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Short Paper

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Abstract

Existing content analysis literature on the virality of social media posts focuses on emotion and topics. During a disaster, a lack of attention to other psychological features rather than emotion may result in unsatisfactory social media content analysis. By referring to Terror Management Theory and information avoidance against materialism, we conducted a logistic regression study using COVID-19-related data collected on Weibo. We identified the negative effect of personal concern-related words on social media posts' virality and the effect of specific concerns varies in different stages of a disaster. Theoretically, our study contributes to adding literature on social media content analysis about virality. On practical implications, we provide guidance on the wording of business advertisements and government announcements on social media during a life-threatening disaster.

Keywords: Virality, personal concern, COVID-19, content analysis, Weibo

Introduction

Disaster management is a hot topic in the 21st century. From human-caused fatal accidents to natural disasters or global long-lasting diseases like COVID-19, whenever a disaster happened, there will be discussions on social media. Owing to the immediacy of online social networks (OSNs), disaster information will inevitably spread on them and some information may even catch people's eyes on social media earlier than on official reports. Instead of only using instant messengers to keep in contact with each other, people also tend to use public social media like Twitter and Facebook to share the latest news and post their comments. There are many research studies conducted on OSNs like Twitter, where one of the popular research topics is virality (Berger and Milkman, 2012; Han et al. 2020). Virality on OSNs refers to the widespread of information. Advertising, notification, the release of new products, and many other activities can be realized through the virality of social network content, which is a convenient, fast, and efficient way to spread information.

In the recent literature, researchers identified different types of factors that affect the spreading of information on social media. Han et al. (2020) summarized the factors into creator characteristics and content characteristics. Creator characteristics include the user's personal information (such as the influential user or official account, the number of followers and friends, etc.; Suh et al. 2010; Susarla et al. 2012; Goes et al. 2014) and the user's historical information (such as the number of historical posts representing a person's social media preferences; Abbasi and Liu, 2013). Content characteristics include information extracted from the post content (such as emotions and topics; Berger and Milkman, 2012, Stieglitz and Dang-Xuan,2013; Chew and Eysenbach, 2010) and parameters of a post (such as length; Suh et al.2010). However, aside from emotional factors, there are other psychological factors reflected by text that may affect the spread of social media information. Therefore, the motivation of this work is to add descriptive and predictive constructs on social media virality indicators by discovering the effective personal concern textual features. We aim to provide insightful factors in the virality predicting model.

In this study, based on research about different stages of a disaster (Chew & Eysenbach, 2010; Ahmed et al. 2017; Chen et al. 2020) and the effect of personal concern factors during a disaster (Tausczik and Pennebaker, 2010), we propose the effect of personal concerns on social media post virality during disaster based on Terror Management Theory (Greenberg et al. 1986) and materialism under mortality salience (Jiang et al. 2021). Our preliminary results indicate that social media posts related to personal concerns are less likely to be reposted during a life-threatening disaster and the materialism-related personal concern is a major cause of this negative effect. Besides, in the same context, the degree of effect of specific types of personal concern content on virality is different in different disaster development stages.

For theoretical contribution, this research adds to the literature on psychological factors-related content analysis (Tausczik and Pennebaker; 2010; Chew and Eysenbach, 2010; Berger and Milkman, 2012, Stieglitz and Dang-Xuan,2013; Han et al.2020) on social media during a disaster by recognizing the effect on virality and its changes during different disaster stages. Our research will also shed light on the implication of wording in the social media advertisement and announcement about a life-threatening disaster, which will generate business value for companies and provide government guidance.

Related Literature

Social Media Information Diffusion

In the era of technology, information diffusion fills every aspect of our life. Three elements of information diffusion are sender, receiver, and medium (Zafarani et al. 2014). The types of information diffusion can be categorized into four types according to whether the network observability is explicit or implicit and the information availability is global or local. One type is herd behavior (Zafarani et al. 2014), which is the type of information diffusion for OSNs such as Weibo because the network is explicit (followers and friends are observable) and global information is available (posts are visible to all the users instead of only visible to followers). When a user's post is browsed, other users may have the same idea based on the information brought by the content without reaching a consensus in advance. And some users will repost the message, thus causing more users to see that content. In this case, users are senders and receivers while the posts are medium in information diffusion. The creator of social media content influences information diffusion. Research reveals that information diffusion on social media will be affected by the number of propagation users, the quality of propagation users, and the network relationship's structure (Chau and Xu 2012; Sun et al. 2019). Moreover, Yang et al. (2017) found that more retweets on Twitter exist among the spreaders rather than the original content creator using a data-driven approach. In addition, the rule and influence of information diffusion also appear in areas of research other than social media. For example, the dispersion of content in social networks and the betweenness centrality will have an impact on auction bidding behavior (Hinz and Spann, 2008).

