovation through opening up policy problems to a wider range of contributions, and the benefits of mutual learning and capacity building in the process; however, it also suffered from the blurring accountability and the different objectives between government and non-state actors. This work investigated how and why government-citizen collaboration in video making, a novel practice of CG in crisis communication, influenced youth engagement.

3.2. Research hypotheses

Guided by the aforementioned theoretical foundations, we propose research hypotheses on the potential effects of influencing factors of youth engagement in crisis videos, especially the novel youth-engaging strategies.

3.2.1. Recreational Video's influence on youth engagement guided by EE

During the COVID-19 pandemic, videos in less serious forms such as animation and music were adopted by government accounts to popularize crisis knowledge and convey authoritative guidelines. It offered a new lens on engaging and educating youths during crises, yet how **recreational video category** influenced youth engagement remained unknown.

The promotion of some specific genres of recreational videos such as animation in youth engagement has been proven in different areas, e.g., health and education. For instance, Shigehatake et al. revealed that the animated cartoon could successfully improve education of Stroke knowledge in high school students (Shigehatake et al., 2014). Also, Pate et al. argued that high-quality online animated videos were a potentially excellent medium to engage youth at a mass level in pain science education (Pate, Heathcote, Simons, Leake, & Moseley, 2020). Martzoukou investigated using cartoon videos to promote youths' development of digital literacy, resilience and citizenship in the online environment, and revealed its positive effects (Martzoukou, 2020).

These studies validated the positive effect of engaging and educating youths through EE, i.e., embedding educational and social issues in entertainment media especially those attracting young generations, such as cartoon and music. Nevertheless, no previous work explored whether educating and engaging youths through recreational videos worked in the crisis communication settings, in which much timely and accurate knowledge on crisis response should be effectively disseminated to and thoroughly understood by youths. Particularly, whether EE's advantages such as accessibility helped to engage youths during crises, or EE played an unexpected negative role in delivering the serious crisis information, is still unknown; What are the best practices of EE in crisis communication, is also not investigated though of great significance in engaging and educating youths. This work aims to fill these gaps, and enriches EE by not only providing practical evidence of its influence on youth engagement during a crisis, but also proposing implications in applying it for effective crisis communication based on its values and limitations.

Enlightened by EE's successful practices in other domains such as health education, we raised our first hypothesis:

H1. Recreational video category would have a positive influence on youth engagement in youth-targeted crisis videos.

3.2.2. Government-citizen Collaboration's influence on youth engagement guided by CG

With the support of the collaborative video making interface in Bilibili (Bilibili, 2019), government uploaders collaboratively made crisis videos with civic video uploaders in the community during COVID-19 (e.g., Wuhan life record vlogs co-generated with vloggers, COVID-19 prevention videos co-generated with knowledge-popularization video uploaders). As a new practice of CG in crisis communication, **government-citizen collaboration in video making** raised new demands on understanding how CG worked in delivering crisis information to youths and engaging them.

Collaboration in content generation, as a common practice in social media websites, has been proved to be beneficial in enhancing content quality and engaging social media users. For instance, Li et al. found that collaborative editing in Stack Overflow increased the number of positive votes by 181% for the questions and 119% for the answers (G. Li, Zhu, Lu, Ding, & Gu, 2015). During times of crisis, government-citizen collaboration could further fill the information gap between government and citizens, and thus serve as a significant approach to facilitate information sharing (Pipek, Liu, & Kerne, 2014). For instance, Panagiotopoulos et al. focused on the citizen-government collaboration on Twitter in the 2011 riots in England and found that collective action of citizens and councils co-evolved in actions such as disproving rumors and identifying suspects (Panagiotopoulos, Bigdeli, & Sams, 2014).

One major advantage of CG is that it can lead to mutual learning and shared experiences, which helps to improve the overall practice and effectiveness of public administration (O'Flynn & Wanna, 2008). This advantage is particularly crucial during crises when the gap in crisis information exists between government and citizens. During COVID-19 pandemic, researchers also discussed CG for crisis management such as in Taiwan (I. Y.-F. Huang, 2020) and Spain (Criado & Guevara-Gómez, 2021). Nevertheless, existing literature lacks the understanding of leveraging CG for online crisis communication, especially through co-generation of crisis videos to disseminate crisis information. To fill this gap, this work systematically explored how government-citizen collaboration influenced youth engagement in COVID-19-related videos. We also applied content analysis on youths' commentary on collaborative videos to uncover perceived values and limitations, which shed light on future directions in better enhancing crisis awareness among youths.

The advantages of online content co-generation, as well as the practices of CG in crisis management, motivated us to propose the second hypothesis:

H2. Government-citizen collaboration in video co-generation would have a positive influence on youth engagement in youth-targeted crisis videos.

3.2.3. Video Content's influence on youth engagement

As suggested by The Uses and Gratifications Theory, individuals deliberately choose media that will satisfy given needs (Katz, Blumler, & Gurevitch, 1973; Menon & Meghana, 2021), and the degree to which media gratifies individuals' differential needs directly influences their media selection and usage behavior (Katz et al., 1973). The motives of using and consuming specific media can be mainly grouped into five categories, including cognitive needs, affective needs, personal identity, integration and social interaction, and escapism (Katz et al., 1973). Different video content, with different **content topics** and **emotion valence**, would satisfy different cognitive needs and affective needs in media usage, and has been proven to affect Citizen Engagement through Government Social Media (CEGSM) by plenty of previous work such as (Bhattacharya, Srinivasan, & Polgreen, 2017; Q.; Chen et al., 2020; Tang, Li, Gu, & Tan, 2019).

Literature on CEGSM suggests different content topics have varied impacts on citizen engagement. For example, Rahim et al. revealed that a good engagement rate was significantly associated with posts of health education and risk communication topics (A Rahim, Ibrahim, A Salim, & Ariffin, 2019). Chen et al. revealed that, during COVID-19 pandemic, information related to the latest news about the pandemic and information on the government's handling of the crisis led to an increase in citizen engagement (Q. Chen et al., 2020). During crises, the topic of government's management of the crisis has been discovered as a dominant factor with a positive influence on citizen engagement in China. For example, Xie et al. found that, when a public crisis happened, the most engaging information topic was the disposition of the government (Xie, Qiao, Shao, & Chen, 2017). Another study on TikTok also proved that videos with topics of the government's handling of the situation and guidelines information promoted citizens' sharing (Q. Chen et al., 2021).

For emotion valence of crisis media content, though it has been proven to have a significant influence on engagement, the conclusions are still unsettled. For instance, Trilling et al. found that both positive and negative emotions promoted news sharing on Facebook and Twitter, but positive emotions outweighed negative emotions (Trilling, Tolochko, & Burscher, 2017). Another study by Xu and Zhang demonstrated that crisis tweets with positive emotions could increase the number of retweets, while content showing anger reduced retweets (Xu & Zhang, 2018). Also, Zavattaro et al. revealed that though governments typically adopted a neutral tone in information sharing, the ones with a positive tone were likely to encourage citizen participation on social media (Zavattaro, French, & Mohanty, 2015).

Nonetheless, most existing works focused on how content topic and emotion valence influenced engagement of the general public in text-based social media settings. How their influences apply in the new scenario, namely which crisis-related content is deliberately created by government in the form of *video* and how video content affects the engagement of *youth generation*, is uninvestigated. Given the significance of engaging youths in crisis and the popularity of video media, answering this question could further the understanding of crisis communication and youth social participation. This work addresses this gap, and contributes to the research venue on CEGSM by providing theoretical and practical implications to effectively disseminate crisis information and engage youths.

Based on the existing literature on CEGSM, we provided our third research hypothesis:

H3. Content topic and emotion valence would have impacts on youth engagement, and the topic of Government's Handling of the Crisis would have a positive impact on youth engagement.

4. Method

This section describes our mixed-methods approach for establishing a systematic comprehension of youth engagement in government-generated crisis videos. We first utilized a quantitative regression model to investigate how *content topic*, *emotion valence*, (*recreational video category* and *government-citizen collaboration*) influenced the multi-dimension youth engagement in government-generated crisis videos. To provide an in-depth understanding of the actual effect of new strategies in engaging youths, we further conducted a qualitative content analysis on the user-generated danmaku and comments, uncovering the values and limitations of the new strategies' practices.

4.1. The present study: hypotheses

Inspired by the theoretical foundations, we sought to explore and validate these research hypotheses on influencing factors of youth engagement:

H1. Recreational video category would have a positive influence on

youth engagement in youth-targeted crisis videos.

