



## Article

# Online Discourse in the Context of COVID-19, the First Health Crisis in China after the Advent of Mobile Social Media: A Content Analysis of China's Weibo and Baidu

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**Abstract:** The COVID-19 epidemic was the first universal health crisis since China entered the era of mobile social media. When Severe Acute Respiratory Syndrome (SARS) broke out in 2003, it was not until almost six years later that Weibo was born, marking China's entry into the era of mobile social media (Weixin 2020). In this context, this research analysed the role of the social media platform Weibo and the Internet search browser Baidu, in a government controlled online media environment, during the COVID-19 pandemic. In order to undertake this study, we applied the use of content and sentiment analysis to the discourse identified through the topics published during the investigation period, which encompassed 15 December 2019 until 15 March 2020. From the findings of this study, we concluded that, during the pre- and post-COVID-19 period, there was an important presence of social and lifestyle topic categories dominating the online discourse, which dramatically changed in correlation to the increasing spread of the disease. Additionally, there was a marked absence of topics in relation to economic and political information, and there was a notable absence of an official Government "voice" generating topics.

**Keywords:** social media; search engine; COVID-19; coronavirus disease; communication; Weibo; Baidu; China

## 1. Introduction

In today's dynamic era of communications, the Internet and its social media networks have become important tools, not only for creating social relations, but also in generating economic transactions through e-commerce. As of 2019, there will be more than 2.82 billion social media users in the world, which is expected to continue growing thanks to the increase of mobile phone ownership in developing nations, as well as the increase in global Internet penetration rates ([Hootsuite and We are Social 2020](#)). China has positioned itself as an important player in the social media environment through creating its own platforms, similar to those created by western nations.

The uptake of social media and Internet browsing in China has been explosive in recent years. From 2015 to 2019, the penetration of social media rose from 31% to 72% ([Hootsuite and We are Social 2020](#)). Social media channels have proliferated in China, and currently the average Chinese Internet user spends approximately 117 min daily, consuming and interacting on social media ([Hootsuite and We are Social 2020](#)). By 2023, estimates indicate that social media users in China will reach some

800 million (Statista 2020b). Within the vast array of platforms available on social media in China, two of the most important channels currently available include “WeChat” and “Weibo”.

WeChat, known as Weixin in China (Business Insider 2020), can be best described as a micro-messaging application with functions similar to other platforms, such as Facebook. The current rate of the popularity in China of WeChat is unsurpassed, and it currently holds the leading position, reaching 79% in terms of market share, as the most popular application to connect for social or business interactions and even e-commerce (Business of Apps 2020). WeChat has 1.08 billion active user accounts, and 40% of its users range from 26 to 35 years of age. On average, a user will spend 66 min a day using the application (Business of Apps 2020).

Weibo, has been described as the Chinese version of Twitter (Ren 2018). The average number of active users per month in China reached 430 million, of which the majority were above the age of 23 years old (Ren 2018). Weibo is defined as a microblogging site, which is defined as “instant messaging and content production” (Sprout Social 2020).

The rise in popularity of search engines in China has been significant, considering that, over the past decade, the number of search engine users in China doubled. In 2010, search engine users online registered 374 million, while in 2018, these reached 681 million users (Statista 2020a). Baidu is China’s leading search engine and currently has an 80% market share of the market for search engines available in the country (Analysys 2018).

The general objective of this research was to determine the trends that emerged from the topics searched on the Internet and published on social networks in China during the COVID-19 health crisis. The relevance of this research lies in the fact that we analysed the role of the social media platform Weibo and the Internet search browser Baidu in China’s online media environment, during the COVID-19 pandemic, which is the first universal health crisis since China entered the mobile social media age. The research sought to review the characteristics of the topics communicated and searched through social media platforms and search browsers in the context of a major public health crisis in China and, hence, to draw attention to the trends in the category of topics posted and searched during these particular periods. This analysis sought to generate a framework for characterising the category of topics posted in social media platforms and posted on web browsers that could be used in the future to effectively aid in defining communication strategies through such channels during a future public health situation in the Chinese context.

