

A Crisis Management Perspective on Topic Evolution and Governance Analysis of Emergency Public Opinion: Postprint

Authors: Guo Yu, Zhang Chuanyang, Zhang Haitao, Wenqian Yu

Date: 2023-04-01T15:51:25+00:00

Abstract

[Purpose/Significance] This study incorporates crisis management elements to investigate the thematic evolution patterns of online public opinion on emergencies, providing new insights for the precise management of emergency network public opinion and dynamic decision-making. [Method/Process] Using factual text data from specific emergencies as the source, we employ the Latent Dirichlet Allocation (LDA) topic model to construct a dynamic topic evolution model, extract stage divisions and topics in social media emergencies, and induce the constituent elements of public opinion crises. [Results/Conclusion] Grounded in PPRR and 4R crisis management theories, we divide public opinion development into four stages: nascent, outbreak, fluctuation, and dissipation, and categorize work tasks into four capabilities: preparedness, response, reduction, and recovery. Finally, a network public opinion governance model is proposed.

Full Text

Preamble

Crisis Management Perspective on Topic Evolution and Governance of Public Opinion in Emergencies

Guo Yu^{1,2}, Zhang Chuanyang¹, Zhang Haitao^{1,2}, Yu Wenqian¹

¹School of Business and Management, Jilin University, Changchun 130022

²Information Resource Research Center, Jilin University, Changchun 130022

Abstract: [Purpose/Significance] This study introduces crisis management elements to investigate the thematic evolution patterns of online public opinion during emergencies, offering novel insights for precise disposal and dynamic decision-making in emergency network opinion management. [Method/Process] Using factual textual data from specific emergencies, we construct a dynamic topic evolution model employing the Latent Dirichlet Allocation (LDA) topic

model to mine stage divisions and topics in social media emergencies, and summarize the constituent elements of public opinion crises. [Result/Conclusion] Grounded in PPPR and 4R crisis management theories, we divide opinion development into four stages: nascent, outbreak, fluctuation, and quiet, while categorizing work tasks into four types: reduction, readiness, response, and resilience. Finally, we propose a network public opinion governance model.

Keywords: emergency; network public opinion governance; topic evolution; crisis management; Latent Dirichlet Allocation

Classification Number: G206

DOI: 10.13266/j.issn.0252-3116.2022.08.012

In recent years, the increasing severity of sudden natural disasters in China has caused tremendous damage to the economy and society [1]. Emergency response to such disasters has garnered attention from relevant authorities. The hazardous and sudden nature of emergencies, compounded by the unrestricted nature of social media [2-5], has greatly intensified the complexity and uncertainty of public opinion dissemination [6]. Online public opinion is characterized by high probability, short outbreak cycles, wide influence, and difficult control. If crisis information is not promptly controlled and guided, it can rapidly evolve into group emergencies involving both ideological and behavioral conflicts [7]. As China undergoes social transformation with growing interest appeals, emergencies occur frequently and public opinion crises emerge regularly. Research on emergencies and public opinion has become an integral component of the overall national security outlook and the “Safe China” strategy [8-9].

Extensive research has been conducted in the field of public opinion both domestically and internationally, primarily employing keyword mining and topic extraction methods to uncover public opinion themes and reveal their evolution patterns. Studies can be categorized into two main areas: First, research on crisis information dissemination mechanisms focuses on the transmission mechanisms before and after emergencies. W. T. Coombs proposed the Situational Crisis Communication Theory (SCCT) based on attribution theory [10]; B. F. Liu et al. developed the Social-Mediated Crisis Communication (SMCC) model, which has become a classic theory in natural disaster crisis communication [11]; C. Yates et al. found that public use of social media for information during natural disasters enhances community resilience [12]; Wang Xiwei et al. employed social network analysis to examine the dissemination paths and network structures of public opinion during the “Ya’an Earthquake” [13]; Li Gang et al. combined geotags and personal information descriptions, using situational awareness to conduct spatiotemporal comparisons of natural disaster hot topics on Weibo, clarifying user attention tendencies and patterns [14]. Second, research on public opinion evolution processes tends to focus on topic mining and pattern evolution. S. Gründer-Fahrer et al. explored the relationship between flood-related public opinion topics and time in Central Europe, analyzing thematic characteristics across different stages and demonstrating the role of topic research in emergency response [15]; B. Resch et al. used LDA (Latent Dirichlet