H2. Government-citizen collaboration in video co-generation would have a positive influence on youth engagement in youth-targeted crisis videos.

H3. Content topic and emotion valence would have impacts on youth engagement, and the topic of Government’s Handling of the Crisis would have a positive impact on youth engagement.

4.2. Procedure of quantitative analysis: influencing factors of youth engagement

To systematically investigate the impact of video content (i.e., content topic and emotion valence) and new engaging strategies (i.e., recreational video categories and government-citizen collaboration) on youth engagement in government-generated crisis videos, we collected a sufficiently large COVID-19-related video dataset from Bilibili.com, designed comprehensive preprocessing steps, and performed quantitative methods to test our hypotheses. The overall quantitative analytical flow is exhibited in Fig. 3.

4.2.1. Data collection and preprocessing

To generate a large-scale government-generated crisis video dataset, we first collected all video data from January 9, 2020 (the time of earliest authoritative information about COVID-19 on Bilibili) to May 15, 2020 (one month after COVID-19 cases per day in China dropped below 100 (Dong et al., 2020)) of 10 popular government video-uploaders (6 national accounts: CCTV News, China Daily, People’s Daily, Xiao Yang TV, Observer and Gongqingtuan Zhongyang; 4 local-government accounts: Gongqingtuan Guangdong, Gongqingtuan Zhejiang, Gongqingtuan Anhui and Gongqingtuan Henan) using Bilibili official API. Government video uploaders were selected based on (1) popularity: more than 200,000 followers, (2) video correlation to COVID-19: at least 10 videos related to COVID-19 in the selected time period. Note that though 4 selected accounts were owned by local governments, their video content about COVID-19 was not limited to the local area, so we also included them without loss of generality. The collected video metadata information included video id, video title, uploader id, uploader name, video duration, description, upload time, category, collaborative video or not, paid video or not, and number of views, sharing, danmaku, comments, likes, favorites and coins.

To select videos related to COVID-19, we first read descriptions and

titles of 200 video samples and generated a keyword table that covered the information of government-generated COVID-19-related videos, which included the following keywords: COVID-19, coronavirus, mask, pneumonia, epidemic, mobile cabin hospital, Wuhan, pandemic (literally translated from Chinese). Then, we utilized the keyword table to select videos whose titles or descriptions contained any of the keywords. This step yielded 3347 COVID-19-related government-generated videos.

4.2.2. Operation of independent variables

To validate the hypotheses, we processed independent variables including content topic, emotion valence, video category and government-citizen collaboration for each video.

Content Topic. As there is no available relevant pre-defined taxonomy, we used grounded theory (Corbin & Strauss, 2014) to derive a coding taxonomy from the data, and then trained machine learning models to generalize the codes to the whole dataset, as shown in Fig. 3. Two coders coded the content of 200 video samples at the beginning. They first watched the videos and read the video description to get a general sense of the video content. Then, each author followed the open coding process to code the 200 video samples and generated a set of initial codes independently. After several rounds of coding, comparing emerging data to existing themes and discussion, the two authors generated a set of codes that emerged naturally to describe the video content. The kappa value is 0.84, indicating substantial agreement (Viera & Garrett, 2005). Then, two coders independently annotated another 400 videos each, yielding a training dataset with 1000 topic-annotated samples. Through the coding, we observed that the description fields in most videos were not empty and well-represented the information of video content. Therefore, we built feature vector of each video by: (1) training 100-dimension Word2Vec word embedding (Mikolov, Sutskever, Chen, Corrado, & Dean, 2013) based on title and description text of the whole dataset, (2) calculating average word vectors as the document vector for each title and description, and (3) concatenating title vector and description vector as the 200-dimension feature of each video. After testing several classification algorithms including SVM, Naive Bayes and Random Forest, we finally chose XGBoost (T. Chen & Guestrin, 2016) as the video topic classifier which has the best performance with the highest f1 score. Trained on 1000 topic-annotated data, it reached a 69.2% f1 score on 10-cross validation, which was substantially good for 5-topic multi-class classification. We leveraged the classifier to assign video topics to the remaining 2347 videos. The video content topics, examples and proportions of the

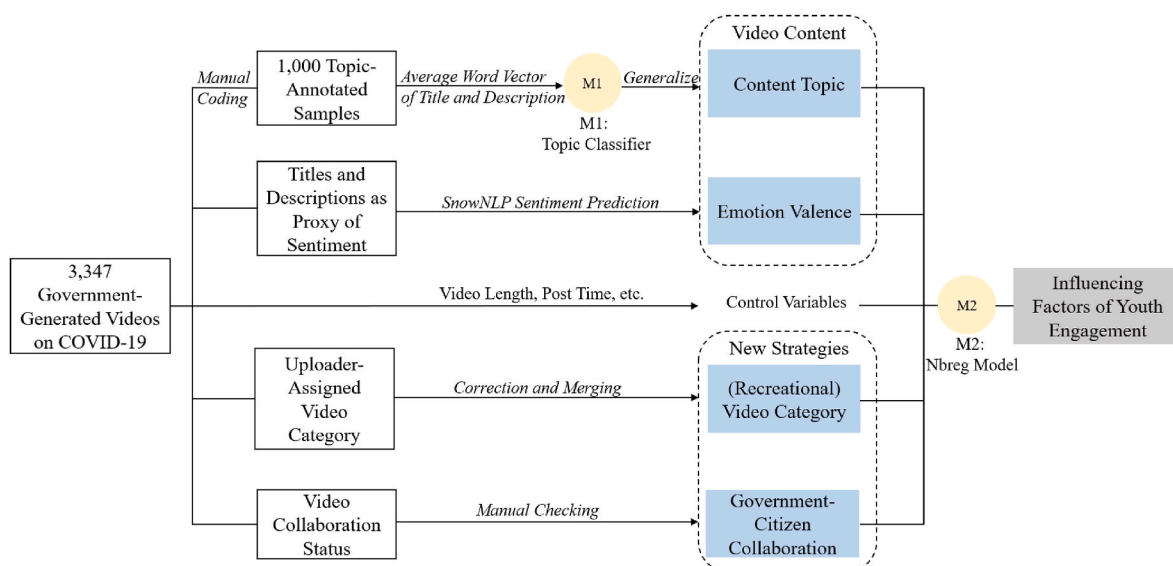


Fig. 3. Overall quantitative analytical flow.

dataset are shown in Table 1.

Emotion Valence. With the success of adopting text metadata including video title and description as the proxy of video content in a wide range of tasks (Filippova & Hall, 2011; C. Huang, Fu, & Chen, 2010) and the nature of comprehensive description in government-generated videos on Bilibili, we measured the emotion valence of video content also based on the video title and description. The emotional valence of each title and video description was calculated based on SnowNLP (Isnowfy, 2013), which has been applied for a large amount of sentiment analysis in Chinese (Ouyang, 2016; Wu, Sang, Zhang, & Huang, 2018). Each title or description was assigned to a weighted emotional valence within the range of 0–1. 0 denoted extreme negative emotion, and 1 denoted extreme positive emotion. The average emotion valence of video title and video description was finally calculated as the proxy of the emotion of video content.

Video Category. The video category label in video metadata was assigned by video producers when they uploaded videos on Bilibili. In addition to the novel recreational videos, two traditional video categories dominated the government-generated videos in the dataset, which were *talks*, the formal talk providing authoritative information, and *records*, the live interviews and records by journalists. To avoid video producers' misclassification of the video category, we manually examined the video title and content, and modified the video categories if misclassification was detected. As each fine-grained recreational video category (e.g., animation) only contained a small number of videos, we merged them into "recreational video" to facilitate analysis based on their common entertainment characteristics, leading to 3 coarse-grained video categories: talks, records and recreational videos, as shown in Fig. 1.

Government-citizen Collaboration. The collaborative video or not in video metadata indicated whether the video involved collaboration (more than 1 video makers), as shown in Fig. 2. We checked the authors of videos with collaboration and validated that all videos were collaborated with at least one civic video producer (individuals or non-governmental organizations). Therefore, we took the status of collaborative video or not to describe whether there was government-citizen collaboration in video making, where 0 denoted no collaboration with only government producers, and 1 denoted collaboration with civic video uploaders.

Apart from the independent variables mentioned above, we also identified the following variables for each video as control variables:

- 1) The popularity of the video uploader: The follower number of the government uploader.
- 2) The activity level of the video uploader: The average COVID-19-related video number per day of the government uploader.
- 3) The upload time of the day: Coded as morning (6 a.m.–12 a.m.), afternoon (0 p.m.–6 p.m.), evening (6 p.m.–10 p.m.) and late at night (10 p.m.–6 a.m.).