Virality on Social Media

Han et al. (2020) define "virality" as the widely sharing behavior on social media. Besides investigating the interaction between content characteristics and creator characteristics for virality on social media, they also summarized the content and creator variables that were tested to influence virality. And they also classified

all variables related to social media content and creator into four categories—content features, content message, creator features, and creator history (Han et al. 2020).

How creator factors work on virality or information sharing have been investigated in the literature. By analyzing YouTube video diffusion data, Susarla et al. (2012) found the network position of the content creator has an impact on the success of a video. Besides, Adamopoulos et al. (2018) showed that user personality characteristics have an influence on information diffusion on social media. They found that users with a low emotional range tend to affect the same kind of users while the situation is opposite when the emotional range is high. Furthermore, the more popular a user is, the greater potential for the posts to be read by other users, and the more posts they are prone to produce on user-generated content platforms (Paulo et al. 2014).

For content factors, emotion is widely used in virality-related research (Chew and Eysenbach, 2010; Berger and Milkman, 2012; Stieglitz and Dang-Xuan, 2013; Han et al., 2020). For instance, the expression that arouses people's strong awe, anger, and anxiety emotions are more likely to spread than weak ones (Berger and Milkman, 2012). Besides, the effect of emotion on virality varies in a different context. For instance, emotional political communication posts are more likely to be reposted, positive tweets are more likely to go viral during Hurricane Harvey, and so on (Stielitz and Dang-Xuan,2012; Chen et al. 2020; Ahmed et al. 2017). Some other content factors related have an influence on social media posts virality are also discovered by researchers such as function words, topics and related event type (Rude, et al. 2004; Chew and Eysenbach, 2010; Son et al. 2013; Peslak et al, 2017; Han et al. 2020). During a disaster, the personal concerns of different groups will also vary. However, there is a lack of previous studies investigating the effect of other types of psychological factors other than emotion, such as personal concerns.

Hypotheses Development

Terror Management Theory (Greenberg et al. 1986) was brought to researcher's eyes by asking why it is so demanded for people to keep themselves feeling good. It refers to the rule that people always build up their worldview and self-esteem to overcome the fear of vulnerability and mortality (Greenberg et al. 1997). In the context of a life-threatening disaster like COVID-19, people suffer from mortality salience which may cause the consumption of their self-esteem (Greenberg et al. 1997). Therefore, people may be less likely to use their self-regulatory resources on their personal concerns. In this case, people will avoid sharing information related to personal concerns on social media.

Hypothesis 1. Social media posts with words of personal concerns are less likely to be reposted during a life-threatening disaster.

More specifically, studies show that people tend to be less concerned with materialism-related personal concern content, such as work and reward, when they are faced with physical or psychological health problems (Zhang and Wang, 2011). Jiang et al. (2021) hired 214 participants in an experiment to find out whether people are more materialistic or less in the context of the COVID-19 disaster. They were assigned to two groups that showed them a COVID-19-related disaster consequence video in the treatment group and a tourist video in the control group. This was followed by a survey testing their degree of materialism and perception of death. The results showed that people tend to be less materialistic, and this effect is mediated by mortality salience (Jiang et al. 2021). This reflects the information avoidance against materialism during a life-threatening disaster like COVID-19.

Also, people's psychological status changes during a life-threatening disaster. Most researchers divided a disaster into four stages. Chen et al. (2020) proposed the 4 stages according to the happen time: disaster-before, disaster-during, disaster-short-after, and disaster long-after. This classification method is suitable for temporary emergencies. For a long-lasting case, divided by the event life cycle, a crisis is composed of the buildup stage, breakout stage, abatement stage, and termination stage (Xu et al. 2020). Similarly, under the context of Hurricane Irma, the disaster development stages are prodromal, acute, chronic, and termination (Xu et al. 2019). When considering disaster management and reaction, the four stages are mitigation, preparedness, response, and recovery (Chou et al. 2020).

According to Pennebaker et al. (2015), the six categories of personal concern related words are work, leisure, home, money, religion, and death. We hold that the part of personal concern about materialism is the main factor causing its negative effect on vitality. Besides, in the acute stage of life-threatening disaster, people's

resistance to sharing materialism-related personal concern reaches its peak. In the termination stage, the negative effect of personal concern diminished.

Hypothesis 2. The effects on social media post virality vary in different types of personal concerns and during different stages of a life-threatening disaster.