Allocation) to extract and analyze earthquake-related Twitter topics, identifying earthquake footprints and revealing their spatiotemporal characteristics to enable real-time generation of implicit information and improve disaster management procedures [16]; Ding Shengchun et al. [17] and Wu Xiaolan et al. [18] used emergency Weibo text data to track topics and their evolution patterns among typical groups; Zhang Haitao et al. constructed a series of scenario models using knowledge element models, ontology models, and Petri nets [19], revealing the characteristics and states of emergency scenario elements through scenario graphs and the evolution patterns and logic of major emergencies through event graphs to reflect development trends [19-20].

In summary, existing research on public opinion and crisis information dissemination has concentrated on communication media, pathways, and control [21], with the focus of emergency public opinion topic research primarily on topic evolution and spatiotemporal distribution. Most studies have overlooked stage-specific differences in emergency public opinion, lacking topic extraction for different phases and rarely considering public opinion constituent elements from a crisis management perspective. Therefore, this study takes emergency network public opinion as its research object, grounded in PPPR and 4R crisis management theories, to mine topics in emergency network public opinion and explore their evolution patterns, ultimately proposing an emergency network public opinion governance model.

2 Related Theories

2.1 Lifecycle Theory

Lifecycle theory is widely applied in political, economic, environmental, technological, social, psychological, and management fields. Raymond Vernon proposed product lifecycle theory, suggesting that products, like human lives, experience cycles of formation, growth, maturity, and decline, with each stage possessing distinct characteristics that enable targeted management strategies [22]. Lifecycle theory is primarily applied in emergency management, which addresses emergencies including natural disasters, accidents, public health incidents, and social security events. These events follow certain patterns in their generation, development, and demise, with their evolutionary process broadly divisible into latent, outbreak, spread, and decline phases.

2.2 Public Opinion Crisis Management Theory

Public opinion crisis management, proposed by Robert Heath [23], posits that when public opinion following an event fails to receive proper guidance, false information and negative emotions gradually accumulate and erupt, ultimately triggering a public opinion crisis. Major crisis management theories include PPPR and 4R theories. The PPPR theory comprises a general management model consisting of four stages: prevention (crisis pre-prevention), preparation (crisis pre-preparation), response (crisis outbreak reaction), and recovery (post-

crisis restoration). The 4R crisis management theory includes four dimensions applied throughout the crisis evolution process: reduction, readiness, response, and resilience. Emergency network public opinion exhibits stage-specific differences, with information volume in the early outbreak stage far exceeding that in later stages. Based on public opinion crisis management theory, institutional and 预案 (plan) formulation and other pre-crisis work can prevent and mitigate damage [24], reduce losses and management costs, and enable rapid assistance and correct public opinion guidance during crisis outbreaks [25].

3 Research Design

3.1 Research Framework

Literature review reveals that all types of emergencies share characteristics of suddenness, hazard, and complexity, which can easily induce public opinion crises. Against the backdrop of rapidly developing online media, network public opinion governance has become a critical issue in emergency management. Governance should proceed through public opinion information collection based on emergencies, clarification of public opinion evolution stages, topic extraction, and finally, proposal of a topic evolution governance model. The research logic framework is shown in Figure 1 [Figure 1: see original paper].

3.2 Stage Division of Emergency Network Public Opinion

The academic community commonly divides emergency public opinion into stages to study its characteristics and governance. Crisis management expert Coombs believes that emergencies at every level have occurrence, development, and mitigation phases [26]; Yao Leye, based on the public opinion evolution lifecycle, mined the interactive relationships among constituent elements to depict the trajectory of public opinion evolution [27]. According to the characteristics and patterns of emergency network public opinion, and based on lifecycle theory and public opinion crisis management theory, we divide it into four stages: nascent, outbreak, fluctuation, and quiet.