Table 1
Content topics, examples and proportions of government-generated videos related to COVID-19 on bilibili.

Topics	Example Video Titles	Proportions
People's Life and Response	<i>Long time no see, Wuhan! A living record of Wuhan in recovery</i>	45.7%
COVID-19 Situation Worldwide	<i>WHO: There have been over 30,000 deaths from COVID-19 globally</i>	37.2%
COVID-19 Situation in China	<i>There have been 2744 confirmed COVID-19 cases nationwide, with 51 cured and 80 dead</i>	9.1%
Government's Handling of the crisis	<i>State Council Notice: The Spring Festival holiday has been extended to February 2 in response to COVID-19 pandemic</i>	4.6%
Knowledge Popularization and Guidance	<i>Could COVID-19 be transmitted through aerosols? Don't panic ...</i>	3.4%

- 4) The pandemic situation when publishing the video: The number of new COVID-19 cases in China on the video-published day.
- 5) Video duration: Based on the video length distribution, we split the data into "short video" (shorter than 1 min), "medium length video" (1–5 min) and "long video" (longer than 5 min).
- 6) Additional descriptive information: Whether the video had subtitles and tags.

4.2.3. Youth engagement as the dependent variable: interaction, feedback and sharing

Compared to conventional social media sites such as Twitter, Facebook and Weibo which mainly support likes, retweets and comments, richer engagement interfaces are available on Bilibili. We concluded youth engagement on Bilibili into three categories: interaction, feedback and sharing. A typical design of how users can engage in videos on Bilibili is illustrated in Fig. 4.

Interaction. We used the numbers of danmaku and comments to represent the level of viewers' interaction. Unlike traditional video forums where comments are displayed below the video, danmaku comments fly from right to left on the video screen (Wu et al., 2018). Users can anonymously send danmaku comments and see other users' danmaku comments while they are watching the videos, building a "Pseudo-Synchronized" communication experience (Satoshi, 2008). With different displayed features and commenting behavior patterns (Ma & Cao, 2017), danmaku and video comments reflect the two different modes of interaction during or after watching the video.

Feedback. The numbers of likes, favorites and coins indicate how viewers are willing to provide positive feedback. Like, favorite and coin reflect users' affection of the video from low to high: Like, similar to other traditional video platforms, represents user approval or support for a video; Favorite, adding the video into users' favorites, not only expresses the affection to the video but also increases the possibility of viewing in the future; Coin is the virtual currency on Bilibili platform that could be sent from viewers to video uploaders.

Sharing. The number of sharing reflects how viewers would like to voluntarily spread the video information. On Bilibili, users could use the sharing interface to share the video to different popular platforms in China, including Wechat, Weibo, QQ, Tieba and Bilibili itself.

4.2.4. Data analysis

Negative binomial regression (nbreg) models are used to model count outcome variables with great variability (Cameron & Trivedi, 2013) and have been applied in different social computing tasks (Q. Chen et al., 2020; G. Li et al., 2015). Considering the over-dispersed distribution of all engagement dimensions as shown in Table 2, we adopted nbreg model to estimate the impact of content topic, emotion valence, video category and government-citizen collaboration on youth engagement. All analyses were conducted using statsmodels (Seabold & Perktold, 2010) in python.

4.3. Procedure of content analysis: unpacking values and limitations of new engaging strategies

The quantitative analysis introduced in the previous subsection provided preliminary insights into the influencing factors of youth engagement. However, the reason behind why such influences formed remained unknown, especially regarding the new engaging-youth strategies, i.e., the recreational videos and government-citizen collaboration. To this end, we performed an in-depth qualitative content analysis of user-generated commentary. Taking commentary as the reflection of viewers' perspectives, we coded 1000 danmaku samples and 1000 comment samples (both including 500 for collaborative videos and 500 for recreational videos) to investigate the values and limitations of the new strategies. Based on the open coding method (Corbin & Strauss, 2014), two coders independently generated initial codes, and resolved the differences through several rounds of meetings and discussion to



Fig. 4. Multi-Dimension Engagement on Bilibili: Interaction (danmaku and comments), Feedback (likes, favorites and coins) and Sharing.

Table 2
Mean and standard deviation of different youth engagement dimensions.

Youth Engagement Dimensions	Interaction		Feedback			Sharing
	danmaku	comments	likes	favorites	coins	sharing
Mean	2026.2	1845.9	23975.5	1982.0	3169.1	1633.2
Standard Deviation	5362.4	2227.7	27563.2	4041.8	11829.7	3429.4

reach a consensus.

5. Result

This section describes the findings of our work, which characterizes the influencing factors, particularly the new engaging strategies, of youth engagement in government-generated videos. We first illustrate the descriptive summary of the target dataset to provide the context of government-generated crisis videos. We then reveal how video content and new engaging strategies affected the multi-dimension youth engagement, including interaction, feedback and sharing. Finally, we

focus on the values and limitations of the new engaging strategies, which throws light on engaging and effective strategies in crisis communication.

5.1. Descriptive summary

After filtering irrelevant videos, we generated a dataset including 3347 government-generated videos related to COVID-19 in total. The volume trend across months is shown in Fig. 5 (a), with a gradual decrease from February to May which nearly corresponded to the COVID-19 pandemic situation development in China. Among different

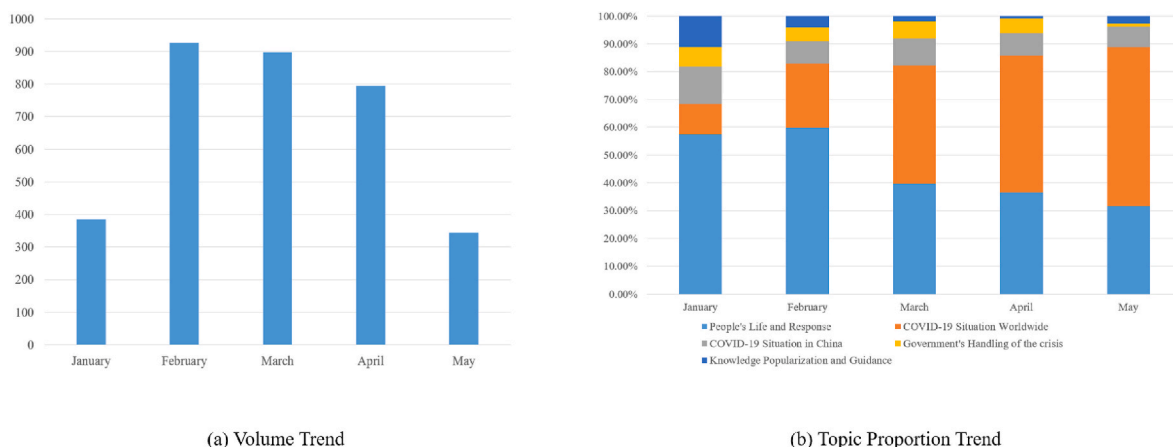


Fig. 5. Volume trend (a) and topic proportion trend (b) of government-generated crisis videos on bilibili during the COVID-19 pandemic.

content topics, *People's Life and Response* accounted for the highest topic proportion (45.7%, N = 1530), followed by *COVID-19 Situation Worldwide* (37.3%, N = 1249), *COVID-19 Situation in China* (9.1%, N = 306), *Government's Handling of the crisis* (4.6%, N = 154) and *Knowledge Popularization and Guidance* (3.2%, N = 108). Fig. 5 (b) shows the content topic proportion trend of government-generated crisis videos in the dataset. As the COVID-19 situation was gradually under control in China from January to May, the number of videos providing *Knowledge Popularization and Guidance* decreased over time, while the proportion of videos about *COVID-19 Situation Worldwide* exhibited an ascending trend. The emotion valence in the video dataset was positive overall, with a 0.72 average sentiment score. The video categories were imbalanced, with high proportions of traditional talks (54.9%, N = 1836) and records (41.6%, N = 1393) and a relatively low proportion of the emerging recreational videos (3.5%, N = 118). 147 videos were co-produced by government accounts and civic uploaders, which accounted for 4.4% of all government-generated videos.

5.2. Influencing factors of multi-dimension youth engagement

Tables 3–5 present the results of negative binomial regression models predicting the multi-dimension engagement in government-generated videos (i.e., interaction, feedback and sharing). We report the effects through incidence rate ratios (IRR), which denotes the ratio change of the dependent variable when increasing an independent variable by one unit.

