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The Impact of Epidemic Rumor Spread on Audience Cognition Under Algorithmic Recommendation: Postprint

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Date: 2023-07-23T00:00:00+00:00

Abstract

During the pandemic era, advancements in Internet communication technologies have provided a vehicle for algorithmic recommendation within China's big data landscape. On social media platforms, users' search and browsing behaviors for preferred content are algorithmically processed by big data systems, which subsequently deliver personalized recommendations. Through Pearson correlation analysis, perceptual analysis of rumor exposure frequency and information cascade effects demonstrates that individuals' frequency of exposure to rumors is significantly positively correlated with their perceived volume of rumor recommendations by the platform. This study examines COVID-19 rumors on social media platforms, grounded in information cascade theory and the primacy effect, employing audience survey methodology to analyze the impact of COVID-19 rumor dissemination on audiences, and finds that individuals' frequency of rumor exposure is significantly positively correlated with their perceived volume of rumor recommendations by the platform.

Full Text

The Impact of Epidemic Rumor Spread on Audience Cognition Under Algorithmic Recommendation

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Abstract

In the era of epidemics, the development of internet communication technologies has provided a medium for algorithmic recommendation within the context of

big data in modern China. On social media platforms, users can browse content by searching for topics of interest, after which big data algorithms record each audience member's preferences through computational analysis and recommend relevant content to them. Through Pearson correlation analysis, the perceptual analysis of rumor contact frequency and rumor information cascade effects reveals that people's frequency of rumor exposure is significantly positively correlated with the number of rumors they perceive as being recommended by the platform. This study takes COVID-19 rumors on social media platforms as its research object, employs information cascade theory and the primacy effect as theoretical frameworks, and utilizes audience survey methods to analyze the impact of COVID-19 rumor spread on social media platforms on audiences.

Keywords: epidemic rumors, rumor spread, primacy effect, algorithmic recommendation, information cascade

1 Introduction

In January 2020, the epidemic began to show multi-point distribution across China. Against this backdrop, social media began to display an endless stream of reports, and epidemic rumors spread widely for a time due to fear of the virus and the unknown. Structural changes in society during the pandemic have made rumor dissemination more frequent. Even now that the three-year-long epidemic era has ended, relevant "rumors" can still be heard. We have noticed that under precise recommendation mechanisms such as Douyin and Toutiao, rumors are accurately recommended through algorithmic systems and repeatedly appear before users, causing them to believe in related epidemic rumors. Moreover, when rumor-refuting messages are issued, users do not believe them to a great extent. We are curious about why this phenomenon occurs and what causes this particular pattern. Taking COVID-19 rumors on social media platforms as the research object and using information cascade theory and the primacy effect as theoretical foundations, this paper employs audience survey methods to analyze the impact of COVID-19 rumor spread on social media platforms on audiences.

2 Literature Review

2.1 Rumor Spreading

The phenomenon of rumor dissemination has attracted research from multiple disciplinary perspectives in the academic community. American psychologist Gordon W. Allport, through analysis of wartime rumors such as the "Pearl Harbor Rumors," pointed out in *The Psychology of Rumor* that rumor production is a "projection" behavior—the externalization of personal thoughts, desires, and so forth—and summarized the original rumor formula as "$R = I \times A$," where the importance of events (Important) and the ambiguity of events (Ambiguous) are the most critical influencing factors in rumor propagation, with a positive correlation between them [1]. Communication scholar Cross further studied this original rumor formula and proposed a new perspective: the lethality of rumors

= (importance of events × ambiguity of events) / critical ability of the public [2].

From this, we can conclude that the lethality of rumors generally derives from three aspects: first, the correlation between the event and the individual—if closely related, importance increases substantially. Second, insufficient accuracy of news leads to the public's understanding of objective facts remaining in a hazy state, increasing the ambiguity of the incident. Third, weak public judgment—if either the importance or ambiguity factor tends toward zero, rumors will not emerge. However, some scholars have studied the spread mode of "Live Journal" rumors on blogging platforms through mathematical modeling and analyzed the influencing factors of their dissemination [3].