The nascent stage is the initial phase of emergency network public opinion, where events are about to occur or are occurring but people have not yet responded. Information volume is low in this stage but shows a rapid growth trend. The outbreak stage refers to the short period when an event reaches its climax, during which people panic over massive destruction and public opinion information exhibits near-exponential growth. The fluctuation stage is characterized by fluctuating public opinion, where after the event ends, various information floods the network, people struggle to distinguish truth from falsehood, and react intensely to key event information, manifesting as sudden small increases or decreases in information volume. The quiet stage sees public opinion gradually returning to calm, with event attention declining and information volume decreasing, though small-scale public opinion rebounds may still occur.

3.3 Network Public Opinion Governance from a Crisis Management Perspective

Public opinion crisis management theory maps the four-stage crisis management model of PPPR theory—pre-crisis prevention, pre-crisis preparation, outbreak response, and post-crisis recovery—to the four dimensions of 4R theory: reduction, readiness, response, and resilience. Based on the unique stage-specific characteristics of emergency network public opinion, we analyze network public opinion from the perspective of public opinion crisis management theory. The pre-crisis prevention stage corresponds to the reduction dimension, summarizing previous crises to reduce damage and ensure complete quietude of past public opinion crises while preventing future ones by reducing unnecessary costs and resources. The pre-crisis preparation stage corresponds to the readiness dimension, focusing on strengthening public opinion crisis monitoring and early warning while making adequate preparations for crisis outbreaks. The crisis outbreak response stage corresponds to the response dimension, requiring acute and efficient emergency response capabilities to timely control and guide public opinion and prevent rebounds. The post-crisis recovery stage corresponds to the resilience dimension, emphasizing restoration to pre-crisis conditions, summarizing lessons learned, and guiding public opinion crises toward quietude.

4 Empirical Analysis

The Emergency Response Law of the People’s Republic of China defines emergencies as natural disasters, accidents, public health incidents, and social security events [28]. Among these, natural disasters cause severe social disruption, with chaos and disorder providing “ignition points” for public opinion, surfacing latent social contradictions and even spawning secondary public opinion disasters, severely testing the Party and government’s ability and efficiency in preventing and resolving major security risks [29]. Weibo is a social media platform based on user relationships that enables instant information sharing and interactive dissemination, with 573 million active users as of December 2021 [30], making it well-suited to reflect network conditions. We selected the highly commented topic #HenanRainstorm#, using Python to crawl data including: publisher ID, Weibo content, publication time, commenter ID, comment content, comment time, etc.

4.1 Stage Division of Network Public Opinion

We collected Weibo posts from July 18 to August 26, 2021, with actual comment data extending to October 7, 2021, obtaining 30,916 data entries. Data processing proceeded as follows: 1) Missing value cleaning to remove entries without content; 2) Standardization of data formats and characters, deletion of abnormal data with logical errors; 3) Removal of extensive emojis and symbols using stop word deletion; 4) Chinese word segmentation using the jieba database. This yielded 29,912 valid data entries, with the information dissemination volume trend shown in Figure 2 [Figure 2: see original paper].

As shown in Figure 2, public opinion information began appearing on July 18, with volume slightly increasing on July 19. When the rainstorm occurred on July 20, public opinion information dissemination rapidly increased, peaking on July 21 before quickly declining. From July 24 to August 8, public opinion information volume experienced a fluctuating decline, after which it gradually quieted. This result aligns with the stage division model proposed above. Accordingly, we divided the #HenanRainstorm# network public opinion into: nascent stage (July 18-19), outbreak stage (July 20-23), fluctuation stage (July 24-August 8), and quiet stage (August 9-26).

We selected Latent Dirichlet Allocation (LDA) to extract public opinion topics. As Figure 2 shows, the nascent and outbreak stages exhibit distinctly different characteristics from the fluctuation and quiet stages, with each stage potentially containing unique public opinion topics and characteristic words. Events have different features before and after outbreak. The nascent and outbreak stages share similar characteristics as they both occur during the event outbreak period, while the fluctuation and quiet stages share similarities as they both occur post-outbreak. Additionally, the vast information volume gap between the nascent/outbreak stages and fluctuation/quiet stages means that extracting topics from the entire dataset may prevent important topics and characteristic words in the latter stages from being reflected, obscuring their characteristics and failing to comprehensively capture public opinion evolution patterns. Therefore, we separately extracted topics and characteristic words for the nascent/outbreak stages and fluctuation/quiet stages to more comprehensively reflect public opinion evolution features.