5.2.1. Interaction

Table 3 exhibits the result of negative binomial regression model predicting video interaction in government-generated videos (*Model 1: Danmaku* and *Model 2: Comments*). Generally, the independent variables had differentiated impacts on the two different interaction interfaces (i.e., danmaku and video comments).

The result indicated that youth engagement was contingent upon the content topic. Taking *Knowledge Popularization and Guidance* as the reference group, videos on *People's Life and Response* led to a 66% increase of danmaku volume. *COVID-19 Situation Worldwide*, *COVID-19 Situation in China*, and *Government's Handling of the Crisis* also promoted danmaku interaction by 51%, 25%, 22% compared to *Knowledge Popularization and Guidance*. However, such effects of content did not hold on comments, which was less sportful and interactive compared to danmaku. Specifically, *Knowledge Popularization and Guidance* had the highest positive effect in promoting youth users'

Table 3

Negative binomial regressions predicting video interaction in government-generated videos.*** p < 0.001; ** p < 0.01; * p < 0.05. Note that IRR can be interpreted as the ratio change of the dependent variable when increasing an independent variable by one unit.

	Interaction			
	Model 1: Danmaku		Model 2: Comments	
	IRR	Std. Err.	IRR	Std. Err.
<i>Content Topic</i> (Reference Group: Knowledge Popularization and Guidance)				
People's Life and Response	1.66*	0.10	0.92	0.06
COVID-19 Situation Worldwide	1.51	0.10	0.91	0.06
COVID-19 Situation in China	1.25	0.11	0.97	0.07
Government's Handling of the Crisis	1.22	0.13	0.75***	0.08
<i>Emotion Valence</i>	1.18**	0.06	1.08*	0.04
<i>Video Category</i> (Reference Group: Recreational Videos)				
Records	0.82*	0.10	0.84**	0.06
Talks	0.83*	0.10	0.92	0.06
<i>Government-citizen Collaboration</i>	1.73***	0.10	1.42***	0.06

Table 4

Negative binomial regressions predicting video feedback in government-generated videos.*** p < 0.001; ** p < 0.01; * p < 0.05.

	Feedback					
	Model 3: Likes		Model 4: Favorites		Model 5: Coins	
	IRR	Std. Err.	IRR	Std. Err.	IRR	Std. Err.
<i>Content Topic</i> (Reference Group: Knowledge Popularization and Guidance)						
People's Life and Response	1.25***	0.05	1.30***	0.06	1.60***	0.09
COVID-19 Situation Worldwide	0.92	0.05	0.95	0.06	0.84*	0.10
COVID-19 Situation in China	0.99	0.06	0.80**	0.07	0.68***	0.11
Government's Handling of the crisis	1.25***	0.06	1.08	0.08	1.33*	0.12
<i>Emotion Valence</i>	1.15***	0.03	1.36***	0.04	1.52***	0.06
<i>Video Category</i> (Reference Group: Recreational Videos)						
Records	0.86**	0.05	0.60***	0.06	0.46***	0.09
Talks	0.85***	0.05	0.61***	0.06	0.42***	0.09
<i>Government-citizen Collaboration</i>	1.19***	0.05	1.58***	0.06	1.79***	0.10

Table 5

Negative binomial regressions predicting video sharing in government-generated videos.*** p < 0.001; ** p < 0.01; * p < 0.05.

	Sharing	
	Model 6: Sharing	
	IRR	Std. Err.
<i>Content Topic</i> (Reference Group: Knowledge Popularization and Guidance)		
People's Life and Response	0.73***	0.08
COVID-19 Situation Worldwide	0.57***	0.08
COVID-19 Situation in China	0.56***	0.09
Government's Handling of the crisis	0.58***	0.10
<i>Emotion Valence</i>	1.09*	0.05
<i>Video Category</i> (Reference Group: Recreational Videos)		
Records	0.63***	0.08
Talks	0.72***	0.08
<i>Government-citizen Collaboration</i>	1.09	0.08

comments, with all other four topics leading to varying degrees of decrease in video commenting. Videos about *Government's Handling of the Crisis* received the fewest video comments.

Positive emotion valence would slightly enhance youth interaction, which increased danmaku numbers by 18% and comments numbers by 8%. Youths were more willing to interact in recreational videos instead of traditional records (IRR = 0.82 for danmaku and IRR = 0.84 for video comments) and talks (IRR = 0.84 for danmaku and IRR = 0.92 for video comments) videos. *Government-citizen collaboration* in video making was also a significant positive predictor of user interaction, with a one-unit increase in the level of government-citizen collaboration resulting in a 73% increase of danmaku and 42% increase in video comments.

5.2.2. Feedback

The influence of independent variables on feedback of government-generated videos is shown in Table 4 (*Model 3: Likes*, *Model 4: Favorites*, and *Model 5: Coins*). Videos about *People's Life and Response* received the most positive feedback, followed by Videos about *Government's Handling of the crisis*. Both *COVID-19 Situation in China* and *Worldwide* slightly brought down the number of likes, favorites and coins compared to the reference group *Knowledge Popularization and Guidance*. The

positive emotion valence of the video was a significantly positive influencing factor which increased the number of likes by 15%, the number of favorites by 36%, and the number of coins by 52% respectively. The two new engaging strategies, adopting recreational video category and collaborative video making with citizens, were proved to be effective in attracting more positive feedback.

5.2.3. Sharing

Table 5 reflects the result of negative binomial regression model predicting video sharing (Model 6: Sharing). Distinguished from interaction and feedback, videos with the topic of Knowledge Popularization and Guidance were significantly more likely to be shared compared to other video topics. The IRR of emotion valence was 1.09, indicating a slightly higher probability of being shared for more positive videos. Youths were significantly more willing to share recreational videos compared to conventional records (IRR = 0.63) and talks (IRR = 0.72). Government-citizen collaboration in video making, in addition, would also increase the video sharing amount by 9%.

5.2.4. Hypothesis testing

Combining the results of multi-dimension youth engagement (interaction, feedback and sharing), we tested our hypothesis. First, H1 claimed that the recreational video would promote youth engagement in youth-targeted crisis videos. The results revealed that recreational videos would bring in varying degrees of promotion of interaction, feedback and sharing. Thus, **H1 was supported**. Second, H2 hypothesized that government-citizen collaboration in video making would positively influence youth engagement in youth-targeted crisis videos. We found that collaborative video making with citizens increased the number of danmaku by 73%, the number of comments by 42%, the number of likes by 19%, the number of favorites by 58%, the number of coins by 79%, and the number of sharing by 9%. Therefore, **H2 was supported**. Finally, H3 argued that content topic and emotion valence would have impacts on youth engagement, and the topic of Government's Handling of the Crisis would promote youth engagement. We showed that content topic had a significantly differentiated influence on interaction, feedback and sharing. Also, positive emotion valence promoted youth engagement among all engagement dimensions. Nevertheless, Government's Handling of the Crisis did not particularly increase the indexes of youth engagement. Actually, videos on People's Life and Response received the highest positive feedback, and videos on Knowledge Popularization and Guidance were most shared by youths. Thus, **H3 was partially supported**.

5.3. New strategies: practices, values and limitations

Among all government-generated videos during COVID-19 pandemic in our dataset, 118 (3.5%) were identified as recreational videos and 147 (4.4%) involved government-citizen collaboration. Though collaborative and recreational videos were rare, the quantitative analysis proved their effectiveness in engaging youths. In this section, we uncovered what values the two new strategies added to crisis communication and how they brought possible opportunities to better engage youths during a crisis, as well as the limitations of such new strategies in current practice.