Based on analysis of more than 4,000 rumors in WeChat Moments, Li Biao and Yu Guoming pointed out that the propagation path of online rumors conforms to a power-law distribution and adopts nested propagation—that is, circle-group transmission similar to traditional social interpersonal networks [4]. Huang Aiping conducted a more detailed study of China's online rumors regarding transmission laws in *A Preliminary Study on the Transmission Characteristics and Transmission Forms of Online Rumors*, and her research shows that the transmission mode of online rumors changes according to different times and scopes, with its overall pattern demonstrating a quadratic function trend of rising first and then falling [5]. However, although these studies have examined rumors, they have neglected the phenomenon of repeated rumor spread.

2.2 Primacy Effect

The theory of the primacy effect was first proposed by American psychologist Luchins in 1957, also known as the first effect, priority effect, or first impression effect [6]. Since its proposal, it has attracted great attention from scholars both domestically and internationally, yielding numerous research results. Foreign scholars such as Asch et al. supplemented the theory by studying the primacy effect in the field of social cognition, finding that the effect of first impressions is not only strong but also long-lasting.

In *The Primacy Effect and Brand Reconstruction*, domestic scholar Li Shasha combines the actual phenomenon of brand cognitive transformation in China with primacy effect theory, proposing that public opinion and other factors integrate from all aspects in attempts to reshape the audience's psychological image [7]. It is believed that in the primacy effect, this preconceived priority influence affects consumers' brand choices.

However, these studies did not examine the proliferation of epidemic rumors from the perspective of algorithmic recommendation, and therefore did not answer the question of why rumors would be repeatedly and accurately recommended to users, making them convinced, while users did not believe much when rumors were refuted.

3 Research Methods

This paper employs audience research methods and interviews to attempt to answer the above questions.

3.1.1 Hypothesis Development

Based on the aforementioned questions, the following hypotheses are proposed:

H1: The more people pay attention to COVID-19 rumors during the pandemic, the more relevant rumors are recommended in their information streams.

H2: The more people pay attention to COVID-19 rumors during the epidemic, the deeper their awareness of the rumors becomes.

H3: There is significant variability in the profundity of rumor perception among audiences with different education levels—the higher the education level, the lower the perception of rumors.

To test these hypotheses, this study employed an audience survey method, sampled the population, and produced a questionnaire.

3.1.2 Sampling Method

This hypothesis corresponds to the study of netizens. The data collection, collation, and analysis process of this survey was completed on April 4, 2023. The survey was primarily based on open-ended and closed questions, with main contents including: (1) Basic information confirmation, including age and gender; (2) The dimensionality reduction statement portion of the independent variable "rumor contact frequency"; and (3) The dimensionality reduction statement portion of the dependent variable "audience's cognitive attitude to the rumor." This questionnaire contained 9 questions, including 7 single-choice questions, 1 multiple-choice question, and 1 matrix multiple-choice question. It was distributed online through WeChat Moments, QQ Space, and Questionnaire Star.

3.2 Sample Characteristics

A total of 189 valid samples were collected in this survey. Through descriptive analysis, we found that internet users' exposure to rumors occurred mostly through information media, short video apps, and social media. The frequency of their rumor exposure was predominantly "occasionally" (47%), and their degree of concern about rumors was predominantly "more concerned" (47%). It is evident that respondents' exposure to rumors in this questionnaire survey was at a medium-to-high level.

3.3 Results of Structural Analysis

Through Pearson correlation analysis, the perceptual analysis of rumor contact frequency and rumor information cascade effect shows that people's contact fre-

quency with rumors is positively correlated with the number of rumors they perceive as being recommended by the platform ($R = 0.28$, $P < 0.05$), supporting research hypothesis H1. Similarly, analysis of three related statements regarding rumor contact frequency and rumor perception found that people's contact frequency with rumors was significantly positively correlated with perception of stereotypes after rumor exposure ($R = 0.209$, $P < 0.05$), and rumor contact frequency was significantly positively correlated with perception of objective facts after rumor exposure ($R = 0.154$, $P < 0.05$). These results indicate that the more netizens came into contact with epidemic-related rumors, the more vulnerable their own ideas were to rumor influence. Hypothesis H2 is supported.