4.2 Topic Analysis of Nascent and Outbreak Stages

Appropriate topic quantity is crucial for topic analysis. Perplexity is an important metric for measuring how well a probability distribution or model predicts samples. To determine appropriate topic quantities, we calculated perplexity for both topic extractions, with results shown in Figure 3 [Figure 3: see original paper].

As Figure 3 shows, the common low-perplexity interval for both extractions is 8-10. Since perplexity only measures model accuracy and does not necessarily represent optimal topic quantity, and to avoid missing important topics, we selected 10 topics. Regarding characteristic words per topic, reference to multiple studies reveals that quantity should be determined based on actual text extraction conditions, prioritizing comprehensive yet distinctive words. For instance, Ma Xiaoyue et al. [5] selected 15 characteristic words to reflect the “Changsheng Vaccine Incident,” while Li Gang et al. [14] selected 100 characteristic words for the “Hurricane Harvey Incident.” We determined characteristic word quantities through multiple trials, ultimately selecting 25 and 20 characteristic words per topic respectively.

Given that the outbreak stage features suddenness, massive information volume,

and rapid dissemination speed, with many contradictions and focal points concentrated in this phase, topic extraction for these two stages is paramount for public opinion governance. We therefore first extracted topics from the nascent and outbreak stage data, with results summarized in Table 1 .

Analysis reveals that: 1) The characteristic words “monitoring,” “early warning,” “personnel,” and “plan” correspond to the main content of the nascent stage, while “prevention and control,” “rumor refutation,” “interaction,” and “guidance” represent the main content of the outbreak stage, demonstrating the rationality and accuracy of content composition for these stages. 2) The four thematic words “plan,” “summary,” “feedback,” and “coordination” correspond to the reduction dimension in emergency network public opinion governance, aligning with the main content of the pre-crisis prevention stage; “personnel,” “monitoring,” “early warning,” and “joint prevention” correspond to the readiness dimension and pre-crisis preparation stage; “prevention and control,” “rumor refutation,” “interaction,” and “guidance” correspond to the response dimension and crisis outbreak reaction stage; while “openness” and “rescue” correspond to the resilience dimension and post-crisis recovery stage.

4.3 Topic Analysis of Fluctuation and Quiet Stages

Although information volume in the fluctuation and quiet stages is far smaller than in the nascent and outbreak stages, they may contain unique public opinion topics. We therefore extracted topics from these two stages, extracting 10 topics with 20 characteristic words each due to relatively thin information volume. Results are summarized in Table 2 .

The characteristic words “news,” “comment,” “message,” “verification,” “information,” “contact,” and “disaster situation” widely appearing in nearly all topics indicate that people in the fluctuation stage pay more attention to event-related information disclosure, hoping to obtain feedback for solving their problems. Additionally, frequent appearance of “materials,” “equipment,” “government,” and “state” in topics 1, 2, 3, 5, 6, 7, and 9 shows that government remains the main force in public opinion governance. While specific materials are not extensively mentioned, coordinated action and material allocation across departments remain important governance tasks.

The characteristic words “disaster relief,” “rescue teams,” “assistance,” and “flood fighting” still widely appear in topics 1, 2, 4, 5, 7, 9, and 10, indicating that post-outbreak assistance remains an important theme in emergency and public opinion governance. The word “epidemic” appearing in topics 3, 8, and 10 demonstrates that while addressing emergency network public opinion, attention must also be paid to other crises with major potential dangers such as infectious diseases, highlighting the importance of joint prevention and control. The appearance of “mental health” in topics 7 and 8 reflects the urgent need for psychological counseling among affected populations.