5.3.1. Practices of recreational videos and government-citizen collaboration

In 118 recreational videos, there were 66 music videos, 20 short movies, 15 animations and 17 other special forms (e.g., painting videos, game videos and auto-tune remix-themed content). The content topic distribution in recreational videos and collaborative videos is exhibited in Fig. 6. It revealed that the topic of People's Life and Response dominated both recreational videos and collaborative videos (78.8% and 77.6% separately compared to 45.7% in the whole dataset). Typically, recreational videos under this topic exhibited the public's response to the pandemic and appreciated people's spontaneous support

to the severely afflicted areas in the art form of music, short movie or animation (e.g., music video titled "Light in Night - dedicated to the heroes who keep the defense line in the battle against the pandemic"), while collaborative videos under this topic presented the on-spot record of people's livelihood in endemic areas collaborated with civic vloggers (e.g., "Wuhan Vlog: Can I order take-out at late night in Wuhan under the pandemic?"). Topics of COVID-19 Situation Worldwide, COVID-19 Situation in China and Government's Handling of the Crisis were much less mentioned in recreational and collaborative videos compared to in all government-generated videos. Besides, quite a few recreational and collaborative videos on Knowledge Popularization and Guidance appeared (e.g., game video titled "Very clear! Understand aerosol propagation in the way of League of Legends", the collaborative video titled "Will there be sequelae after recovery from COVID-19? Aid-Hubei doctor answering online" collaborated with a civic video uploader who interviewed an aid-Hubei doctor). It is interesting to note that there was a large intersection of recreational videos and government-citizen collaborative videos (N = 31, 26.3% among all recreational videos and 21.1% among all collaborative videos), indicating the prevalent practice of collaborating with recreational video uploaders such as singers and animation makers on the platform to generate better content.

5.3.2. Values of the new strategies in crisis communication

Through qualitative content analysis on 1000 danmaku and 1000 comment posts, we revealed the following four unique values of the collaborative and recreational videos.

Video Quality Enhanced by Collaborators. The danmaku and video comments reflected the high quality of videos co-created by government accounts and civic collaborators who were specialized in specific video genres (e.g., vlog, music and animation). Danmaku and comments which directly praised the video content quality such as "Very high quality, thank you!" appeared in high frequency. Some users also appreciated contributions of civic collaborators in promoting the video quality in detail based on the viewing impression and content artistry. For instance, one danmaku described the feeling that "seeing the video of [nickname of the civic vlogger], I always feel relieved and have less fear of the virus. Thank you very much.", and a comment noted that "Actually the origin rhyme is not easy to be adapted to the fighting-pandemic lyrics, but the video maker really did a good job! Come on Wuhan!"

Addressing Information Gap through Co-generation. Video co-generation with civic uploaders conveyed information from a synthetic perspective that merged standpoints of both government and public, which relatively addressed the government-citizen information gap. As such, users were more willing to accept the transmitted information, as a comment noted, "Glad to see a (government-generated) Wuhan record that is truly from the citizens' perspective. Thanks for showing the real side of Wuhan. Please wear a mask and stop gathering!". Meanwhile, addressing information gap through co-generation was also beneficial to make the conveyed knowledge easy to understand for the general public. For example, in a video that delivered personal prevention knowledge made by the government and a professional knowledge popularization video-maker, many danmaku showed gratitude, "Thanks! Finally find a clear and understandable video".

The Suitability of Recreational Videos under Particular Topics. User comments and danmaku revealed the superiority of leveraging a specific type of recreational videos to efficiently convey crisis information, especially in making the knowledge more comprehensible. For instance, in the Game Video "Very clear! Understand aerosol propagation in the way of League of Legends", a user endorsed the expression method, "CCTV uses continuous imagination and analogy to explain that the virus can exist in the form of aerosol in addition to droplets...some citizens think that the official is not serious, in fact, imagination and analogy are the two simplest yet most effective ways for initial information input." Under the animation video "Human-Virus War: We will win finally!", a comment wrote, "(this video) vividly reflects the whole process of our war against the

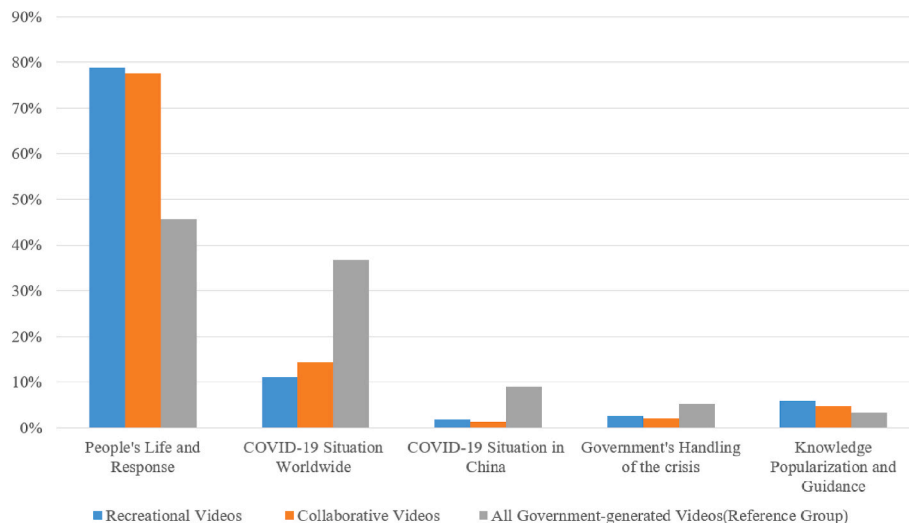


Fig. 6. Content topic proportions in recreational and collaborative videos.

pandemic in the way of Chinese Ink Animation. We fight, and we sacrifice against the virus...This animation is very exciting and touching, and it can even give future generations a reminder and promotion.”

Trust Work for Youth Participation. Both collaborative and recreational videos managed to build trust and reduce the *relationship distance* (Corbett & Le Dantec, 2018) between public officials and youths. In collaborative videos, youths felt psychological closeness when finding individual video uploaders, who were also civics, appeared in government-generated videos. For instance, a user said, “I have followed [nickname of the civic uploader] for several years and never thought he would collaborate with government one day! Thanks [nickname of government account], I would pay more attention to your videos”. While in recreational videos, youths felt excited when the ACG culture in their community was accepted and adopted by the serious and formal government account. One user joked that “When browsing Bilibili homepage: another recreational video about fighting coronavirus! Hurriedly come in to LIKE. After viewing the video: The avatar is so familiar to me. Wait, is that [nickname of government account]???”

5.3.3. Limitations of the new strategies in practice

The content analysis also discovered limitations of the new strategies in current practice.

The Imbalanced Topic Distribution. Both collaborative and recreational videos had more than 75% videos under the topic about People’s Life and Response, and most of them eulogized the effort and sacrifice of people (especially the medical staff) to overcome the COVID-19 pandemic. Though these videos succeeded in building cohesion and confidence, some viewers questioned the effectiveness of these videos. For example, a video comment complained that, “I think that this video piled up music and hope, which is seemingly full of positive energy but does little help to the real problem...I expect something more useful, such as the record of the people in and out of the hospital, the protective measures around the hospital, or advocating some feasible prevention suggestions.”

The Dilemma in Choosing Appropriate Recreational forms. Danmaku and comments of part of recreational videos, especially those delivering serious themes, reflected the disastrous consequences of using an unsuitable recreational form to engage youths. It would lead to criticism and complaint on the failure of communicating crisis information, and over-deliberately using recreational videos to attract youths may cause antipathy. A typical example of dissenting voices noted that “I don’t understand why the government account makes such meaningless efforts. First, this song is initially for a game. Let alone anything else, is it appropriate to use this song to support the fighting-virus war in Wuhan?...I asked one of my friends to watch this music video, and she thought it did not

have the power to inspire people ... I also sent this video to a chat group, most of them failed to get the sense of this video.”

6. Discussion

This paper developed and tested hypotheses on influencing factors of youth engagement in government-generated crisis videos based on EE and CG, systematically investigating how video content, recreational video category and government-citizen collaboration would influence youth engagement during a crisis. Further, through in-depth content analysis on user commentary in recreational and collaborative videos, this work revealed the values and limitations of adopting recreational and collaborative videos in engaging youths. Overall, this paper contributes to a growing body of research on youth engagement and crisis communication. In this section, we first position our findings within previous research and discuss how the findings theoretically enrich EE and CG, and provide practical implications to effectively engage youths during time of crises.

6.1. Situating within existing research on youth engagement and crisis communication

In this section, we situate our findings within existing research on youth engagement and crisis communication, and discuss three overarching aspects that researchers and practitioners should be mindful of when communicating crisis information to youths through videos.

6.1.1. Theoretical implications to EE: how entertainment videos effectively engage youths under crisis

EE suggests purposefully embedding educational and social issues through entertainment program (H. Wang & Singhal, 2009). In this study, we found that though the emerging recreational videos did not account for a high proportion in volume compared to talks and records, they successfully promoted youth engagement across different engaging dimensions. Such positive effects were particularly salient in attracting more positive feedback of youths, which indicated youths’ praise and support when noticing recreational videos made by government accounts. This finding proves the effectiveness of engaging youths through recreational videos under the context of crisis, which is consistent with the successful practice of EE in other areas such as health education (Martzoukou, 2020; Pate et al., 2020; Shigehatake et al., 2014).