Methodology

Weibo, a social media platform in China, has a large user group. According to official reports, Weibo had 229 million daily active users at the end of 2020[1], which is more than Twitter which had 192 million daily active users at the same time[2]. Sharing behavior on OSNs not only measures the number of readers of a post but also reflects the willingness-to-engage of users, and they further lead to the potential for a higher exposure, which is a critical performance measure for advertising and popularizing of policies (Heimbach and Hinz, 2018). The number of retweets is widely adopted as a dependent measure for research on virality on OSNs (e.g., Chen et al. 2020; Stieglitz and Dang-Xuan 2013). We adopt the binary measure of virality in Han et al. (2020) and use the repost to be our dependent variable in our model.

Data and Variables

We selected COVID-19 in China as the focus of our case study. The dataset in our study was collected by a web crawler. The crawled dataset contains both creator information and content information. The creator information includes the verified status, the number of users following and the number of followers, while the content information includes the post content, and the number of reposts. According to Figure 1, the number of existing COVID-19 cases reached the peak on February 16 and the new cases approached zero at the end of the selected period. Therefore, the selected period is the major development period of COVID-19 in China from January 20th, 2020 to March 29th, 2020. A total number of 36,374 Weibo posts related to COVID-19 were collected from this period.

The dependent variable is virality, which is measured by a binary variable based on the number of reposts. It is coded as 1 if the repost number is not zero, and 0 otherwise.

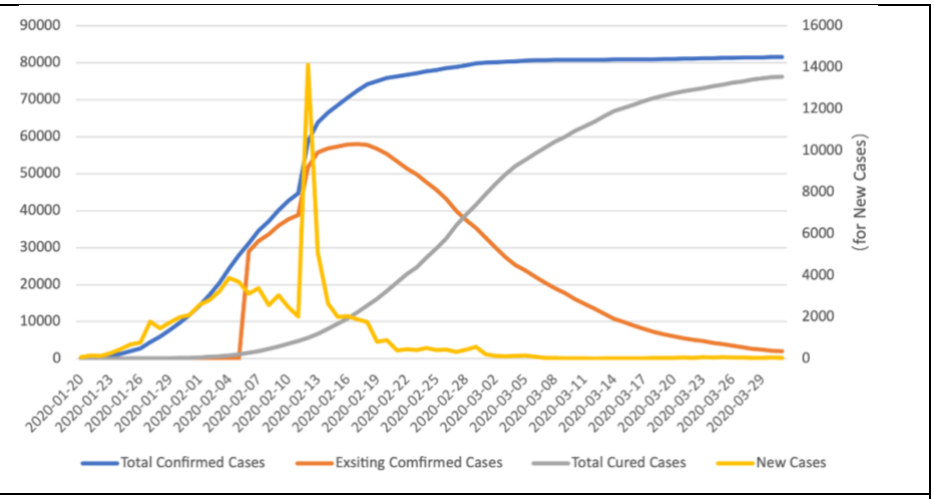

Figure 1. COVID-19 Cases in Mainland China[3]

[1] https://data.weibo.com

[2] https://www.oberlo.com/blog/twitter-statistics

[3] Collected from National Health Commission of the People's Republic of China (http://www.nhc.gov.cn).

The independent variable in this study is personal concern words percentage. We assume that the greater the proportion of personal concern-related words used in a post, the greater the degree to which it relates to personal concerns. Therefore, we applied the text analysis tool Jieba[4] to tokenize sentences and the Simplified Chinese Linguistic Inquiry and Word Count (SC-LIWC; Pennebaker et al. 2015) lexicon to generate the independent variables. To test Hypothesis 2, we also generate the percentage of the words for the six different personal concerns. Both creator factors and previously investigated content factors are controlled in the model. Creator-related control variables are verified status, the number of users following, the number of followers, and the total post count on Weibo. Content-related control variables are word count, function words, positive emotion, and negative emotion, of which the latter three are generated by the LIWC lexicon and measured by the percentage of words in the post.

Hypotheses Testing

We model the virality in a logistic regression framework to examine how the effect of personal concern works under the context of a life-threatening disaster. We first use the full dataset to test Hypothesis 1. To test Hypothesis 2, following previous literature (Chou et al. 2014; Xu et al, 2019; Xu et al. 2020), the full dataset is divided into datasets of four stages according to the cases development trend shown in Figure 1 and the corresponding events that happened.