The characteristic words “impact” and “problem” appearing in topics 1, 2, 3,

5, 6, 8, and 10 show that emergencies cause significant impacts on all aspects of people's lives and production, generating various problems that become concentratedly exposed after the event and require systematic summarization. The words "work" and "life" in topics 1, 3, 6, 7, 8, and 10 express affected people's desire to return to normal life, making restoration of infrastructure, social order, and production in affected areas important post-event tasks. The widespread appearance of "personnel," "professional," "rescue teams," and "volunteers" in topics 1, 2, 4, 5, 6, 7, 9, and 10 suggests that personnel demand remains substantial long after the event. However, unlike during the outbreak, the frequency of "rescue teams" and "volunteers" decreases while "professional" increases, indicating that personnel needs gradually shift toward professionals.

In summary: 1) The four thematic words "coordination," "rescue," "feedback," and "joint prevention" align with the main content of the nascent stage, while "mental health," "restoration," "summary," and "openness" reflect the main content of the outbreak stage, demonstrating rationality and accuracy. 2) "Coordination," "feedback," and "summary" correspond to the reduction dimension and pre-crisis prevention stage; "personnel" and "joint prevention" represent the readiness dimension and pre-crisis preparation stage; while "openness," "rescue," "mental health," and "restoration" represent the resilience dimension and post-crisis recovery stage.

4.4 Topic Evolution Analysis Across Stages

Comparative analysis reveals three key patterns: First, in terms of information scale, both Weibo quantity and information dissemination volume in the nascent and outbreak stages far exceed those in the fluctuation and quiet stages. Second, in terms of time span, the nascent and outbreak stages are much shorter than the fluctuation and quiet stages. Third, in terms of information fluctuation, the nascent and outbreak stages experience extreme volatility with a brief process of sharp rise and rapid fall, while fluctuation amplitude in the latter stages is much smaller and gradually diminishes over time until public opinion quiets. This demonstrates that emergency network public opinion has strong suddenness, concentrated explosiveness, and post-outbreak spread. While the main contradictions in emergency public opinion governance concentrate in the short, violently changing nascent and outbreak stages, the longer, more gradual yet sensitively reactive fluctuation and quiet stages cannot be neglected, as any negative information about the event during this period may reignite gradually quieting public opinion, requiring equally careful disposal.

5 Emergency Network Public Opinion Governance

Topic extraction reveals that the pre-crisis prevention stage corresponds to four thematic words: "feedback," "coordination," "plan," and "summary"; the pre-crisis preparation stage corresponds to "monitoring," "early warning," "personnel," and "joint prevention"; the crisis outbreak response stage corresponds to "prevention and control," "rumor refutation," "interaction," and "guidance";

and the post-crisis recovery stage corresponds to “rescue,” “openness,” “mental health,” and “restoration.” We now integrate these extracted thematic elements into the network public opinion governance framework from a crisis management perspective. Adding thematic elements enables more intuitive and clear reflection of each stage’s characteristics and tasks, demonstrates the evolution patterns of public opinion topics, and facilitates more scientific and rational governance approaches. The integrated emergency network public opinion governance model is shown in Figure 4 [Figure 4: see original paper].

The pre-crisis prevention stage, also called the mitigation stage, corresponds to the reduction dimension and contains dual meanings: On one hand, it reduces crisis impact through comprehensive prevention strategies; on the other, during the prevention stage between crises, it reduces information feedback time and processes, eliminates poor resource management, builds comprehensive and sustainable crisis prevention mechanisms, and reduces unnecessary costs. First, statistics and planning should be conducted for emergencies and network public opinion, including event causes, victim situations, recovery progress, public opinion hotspots, and impacts. Second, coordinated content should be organized and transformed into comprehensive, intuitive visualizations for feedback to relevant departments and the public. Third, feedback information should be summarized for learning. Departments should extract valuable lessons from effective public opinion responses and reflect on deficiencies to improve governance capabilities. For the public, emphasis should be placed on interpreting event causes and sharing emergency measures to enhance public response capabilities. Finally, comprehensive and rigorous emergency response plans should be formulated to prevent similar events and reduce losses and negative impacts from emergency network public opinion.