More notably, previous work suggested that entertainment videos like animation would help youths build a deeper understanding of the conveyed concept in the video (Shigehatake et al., 2014). Through

analyzing users' comments and danmaku, this work further revealed the suitability of recreational videos in making specific knowledge more comprehensible and thus effectively educating viewers, e.g., using elements in popular games as an analogy of COVID-19 virus dissemination. Besides, we also showed that the enjoyment of the recreational video contrasted with the stereotype of government seriousness, shortening the distance between government agencies and youths and leading to better youths' feedback, which is crucial in trust work for youth participation (Corbett & Le Dantec, 2018). Nonetheless, we discovered the limitation that the recreational videos were not always applicable to all types of crisis videos. Delivering serious themes through recreational videos might be self-defeating and cause viewers' antipathy.

In conclusion, this work enriches EE by not only showing its practical evidence in effectively engaging youths in crisis settings, but also unearthing the hidden reasons of EE's attractiveness to youths. To this end, this work sheds light on the unique values in strategically leveraging recreational videos to disseminate crisis information and enhance youth's crisis awareness.

6.1.2. Theoretical implications to CG: online crisis management through collaborative video generation

This work illustrated that collaboration with civil video uploaders would greatly promote youth engagement, including increasing danmaku number by 73% and coins number by 79%. Through qualitative content analysis on users feedback, we revealed that the engagement promotion could be attributed to: (1) successfully addressing the information gap and disseminating information in a "down-to-earth" way, which validates the dominant advantage of CG (O'Flynn & Wanna, 2008) in the new context; (2) shortening the relationship distance and establishing youths' trust through collaborating with civic uploaders, some of whom are popular among youths; (3) enhancing video quality with civic video makers' professional skills.

Most previous work on crisis management based on CG focused on offline settings, such as citizen-assisted mask supply and distribution (I. Y.-F. Huang, 2020). Recently, online government-citizen collaboration for crisis management has also gained researchers' attention, such as dialogic loop between government and public (Q. Chen et al., 2020) and collective information spread (Panagiotopoulos et al., 2014). This work contributes to CG from the perspective of understanding government-citizen collaborative content generation, which is a core element in crisis communication. Though we explored the collaborative content generation in the form of videos, it has the potential to generalize to other media, such as collaboratively generating understandable crisis response guidelines with civic experts in text-based platforms (e.g., Twitter and Weibo). Future work shall critically think about and evaluate the broad applications of CG in online settings to promote effective crisis management.

6.1.3. Users' needs during a public health crisis: video Content's influence on youth engagement

The Uses and Gratifications Theory suggests that individuals deliberately choose media that will satisfy given needs (Katz et al., 1973; Menon & Meghana, 2021). During crises, cognitive and affective needs (seeking crisis information and emotional support) are two core motivations that drive netizens to use social media (Qu, Huang, Zhang, & Zhang, 2011; Qu, Wu, & Wang, 2009). This work contributes to understanding youths' needs during a public health crisis by investigating how they were engaged in videos with different content topics and emotion valence.

This work revealed that youth users provided more positive feedback on videos about Government's Handling of the Crisis and People's Life and Response, but paid less attention to COVID-19 Situation in China and Worldwide. This result partially validates the previous finding that government disposal information was one of the most needed information topics for Chinese social media users during crises (Xie et al., 2017). Also, it is interesting to note that though not attracting more feedback

and interaction, videos focusing on Knowledge Popularization and Guidance were most shared among the five topics. Instead of delivering positive energy and building public confidence, such videos directly convey practical crisis-prevention information to the public, and thus are proved with unique values to stabilize public sentiments and strengthen individuals' awareness of prevention during a crisis (Han, Wang, Zhang, & Wang, 2020). To this end, this work uncovered that these videos were substantially valued by youths with the most sharing times, but could be further improved in attracting more citizens' reflection, discussion and acceptance. In addition, youths were more engaged in videos with positive emotions that provided emotional support, which corresponds to previous work such as (Trilling et al., 2017; Zavattaro et al., 2015).

Generally, this work detected a gap between "which information public regard important" (shared more, e.g., Knowledge Popularization and Guidance) and "which information public feel attracted" (discussed and voted more, e.g., People's Life and Response) on government-generated crisis videos. Future researchers should particularly focus on how to promote the attractiveness of "needed yet less attractive" videos during crises and broaden their dissemination.

6.2. Practical implications for effective and engaging crisis communication

Based on the findings, we proposed three practical implications in engaging youths and better communicating crisis information through online crisis videos.

First, the findings indicated that intentionally adopting recreational videos to engage youths would be a promising crisis communication strategy. Nevertheless, as revealed in practical limitations, choosing appropriate recreational forms to convey specific crisis information was still a challenging task. Therefore, we suggest that government take advantage of the characters of different video categories, e.g., using talks to disseminate authority crisis information and utilizing recreational videos to reduce public anxiety, build public confidence and vividly popularize knowledge during a crisis. Also, actively learning the video category preference of youths from user-generated commentary would be helpful to develop an effective and engaging crisis communication strategy.

Second, government accounts should consider strategically collaborating with civic uploaders to address the information gap and better generate engaging crisis information. It is suggested to carefully selecting suitable collaborators for content co-generation, so as to leverage the influence of civic collaborators as well as generate high-quality video content, in which way crisis information dissemination could be maximized. Pre-generation communication, on-generation coordination, and post-generation checking are necessary duties that government should bear to avoid generating misinformation and disinformation, the dissemination of which would cause catastrophic consequences (H. O.-Y. Li et al., 2020).

Finally, government agencies should pay more attention to promote the dissemination of the videos about Knowledge Popularization and Guidance, which were highly valued and most shared, but less discussed and voted. As perceived from users' danmaku and comments, there was an imbalanced topic distribution of the two new strategies, with few collaborative and recreational videos adopted for the topic Knowledge Popularization and Guidance. On this note, government agencies should take the advantage of the successful practices of EE and CG to enhance knowledge and guidance popularization, such as using vivid animation to clarify situational knowledge and collaborating with popular science popularization uploaders.

6.3. Limitations and future work

First, though the majority of users on the investigated platform Bilibili are youths (more than 75% under 24 years old), there are also

about 9% of users older than 30,² the influence of which may not be neglected. A carefully designed user study recruiting volunteers across different demographics might be helpful to generate more detailed results of how different influencing factors affect youth engagement. Also, it could help to explain whether the youth-engaging strategies (e.g., government-citizen collaboration) could be generalized to the communication to the general public.

Second, this work focused on promoting youth engagement in government-generated videos on only one Chinese video platform, [bilibili.com](http://www.bilibili.com), and the findings may not generalize to other countries or video platforms. Governments in different countries are taking differentiated strategies to engage youths due to the discrepancy of cultures, regimes and development levels. Besides, different video platforms adopt different designs (e.g., TikTok featured in short videos) and attract different target users, which would also influence governments' tactics of engaging youths. Consequently, cross-country and cross-platform studies might yield interesting findings.

Third, we only investigated how to engage youths based on video-related factors (content topic, emotion valence, video category and government-citizen collaboration), yet factors beyond videos remain unexplored. For instance, government accounts can initiate dialogic loop (Kent & Taylor, 1998; Y.; Wang & Yang, 2020) in video comments and danmaku to stimulate government-citizen communication. Also, forwarding videos to other platforms to leverage the influence of accounts on these platforms is a common strategy of government social media to promote citizen engagement. Future work shall identify the external factors, and explore the practices and challenges of the "beyond-content" promotion approaches.

7. Conclusion

Understanding how to promote youth engagement in government-generated videos is of great significance to design a better publicity strategy during time of crises. Through a mixed-methods approach incorporating quantitative regression analysis and qualitative content analysis, this work systematically investigated the influencing factors of different dimensions of youth engagement (interaction, feedback and sharing) in government-generated videos. Specifically, this work examined how video content (content topic and emotion valence) and new engaging strategies (recreational video category and government-citizen collaboration) influenced youth engagement in government-generated crisis videos on a youth-targeted video platform Bilibili. We found 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 were most frequently shared by youth users. Videos with positive emotion valence could better engage youths. Compared to traditional records and talks, the emerging recreational videos such as music and animation would significantly promote youth engagement across all engagement dimensions. Collaboration with civil video uploaders in video making also had a substantially positive impact on youths' interaction, feedback and sharing. Focusing on the two new engaging strategies, we revealed several values of them such as the enhanced video quality and the trust work for youth participation, as well as the limitations such as the imbalanced topic distribution. We discuss how this work theoretically enriched Entertainment Education and Collaborative Governance in the crisis communication settings, and how our findings may help to facilitate effective and engaging crisis communication to youths in practice.