Stage	Chou et al. (2014)	Xu et al. (2019)	Period	Event
1	Mitigation	Prodromal	1.20-1.30	On January 31, WHO has announced that the Coronavirus outbreak is listed as a public health emergency.
2	Preparedness	Acute	1.31-2.16	On February 16, the National Health Commission said that the epidemic prevention and control effect has been shown throughout the country.
3	Response	Chronic	2.17-3.12	On March 12, the National Health Commission announced that the peak of the epidemic has passed.
4	Recovery	Termination	3.13-3.28	On March 28, interregional traffic control lifted. Zero confirmed cases in major cities.

Table 1. Division of Disaster Stages

The specific divided periods, criteria and events based on which the divisions are made are shown in Table 1. The logistic regression model is also used to test the effect of personal concern in different stages of COVID-19 on the virality of social media posts. Furthermore, to further figure out the effective types of personal concern on virality, we also replace the independent variable with the six specific personal concerns and test the effect again.

Preliminary Results

Through the preliminary exploration of the Weibo data, 6.14% of personal concern words appeared in the posts on average in which work-related words are the most frequently referred to and count for 4.11%. The social media posts we used are under a specific context but not within a hot topic during a small period as the average repost number is 9.25. There are 21.78% of posts were reposted at least once. Table 2 is a combination report for the three groups of tests (tests of the effect of overall personal concern, the effect of the overall personal concern in different disaster stages, and the effect of specified personal concerns in different disaster stages on virality under the context of a life-threatening disaster).

[4] https://github.com/fxsjy/jieba

	Stage			
	1 (N=5126)	2 (N=11897)	3 (N=8954)	4 (N=10397)
DV: Virality				
Repost (binary)				
IV: Personal Concern	**-0.015*** **			
	-0.026* **	**-0.014*** **	**-0.012** **	**-0.007**
Work	-0.046***	-0.016**	-0.018***	-0.018***
Leisure	0.022	0.018	0.001	0.029*
Home	-0.016	0.006	0.024	0.024
Money	0.003	-0.039**	-0.009	0.005
Religion	-0.008	-0.010	-0.022	0.024
Death	-0.012	0.081	0.059	-0.009
Control Variables				
Creator Factor				
Verified Status	Yes	Yes	Yes	Yes
No. of Users Follows	No	No	No	No
Followers	Yes	Yes	Yes	Yes
No. of Posts	Yes	Yes	Yes	Yes
Content Factor				
Word Count	Yes	Yes	Yes	Yes
Function Words	No	No	No	No
Positive Emotion	No	No	No	No
Negative Emotion	No	Yes	Yes	Yes
*p < 0.1, ** p < 0.05, *** p < 0.01				

Table 2. Logistic Regression Results

According to the aforementioned studies, we controlled the verified reflective factors. The creator factors including the user level (verified official account, celebrities, or ordinary unverified users), the number of followers and friends, and the number of history posts are controlled. Content features such as text length, the use of function words, and emotion-related words percentage are also controlled. According to Table 2, when testing the effect of overall personal concern during the event is negatively significant with a coefficient of -0.015 that supports Hypothesis 1. However, when looking at the results for different stages, although the overall personal concern shows in content has a negative effect on its virality in the first three stages, the pattern disappears in the disaster termination stage.

When further investigating into the specific personal concern types, we find that work is always significantly negative, which means people are less likely to share information related to work under the context. This is in line with previous research that young people's majority personal concern is study or work-related as the main group of users of social media are young people (Ranta et al. 2020). And according to Terror Management Theory, people tend to avoid information that resists their willingness to build self-esteem in the context of disaster. Besides, in the acute stage, the content related to money also shows a negative effect on virality. The result is in line with Hypothesis 2. Words related to materialism are a major personal concern-related reason that drives people on social media away from sharing. Also, the extent of the effect of materialism-related personal concern content on virality varies in different stages by adding money as a

negative significant factor on virality at the acute stage. These results are consistent with previous literature and provide support for Hypothesis 1 and Hypothesis 2.

Future Work

Our preliminary results are in line with the literature on Terror Management Theory (Greenberg et al. 1997) and information avoidance against materialism (Jiang et al. 2021) during life-threatening disasters. There exist changes in the specific types of personal concerns. When the situation gets worse, i.e., from prodromal to acute stage, the negative effect of another kind of materialism-related personal concern, money, shows up. Noticeably, leisure shows a positive effect in the termination stage which is an interesting pattern that indicates people begin are more likely to share leisure-related social media content at the end of a life-threatening disaster. We expect to figure out the changes in the effect of specific types of personal concerns on virality in our future research. This research is of great business and managerial potential by helping advertisement and government official accounts evaluate their expression on social media and guiding them to achieve content virality.

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