The pre-crisis preparation stage, also called the readiness stage, corresponds to the readiness dimension and consists of monitoring and early warning systems and prevention preparation systems. The former must operate in real-time, monitoring every adverse change and signaling other departments to ensure rapid response at crisis onset, timely early warning, and activation of crisis response procedures. The latter mainly includes organization and training of public opinion response personnel and joint prevention and control of secondary disasters and other crises, enabling rapid assembly and deployment of various control personnel to quickly extinguish other crises and secondary disasters when public opinion crises erupt. This stage should emphasize personnel, monitoring, early warning, and joint prevention. Personnel include all response staff, both official and civilian rescue teams and volunteers, requiring strengthened organization and training to improve quality and emergency response capabilities. Monitoring includes real-time monitoring and recording of explicit and implicit threat factors in public opinion crises, along with historical information analysis to explore crisis outbreak patterns. Early warning focuses on precise prediction and timely alerts. Joint prevention requires vigilance against secondary disasters and other events accompanying emergencies (such as infectious diseases, typhoons) to eliminate secondary damage.

The crisis outbreak response stage corresponds to the response dimension, with response capabilities fully reflected in four aspects: prevention and control, rumor refutation, interaction, and guidance, handled in this order. First, during the outbreak stage, rapid response is required to identify content needing strict control, prevent misinformation and rumor spread, and curb negative emotion proliferation. Second, rumors should be quickly clarified through official channels releasing correct information promptly and truthfully to eliminate rumors while severely punishing rumor-mongers. Third, active information interaction should be achieved through field interviews, telephone interviews, and online comments to exchange information with departments, organizations, and the public, addressing concerns and grasping real needs. Finally, government and media should correctly guide public opinion, increase information transparency, release event-related information promptly and truthfully through various channels, properly guide public opinion, and clarify its direction.

The post-crisis recovery stage corresponds to the resilience dimension, prioritizing people's lives and property safety and social order, followed by restoration of damaged infrastructure and equipment, and finally restoration of normal production, life, and mental health of affected people. Specific measures include: quickly and accurately grasping public needs, fully assisting people in difficulty, disclosing event causes and full processes, planning infrastructure and normal life restoration, and dispatching professionals to address psychological trauma. This stage should emphasize rescue, openness, mental health, and restoration. During emergencies, large volumes of online rescue calls should be promptly captured and responded to, launching timely assistance to reduce negative emotion spread. Openness mainly refers to disclosure of event investigations and accountability, communicating important information such as event causes and processes to the public to calm public opinion. Mental health refers to potential psychological trauma among affected people, as Post-Traumatic Stress Disorder (PTSD) and depression are the most common mental illnesses after disasters [32]. Severe psychological trauma manifests in network public opinion, requiring close attention and professional counseling during recovery. Restoration involves planning and recovery of both physical facilities and normal work and life.

This study combines public opinion governance with crisis management theory, dividing emergency network public opinion into four stages, extracting topics for each stage, and revealing evolution patterns. Theoretically, by using LDA to extract topics from different public opinion stages and establishing an emergency network public opinion governance model combined with crisis management theory, we enrich management theoretical research. Practically, responding to national "Safe China" strategy demands for crisis management research, this study facilitates public expression, government-public interaction, improves administrative management and social governance capabilities, and provides a basis for managing emergency public opinion crises.

This study has limitations and areas for improvement. Using the "Henan 7.20

Flood Disaster” as a case study, the generalizability of conclusions requires further verification. Future research will apply the proposed topic identification and evolution analysis methods to other emergencies or consider the influence of user sentiment factors [33-34] on network public opinion development.