Author statement

Changyang He: Conceptualization, Methodology, Software, Writing

– original draft. Huan Liu: Methodology, Software, Data curation. Lu He: Writing – review & editing, Methodology. Tun Lu: Writing – review & editing, Supervision. Bo Li: Writing – review & editing

Declaration of competing interest

None.

Acknowledgements

The research was support in part by RGC RIF grant R6021-20, RGC GRF grants under the contracts 16207818 and 16209120, and the National Natural Science Foundation of China (NSFC) under the grant No. 62172106.

References

- A Rahim, A. I., Ibrahim, M. I., A Salim, F. N., & Ariffin, M. A. I. (2019). Health information engagement factors in Malaysia: A content analysis of facebook use by the ministry of health in 2016 and 2017. *International Journal of Environmental Research and Public Health*, 16(4), 591.
- Abbott, A., Askelson, N., Scherer, A. M., & Afifi, R. A. (2020). Critical reflections on covid-19 communication efforts targeting adolescents and young adults. *Journal of Adolescent Health*, 67(2), 159–160.
- Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, 18(4), 543–571.
- Atac, O., Ozalp, Y., Kurnaz, R., Guler, O. M., Inamlik, M., & Hayran, O. (2020). *Youtube as an information source during the coronavirus disease (covid-19) pandemic*. medRxiv.
- Basch, C. E., Basch, C. H., Hillyer, G. C., & Jaime, C. (2020a). The role of youtube and the entertainment industry in saving lives by educating and mobilizing the public to adopt behaviors for community mitigation of covid-19: Successful sampling design study. *JMIR Public Health and Surveillance*, 6(2), Article e19145.
- Basch, C. H., Hillyer, G. C., Meleo-Erwin, Z. C., Jaime, C., Mohlman, J., & Basch, C. E. (2020b). Preventive behaviors conveyed on youtube to mitigate transmission of covid-19: Cross-sectional study. *JMIR public health and surveillance*, 6(2), Article e18807.
- Bhattacharya, S., Srinivasan, P., & Polgreen, P. (2017). Social media engagement analysis of us federal health agencies on facebook. *BMC Medical Informatics and Decision Making*, 17(1), 1–12.
- Bilibili. (2019). *Instructions for the use of joint contribution function*. <https://www.bilibili.com/read/cv3336929/>. (Accessed 25 September 2020).
- Bilibili. (2020a). *Bilibili inc. third quarter 2020 financial results*. <https://ir.bilibili.com/static-files/cebdf573-e356-46b4-b042-598862c1a505>. (Accessed 4 July 2020).
- Bilibili. (2020b). *Bilibili inc. third quarter 2020 oral financial report*. <https://finance.sina.com.cn/tech/2020-11-19/doc-iznezxs2619371.shtml>. (Accessed 4 July 2021).
- Bonsón, E., & Ratkai, M. (2013). A set of metrics to assess stakeholder engagement and social legitimacy on a corporate facebook page. *Online Information Review*, 37(5), 783–803.
- Cameron, A. C., & Trivedi, P. K. (2013). *Regression analysis of count data* (Vol. 53). Cambridge university press.
- Chatfield, A. T., & Reddick, C. G. (2018). All hands on deck to tweet# sandy: Networked governance of citizen coproduction in turbulent times. *Government Information Quarterly*, 35(2), 259–272.
- Cheng, C., Barceló, J., Hartnett, A. S., Kubinec, R., & Messerschmidt, L. (2020). Covid-19 government response event dataset (corononet v. 1.0). *Nature human behaviour*, 4(7), 756–768.
- Chen, T., & Guestrin, C. (2016). Xgboost: A scalable tree boosting system. In *Proceedings of the 22nd acm sigkdd international conference on knowledge discovery and data mining* (pp. 785–794).
- Chen, Q., Min, C., Zhang, W., Ma, X., & 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*, 23(2), Article e21463.
- Chen, Q., Min, C., Zhang, W., Wang, G., Ma, X., & Evans, R. (2020). Unpacking the black box: How to promote citizen engagement through government social media during the covid-19 crisis. *Computers in Human Behavior*, 106380.
- Coombs, W. T. (2007). *Crisis management and communications* (Vol. 4, p. 6). Institute for public relations, 5.
- Corbett, E., & Le Dantec, C. A. (2018). Going the distance: Trust work for citizen participation. In *Proceedings of the 2018 chi conference on human factors in computing systems* (pp. 1–13).
- Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications.
- Criado, J. I., & Guevara-Gómez, A. (2021). Public sector, open innovation, and collaborative governance in lockdown times. a research of Spanish cases during the covid-19 crisis. *Transforming Government: People, Process and Policy*. In press.
- Davies, S. L., Smith, T. L., Murphy, B., Crawford, M. S., Kaiser, K. A., & Clay, O. J. (2020). City health ii-using entertainment education and social media to reduce hiv among emerging adults: A protocol paper for the beat hive project. *Contemporary Clinical Trials*, 99, 106167.

² Bilibili in-depth report, http://pdf.dfcfw.com/pdf/H3_AP201807111165316350_1.pdf.