4 Discussion of Structural Analysis Results

4.1 Platform Recommendation Frequency and Audience Attention

Research hypothesis H1 is supported. The frequency of people's contact with rumors is significantly positively correlated with the number of rumors recommended by the platform ($R = 0.28$, $P < 0.05$). Audience attention to epidemic rumors and contact frequency are key factors affecting the number of rumors recommended by the platform, which directly influences the volume of rumor recommendations. According to H1, which is based on information cascade theory, the frequency of people's exposure to rumors is significantly positively correlated with the number of rumors they perceive as being recommended by the platform. People's attention to epidemic rumors has substantially increased the frequency of audience contact with epidemic rumors, thereby significantly affecting the number of relevant epidemic rumors recommended by the platform.

Rumor propagation is accomplished through information cascades and overlapping group polarization. Information cascades occur because people themselves lack relevant information, especially when they do not know the content of a rumor and are more inclined to believe what others trust. When the COVID-19 event broke out, audiences lacked relevant knowledge and experience. In this situation, audiences involuntarily sought to know the truth of the matter through communication with others or by searching for epidemic-related events online, thereby paying attention to COVID-19. Social media platforms then began recommending relevant videos to audiences. Specifically, the public's herd imitation behavior constitutes the social basis for creating information cascades [8]. Audiences are often confused and overwhelmed due to lack of relevant knowledge, so they engage in simple, labor-saving responses—that is, unconscious, conditioned reflexes that directly imitate the behavior of others around them. Everyone imitates each other, with group hints and group infections reflected in mutual imitation. People involuntarily participate in forwarding social media information under the hints and influence of herd psychology, thereby producing information cascades.

There are three key points in the formation of information cascades. First, peo-

ple's lack of knowledge or cognition regarding the content involved in rumors constitutes the premise for information cascade formation. Second, at the beginning of the spread, a certain number of people begin to believe a rumor, which is key to information cascade formation. Only when a certain number of people or enough individuals around them believe it will rumor attention increase and public or collective cognition form. Third is the technological means based on social media platforms [9]. With the assistance of social media platforms, rumor spread gradually expands on a large scale, and relevant videos begin to be recommended to audiences concerned about the epidemic. If the above three key points are met, then the information cascade of online rumors about COVID-19 can form.

4.2 Exposure Frequency and Stereotype Formation

Hypothesis H2 is supported. There is a significant positive correlation between people's exposure frequency and stereotype formation after rumor exposure ($R = 0.209$, $P < 0.05$). In the context of COVID-19, whether out of curiosity or self-preservation, people began constantly paying attention to various events about the epidemic on the internet. While some of these events were certainly true, the number of rumors was also uncountable. As the frequency of exposure to epidemic rumors increases, people's stereotypes are subtly altered. In the media environment, stereotypes can spread more rapidly and widely. Social media has a rapid information transmission speed. Whenever the media reports information with the potential to expose relevant audiences to stereotype threat, it quickly and widely affects the psychology of the relevant audience, which in turn has a stereotypical impact on them. According to this study's conclusions, people's exposure frequency to rumors is significantly positively correlated with stereotype formation after rumor exposure. The more attention paid to epidemic rumors, the more the number of relevant epidemic rumors recommended by the platform increases, and the frequency of contact increases relatively more. The higher the frequency of people's contact with epidemic rumors, the more likely it is to influence some stereotypes of the audience, thus supporting hypothesis H2.