References

- [1] NAWEED A, BYER R. Joint cognitive systems: patterns in cognitive systems engineering[J]. *Ergonomics*, 2008, 51(5): 768-770.
- [2] Guo Yu, Wang Xiwei, Yang Mengqing, et al. Research on knowledge sharing models in online communities based on grounded theory[J]. *Information and Documentation Services*, 2018(4): 49-55.
- [3] Liu Yashu, Zhang Haitao, Xu Hailing, et al. Research on topic graphs of network public opinion emergencies based on multi-dimensional feature fusion[J]. *Journal of the China Society for Scientific and Technical Information*, 2019, 38(8): 798-806.
- [4] Guo Yu, Liu Wenqing, Sun Zhenxing, et al. Analysis of influencing factors of copyright protection in knowledge payment platforms from a user perspective[J]. *Information Science*, 2021, 39(10): 18-24.
- [5] Ma Xiaoyue, Xue Pengzhen, Chen Yijin, et al. Construction and trend analysis of social media crisis topic evolution models[J]. *Library and Information Service*, 2021, 65(13): 77-86.
- [6] Ma Zhekun, Tu Yan. Research on content monitoring of sudden topics in network public opinion based on knowledge graphs[J]. *Information Science*, 2019, 37(2): 33-39.
- [7] Yang Changchun, Wang Tianyun, Ye Shiren. Research on evaluation system of Weibo opinion leaders’ crisis management capabilities—Based on crisis lifecycle perspective[J]. *Information Science*, 2016, 34(6): 19-25.
- [8] Liu Yashu. Research on evolution mechanisms and coping strategies of major emergencies from multi-dimensional perspectives[D]. Changchun: Jilin University, 2021.
- [9] Li Beiwei, Fu Jinxin, Zhou Xin. Mechanism for coping with network public opinion crises from an ideological perspective[J]. *Information Studies: Theory & Application*, 2018, 41(5): 27-31, 49.
- [10] COOMBS W T. *Ongoing crisis communication: planning, managing, and responding*[M]. 3rd edition. Thousand Oaks: Sage, 2012.
- [11] LIU B F, JIN Y, AUSTIN L. The tendency to tell: understanding publics’ communicative responses to crisis information form and source[J]. *Journal of public relations research*, 2013, 25(1): 51-67.
- [12] YATES C, PARTRIDGE H. Citizens and social media in times of natural disaster: exploring information experience[J]. *Information research*, 2015, 20(1): 659-684.
- [13] Wang Xiwei, Wen Qing, Zhao Dan, et al. Research on dissemination paths and network structures of natural disaster public opinion in new media environment—Taking Sina Weibo “Ya’an Earthquake” topic as an example[J]. *Information Science*, 2018(2): 110-116.

- [14] Li Gang, Chen Sijing, Mao Jin, et al. Spatiotemporal comparative analysis of natural disaster hot topics on Weibo[J]. *Data Analysis and Knowledge Discovery*, 2019, 35(11): 01-15.
- [15] GRÜNDER-FAHRER S, SCHLAF A, WIEDEMANN G, et al. Topics and topical phases in German social media communication during a disaster[J]. *Natural language engineering*, 2018, 24(2): 221-264.
- [16] RESCH B, USLÄNDER F, HAVAS C. Combining machine-learning topic models and spatiotemporal analysis of social media data for disaster footprint and damage assessment[J]. *Cartography and geographic information science*, 2018, 45(4): 362-376.
- [17] Ding Shengchun, Wang Pengpeng, Gong Silan. Research on potential topic discovery in network public opinion based on community detection and keyword co-occurrence—Taking the Wei Zexi incident on Sina Weibo as an example[J]. *Information Science*, 2018, 36(7): 78-84.
- [18] Wu Xiaolan, Zhang Chengzhi. Research on user community discovery and community topic evolution based on emergency feature networks—Taking the H7N9 incident on Sina Weibo as an example[J]. *Information Theory and Practice*, 2017, 40(5): 94-98, 60.
- [19] Zhang Haitao, Li Jiawei, Liu Weili, et al. Research on construction of event graphs for major emergencies[J]. *Library and Information Service*, 2021, 65(18): 133-140.
- [20] Zhang Haitao, Liu Weili, Luan Yu, et al. Construction of scenario graphs for major emergencies[J]. *Journal of the China Society for Scientific and Technical Information*, 2021, 40(9): 924-933.
- [21] An Lu, Wu Lin. Analysis of emergency Weibo public opinion evolution integrating topic and sentiment features[J]. *Library and Information Service*, 2017, 61(15): 120-129.
- [22] RAYMOND V. International investment and international trade in the product cycle[J]. *The quarterly journal of economics*, 1966, 80(2): 190-196.
- [23] Heath. *Crisis management*[M]. Translated by Wang Cheng, Song Binghui, Jin Ying, et al. Beijing: China CITIC Press, 2001.
- [24] Wang Huiquan, Liu Lu, Xie Dongfang. Research on natural disaster emergency response from the perspective of PPPR theory—Taking Xinxiang flood disaster response as an example[J]. *Yangtze River*, 2018, 49(S2): 27-31, 34.
- [25] Li Quanli, Zhou Chao. Crisis emergency shortcomings and prevention and control capability enhancement of grassroots governments from the perspective of 4R crisis management theory—Taking COVID-19 response as an example[J]. *Theory Monthly*, 2020(9): 73-80.
- [26] Wang Jingru, Chen Zhen. Comparative study of text topic extraction based on latent Dirichlet distribution[J]. *Information Science*, 2018, 36(1): 102-107.
- [27] Yao Leye, Meng Qun. Evolution mechanism of major natural disaster public opinion: constituent elements, operational logic, and driving factors[J]. *Information and Documentation Services*, 2020, 41(5): 49-57.
- [28] *Emergency Response Law of the People's Republic of China*[J]. *Safety*,