- Donahue, J. (2004). *On collaborative governance*. Corporate social responsibility initiative Working Paper, 2.
- Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track covid-19 in real time. *The Lancet Infectious Diseases*, 20(5), 533–534.
- Efuribe, C., Barre-Hemingsway, M., Vaghefi, E., & Suleiman, A. B. (2020). Coping with the covid-19 crisis: A call for youth engagement and the inclusion of young people in matters that affect their lives. *Journal of Adolescent Health*, 67(1), 16–17.
- Elbanna, A., Bunker, D., Levine, L., & Sleight, A. (2019). Emergency management in the changing world of social media: Framing the research agenda with the stakeholders through engaged scholarship. *International Journal of Information Management*, 47, 112–120.
- Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, 22(1), 1–29.
- Farnham, S., Keyes, D., Yuki, V., & Tugwell, C. (2012). Puget sound off: Fostering youth civic engagement through citizen journalism. In *Proceedings of the acm 2012 conference on computer supported cooperative work* (pp. 285–294).
- Filippova, K., & Hall, K. B. (2011). Improved video categorization from text metadata and user comments. In *Proceedings of the 34th international acm sigir conference on research and development in information retrieval* (pp. 835–842).
- Graham, M. W., Avery, E. J., & Park, S. (2015). The role of social media in local government crisis communications. *Public Relations Review*, 41(3), 386–394.
- Guo, J., Liu, N., Wu, Y., & Zhang, C. (2021). Why do citizens participate on government social media accounts during crises? A civic voluntarism perspective. *Information & Management*, 58(1), 103286.
- Han, X., Wang, J., Zhang, M., & Wang, X. (2020). Using social media to mine and analyze public opinion related to covid-19 in China. *International Journal of Environmental Research and Public Health*, 17(8), 2788.
- Huang, I. Y.-F. (2020). Fighting covid-19 through government initiatives and collaborative governance: The taiwan experience. *Public Administration Review*, 80(4), 665–670.
- Huang, C., Fu, T., & Chen, H. (2010). Text-based video content classification for online video-sharing sites. *Journal of the American Society for Information Science and Technology*, 61(5), 891–906.
- Irannejad Bisafar, F., Foucault Welles, B., D'Ignazio, C., & Parker, A. G. (2020a). Supporting youth activists? Strategic use of social media: A qualitative investigation of design opportunities. *Proceedings of the ACM on Human-Computer Interaction*, 4(CSCW2), 1–25.
- Irannejad Bisafar, F., Foucault Welles, B., & Parker, A. G. (2020b). A dramaturgical approach to online activism within youth empowerment organizations. *Proceedings of the ACM on Human-Computer Interaction*, 4(CSCW2), 1–22.
- Isnowfy. (2013). *Snownlp: Simplified Chinese text processing*. <https://github.com/isnowfy/snownlp>. (Accessed 25 December 2020).
- Kapucu, N. (2011). Collaborative governance in international disasters: Nargis cyclone in Myanmar and sichuan earthquake in China cases. *International Journal of Emergency Management*, 8(1), 1–25.
- Kapucu, N. (2015). Leadership and collaborative governance in managing emergencies and crises. In *Risk governance* (pp. 211–235). Springer.
- Katz, E., Blumler, J. G., & Gurevitch, M. (1973). Uses and gratifications research. *Public Opinion Quarterly*, 37(4), 509–523.
- Kent, M. L., & Taylor, M. (1998). Building dialogic relationships through the world wide web. *Public Relations Review*, 24(3), 321–334.
- Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C., et al. (2020). The effect of covid-19 on youth mental health. *Psychiatric Quarterly*, 1–12.
- Li, H. O.-Y., Bailey, A., Huynh, D., & Chan, J. (2020). Youtube as a source of information on covid-19: A pandemic of misinformation? *BMJ Global Health*, 5(5), Article e002604.
- Lim, K., Kilpatrick, C., Storr, J., & Seale, H. (2018). Exploring the use of entertainment-education youtube videos focused on infection prevention and control. *American Journal of Infection Control*, 46(11), 1218–1223.
- Li, G., Zhu, H., Lu, T., Ding, X., & Gu, N. (2015). Is it good to be like wikipedia? Exploring the trade-offs of introducing collaborative editing model to q&a sites. In *Proceedings of the 18th acm conference on computer supported cooperative work & social computing* (pp. 1080–1091).
- Ma, X., & Cao, N. (2017). Video-based evanescent, anonymous, asynchronous social interaction: Motivation and adaptation to medium. In *Proceedings of the 2017 acm conference on computer supported cooperative work and social computing* (pp. 770–782).
- Marchi, R., & Clark, L. S. (2021). Social media and connective journalism: The formation of counterpublics and youth civic participation. *Journalism*, 22(2), 285–302.
- Martoukou, K. (2020). “maddie is online”: An educational video cartoon series on digital literacy and resilience for children. *Journal of Research in Innovative Teaching & Learning*. In press.
- Menon, D., & Meghana, H. (2021). Unpacking the uses and gratifications of facebook: A study among college teachers in India. *Computers in Human Behavior Reports*, 3, 100066.
- Mikolov, T., Sutskever, I., Chen, K., Corrado, G., & Dean, J. (2013). *Distributed representations of words and phrases and their compositionality*. arXiv preprint arXiv: 1310.4546.
- Moon, H., & Lee, G. H. (2020). Evaluation of Korean-language covid-19-related medical information on youtube: Cross-sectional infodemiology study. *Journal of Medical Internet Research*, 22(8), Article e20775.
- O'Flynn, J., & Wanna, J. (2008). *Collaborative governance: A new era of public policy in Australia*. ANU Press.
- Ouyang, X. (2016). *Study on xiamen tourist environment image based on visitors' microblog data analysis (Unpublished doctoral dissertation)*. Ph. D. Dissertation. China: Xiamen University.
- Panagiotopoulos, P., Barnett, J., Bigdeli, A. Z., & Sams, S. (2016). Social media in emergency management: Twitter as a tool for communicating risks to the public. *Technological Forecasting and Social Change*, 111, 86–96.
- Panagiotopoulos, P., Bigdeli, A. Z., & Sams, S. (2014). Citizen–government collaboration on social media: The case of twitter in the 2011 riots in england. *Government Information Quarterly*, 31(3), 349–357.
- Pandey, A., Patni, N., Singh, M., Sood, A., & Singh, G. (2010). Youtube as a source of information on the h1n1 influenza pandemic. *American Journal of Preventive Medicine*, 38(3), e1–e3.
- Pan, P.-L., & Meng, J. (2016). Media frames across stages of health crisis: A crisis management approach to news coverage of flu pandemic. *Journal of Contingencies and Crisis Management*, 24(2), 95–106.
- Pate, J. W., Heathcote, L. C., Simons, L. E., Leake, H., & Moseley, G. L. (2020). Creating online animated videos to reach and engage youth: Lessons learned from pain science education and a call to action. *Paediatric and Neonatal Pain*, 2(4), 131–138.
- Pipek, V., Liu, S. B., & Kerne, A. (2014). Crisis informatics and collaboration: A brief introduction. *Computer Supported Cooperative Work*, 23(4–6), 339–345.
- Qu, Y., Huang, C., Zhang, P., & Zhang, J. (2011). Microblogging after a major disaster in China: A case study of the 2010 yushu earthquake. In *Proceedings of the acm 2011 conference on computer supported cooperative work* (pp. 25–34).
- Qu, Y., Wu, P. F., & Wang, X. (2009). Online community response to major disaster: A study of tianya forum in the 2008 sichuan earthquake. In *2009 42nd Hawaii international conference on system sciences* (pp. 1–11).
- Reddy, M. C., Paul, S. A., Abraham, J., McNeese, M., DeFlicht, C., & Yen, J. (2009). Challenges to effective crisis management: Using information and communication technologies to coordinate emergency medical services and emergency department teams. *International Journal of Medical Informatics*, 78(4), 259–269.
- Rosenthal, U., Hart, P., & Kouzmin, A. (1991). The bureau-politics of crisis management. *Public Administration*, 69(2), 211–233.
- Satoshi, H. (2008). *How information systems have been designed so far. Architecture of the Ecosystem*. BIGART.
- Seabold, S., & Perktold, J. (2010). Statsmodels: Econometric and statistical modeling with python. In *Proceedings of the 9th python in science conference* (Vol. 57, p. 61).
- Shigehatake, Y., Yokota, C., Amano, T., Tomii, Y., Inoue, Y., Hagihara, T., et al. (2014). Stroke education using an animated cartoon and a manga for junior high school students. *Journal of Stroke and Cerebrovascular Diseases*, 23(6), 1623–1627.
- Singhal, A., & Rogers, E. M. (2002). A theoretical agenda for entertainment—education. *Communication Theory*, 12(2), 117–135.
- Singhal, A., Rogers, E. M., & Brown, W. J. (1993). Harnessing the potential of entertainment-education telenovelas. *Gazette*, 51(1), 1–18.
- Stark, A., & Taylor, M. (2014). Citizen participation, community resilience and crisis-management policy. *Australian Journal of Political Science*, 49(2), 300–315.
- Stieglitz, S., Mirbabaie, M., Schwenner, L., Marx, J., Lehr, J., & Brünker, F. (2017). *Sensemaking and communication roles in social media crisis communication*.
- Sun, X. (2017). Research and prospect of collaborative governance theory. *Public Policy and Administration Research*, 7(7), 50–53.
- Tang, X., Li, S., Gu, N., & Tan, M. (2019). *Exploring repost features of police-generated microblogs through topic and sentiment analysis*. The Electronic Library.
- Tilton, J. (2010). *Dangerous or endangered?: Race and the politics of youth in urban America*. NYU Press.
- Trilling, D., Tolochko, P., & Burscher, B. (2017). From newsworthiness to shareworthiness: How to predict news sharing based on article characteristics. *Journalism & Mass Communication Quarterly*, 94(1), 38–60.
- Viera, A. J., & Garrett, J. M. (2005). Understanding interobserver agreement: The kappa statistic. *Family Medicine*, 37(5), 360–363.
- Walton, L. R., Seitz, H. H., & Ragsdale, K. (2012). Strategic use of youtube during a national public health crisis: The cdc's response to the 2009 h1n1 flu epidemic. *Case studies in strategic communication*, 1(3), 25–37.
- Wang, H., & Singhal, A. (2009). Entertainment-education through digital games. *Serious games: Mechanisms and effects*, 271–292.
- Wang, Y., & Yang, Y. (2020). Dialogic communication on social media: How organizations use twitter to build dialogic relationships with their publics. *Computers in Human Behavior*, 104, 106183.
- Wanna, J. (2008). *Collaborative government: Meanings, dimensions, drivers and outcomes. Collaborative governance: A new era of public policy in Australia* (pp. 3–12).
- Wu, Q., Sang, Y., Zhang, S., & Huang, Y. (2018). Danmaku vs. forum comments: Understanding user participation and knowledge sharing in online videos. In *Proceedings of the 2018 acm conference on supporting groupwork* (pp. 209–218).
- Xie, Y., Qiao, R., Shao, G., & Chen, H. (2017). Research on Chinese social media users' communication behaviors during public emergency events. *Telematics and Informatics*, 34(3), 740–754.
- Xu, W. W., & Zhang, C. (2018). Sentiment, richness, authority, and relevance model of information sharing during social crises—the case of # mh370 tweets. *Computers in Human Behavior*, 89, 199–206.
- Zavattaro, S. M., French, P. E., & Mohanty, S. D. (2015). A sentiment analysis of us local government tweets: The connection between tone and citizen involvement. *Government Information Quarterly*, 32(3), 333–341.