At the same time, in the repeated reproduction of epidemic rumors on social platforms, audiences continue to contact and pay attention to epidemic rumors. They constantly emphasize issues influenced by stereotypes about the attributes of specific groups. In this context, audiences influenced by social platforms will also choose stereotypes for value judgment and value choice. The stereotypes generated by long-term exposure to rumors will cause audiences to deepen their negative perceptions of the rumors, thereby reinforcing the stereotypes. Through reinforcement, individuals' thinking patterns and behaviors are also influenced. Even if the audience's initial perception is neutral, when people are indoctrinated with the same information for a long time, they will subconsciously accept the views embedded in this information. When the audience accepts these views, the possibility of reversal through information becomes

smaller, thereby producing irreversible consequences [10]. People's frequency of exposure to epidemic rumors increases the probability of stereotyping by the audience to some extent.

On the other hand, during the epidemic, the audience's different attention to epidemic rumors also affects their perception of epidemic rumors. The frequency of exposure to rumors was positively correlated with changes in cognition of objective facts after rumor exposure ($R = 0.154$, $P < 0.05$).

5 Conclusion and Reflection

This study theorizes the spread of epidemic rumors under algorithmic recommendation through audience surveys and attempts to identify the impact of this phenomenon on audiences. Algorithmic recommendation technology is a recommendation mechanism that speculates on content that may interest target users and recommends desired information to them [11]. It is widely used in information transmission, advertising, news production, etc. This completely user-centered information dissemination method that links individual user needs with information has changed society's information structure. Communication subjects can accurately deliver information by profiling and analyzing users' usage behaviors (including reading duration, commenting, reposting, and other interactive behaviors) [12]. The study found that "H1: The more audiences pay attention to COVID-19 rumors during the epidemic, the more relevant rumors are recommended in their information streams" and "H2: The more audiences pay attention to COVID-19 rumors during the epidemic, the deeper their understanding of the rumors" are supported. However, "H3: There are significant differences in the depth of audience perception of rumors among audiences with different educational qualifications, and the higher the education level, the lower the awareness of rumors" is not supported.

This is mainly because perception of rumors is more reflected in the degree of attention to rumors and the frequency of exposure to rumors. In the collected questionnaires, it can be seen that because college students use media platforms more frequently and are exposed to epidemic rumors, their perception of objective facts changes accordingly. Conversely, some people less connected to the internet use media platforms less frequently, their exposure to epidemic rumors is less frequent, and their perception of objective facts does not change. Therefore, H3 is not supported; in the spread of epidemic rumors, academic qualifications are not a key factor affecting audience perception.

This study not only proposes the role of the primacy effect in rumor propagation in the epidemic era but also provides a medium for algorithmic recommendation in the context of big data in modern China. On social media platforms, users can browse content by searching for topics of interest, after which big data records the content that each audience member is interested in through calculations and recommends relevant content to users in the process. For example, in a pandemic era, users will search for how many new cases are added daily or

focus on what drugs can treat the emerging coronavirus. Through this search content, the media platform calculates that the user is interested in content related to the current epidemic event and will recommend relevant content to the user when they use the media platform in the future.

However, it is worth noting that this study also found that this phenomenon of algorithmic recommendation in the big data era brings the negative impact of information isolation. Under this algorithmic recommendation, users will pay more and more attention to content recommended by the media platform, continue to contact this content, and lose contact with other information. For example, in the COVID-19 epidemic, users search daily for what drugs can treat the new coronavirus, and the media continues to recommend relevant content. Users will pay more attention to and be convinced that these drugs can indeed treat the new coronavirus, ignoring the fact that experts such as Zhong Nanshan have stated that "there is currently no specific drug for the new coronavirus." Users will only see this small portion of content recommended by the platform and will not see more messages. American scholar Sunstein first used "Information Cocoons" to describe this phenomenon in his 2006 book *Information Utopia* [13], which is worthy of vigilance and reflection.

However, due to the timing of questionnaire collection, the number of valid questionnaires is not large, and this study remains insufficient. In future research, scholars in journalism and communication may need to pay more attention to the phenomenon of rumor dissemination's impact on audience cognition, as well as research and practice expanding on algorithmic recommendation and the primacy effect.

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