2007(10): 60-65.

[29] Yao Leye, Meng Qun. Evolution mechanism of major natural disaster public opinion: constituent elements, operational logic, and driving factors[J]. Information and Documentation Services, 2020, 41(5): 49-57.

[30] Sina Finance. Weibo releases Q4 and full-year 2021 financial results[EB/OL]. [2022-03-03]. <http://finance.sina.com.cn/stock/usstock/c/2022-03-03/doc-imcwiwss3985845.shtml>.

[31] Central Meteorological Observatory. “In-Fa” typhoon approaches, typhoon rain and geological disaster warnings issued[EB/OL]. [2022-03-03]. http://www.cma.gov.cn/2011xwzx/2011xqxw/2011xzytq/202107/t20210725_{581615}.htm.

[32] Xu Xiangdong, Lü Shuyun, Zhang Li, et al. Related factors of post-traumatic stress disorder and depression among community residents after mass emergencies[J]. Chinese Mental Health Journal, 2014, 28(4): 241-247.

[33] Guo Yu, Wang Xiwei, Li Shimeng, et al. Research on social network user influence models based on sentiment analysis[J]. Journal of the China Society for Scientific and Technical Information, 2017, 36(11): 1139-1147.

[34] Yang Changzheng. Research on endogenous effects of emotional diffusion, information cascade, and public opinion deviation in cyberspace—Dynamic analysis based on panel data of emergencies from 2015-2020[J]. Journal of the China Society for Scientific and Technical Information, 2021, 40(5): 448-461.

Author Contributions

Guo Yu: Responsible for topic selection, research design, core framework design, and initial draft writing.

Zhang Chuanyang: Responsible for data acquisition, analysis, and initial draft writing.

Zhang Haitao: Responsible for research ideas, framework supplementation and refinement, and initial draft revision.

Yu Wenqian: Responsible for literature review and final version compilation and revision.

Analysis on the Topic Evolution and Governance of Public Opinion in Emergencies from the Perspective of Crisis Management

Guo Yu^{1,2}, Zhang Chuanyang¹, Zhang Haitao^{1,2}, Yu Wenqian¹

¹School of Business and Management, Jilin University, Changchun 130022

²Information Resource Research Center, Jilin University, Changchun 130022

Abstract: [Purpose/Significance] This paper introduces the elements of crisis management to study the theme evolution law of network public opinion of emergencies, so as to provide new ideas for accurate network public opinion disposal and dynamic decision-making of emergencies. [Method/Process] Taking the factual text data of specific emergencies as the source, using the implicit Dirichlet distribution theme model, this study constructs a dynamic theme evolution model, mines the stage division and topics in social media

emergencies, and summarizes the constituent elements of public opinion crisis. [Result/Conclusion] Based on PPPR and 4R crisis management theory, the development of public opinion is divided into just-unfolding stage, outbreak stage, fluctuation stage and quiet stage, and the work tasks are divided into four categories of readiness, responsiveness, reduction and resilience. Finally, the network public opinion governance model is proposed.

Keywords: emergency; network public opinion governance; theme evolution; crisis management; implicit Dirichlet distribution

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.