### *1.1. Usage of Internet and Social Networks in Chinese Society*

Baidu is the most popular Chinese search engine and is commonly used for “agenda setting” and “media framing”, as well as to identify citizens’ concerns based on the keywords of their searches and their intensity and repetition (Ouyang et al. 2017). The main objective of these types of analysis of citizens concerns are generally to reduce the spread of rumours and disinformation (Zeng et al. 2017).

Similarly, the Chinese social networks WeChat and Weibo have become a source of data to explore human behaviour in detail, despite the ambivalence of the use of some emoticons and words that contain positive and negative emotions, which makes it difficult to undertake an automated analysis of the content (Hu et al. 2016). Specifically, online users of Weibo were characterised as manifesting a keen interest in political issues, with a feeling of belonging to the community and a predominant civic attitude toward their need for information and relationships with other users (Wang and Shi 2018). From a psychological point of view, an excessive use of Weibo was associated with those with greater loneliness and lower social skills, which could partially explain the different behavioural expectations attributed to Weibo users compared to those of WeChat (Hou et al. 2018).

Weibo users appeared to no longer trust the messages transmitted by opinion leaders based on whether they have more followers or the tone of the message used, despite the fact that these are increasingly used in political and consumer campaigns to influence attitudes and behaviours (Luqiu et al. 2019). Even Chinese journalists showed political caution when writing on Weibo (Fu and Lee 2016) and, perhaps for this reason, it was common to see everyday users of the platform actively

initiate the reporting of corruption cases, although their leadership in terms of opinion is very limited (Nip and Fu 2016).

A high number of followers is an indicator of a collective opinion of greater confidence (Huang and Sun 2014), and Weibo reinforces this situation by showing the number of followers of each account and recommends for other users to begin following it, based on its popularity (Nguyen et al. 2012). This question is especially relevant on Weibo, where only 4.8% of users post more than 80% original content and the rest are limited to commenting or reposting (Fu and Chau 2013).

On Weibo it is possible to buy followers by acquiring fake accounts (Zhang and Lu 2016), so that the publications are automatically shown as a trending topic (Auer and Fu 2015), although other social networks are also not free from this black market of fake followers (Confessore et al. 2018).

### 1.2. Social Networks and Search Engines in the Face of Health Emergencies

Social networks and search engines have emerged as a relevant source of information for users in recent years (Chou et al. 2009), particularly in the face of health crises and other catastrophes. In these situations, they provide social support to patients by connecting them with medical information, other patients, and people in the social environment that foster behavioural and attitudinal changes in a positive way (Maher et al. 2014).

In China, numerous public emergencies have been alerted through social networks due to their dissemination capacity, such as the SARS crises in 2003, the Chinese Red Cross in 2011, the Hepatitis B vaccine scandal in 2013, and the Ebola crisis in 2014–15, during which the degree of disinformation was still very low in China, specifically in Weibo (Fung et al. 2016). Despite the fact that government control still served to inhibit conversations (Xie et al. 2016), either by blocking sensitive words and social media accounts or filtering emoticons (Cairns and Carlson 2016), research identified that social networks promoted more active participation of Chinese citizens (Romenti et al. 2014) as a consequence of the transformation of the Chinese government from censorship to oversight, and that now guided conversations rather than fully controlling them (Xie et al. 2016; Cheng 2020).

Despite this, during the SARS crisis, local officials concealed the actual number of infected people from the public until the government authorised it, which exemplifies the high levels of citizen distrust regarding official information (Hong 2007). This government control is precisely what could differentiate this research from others carried out in other markets, in which rumours, disinformation, and critical or even destructive opinions can amplify the emotions and the predominance of content generated, on the basis of official content transmitted during the crisis (Wigley and Fontenot 2010). All in all, social networks are the main channel of public participation in China, through which discontent about social and political challenges is shown by citing other sources, creating rumours, and satirizing the official discourse (Wu 2018).

In previous health crises, such as the H1N1 pandemic in 2009, social networks already demonstrated their capacity for emotional support (Liu and Kim 2011) and even encouraged the mobilisation of aid in natural disasters, such as the Haiti earthquake (Muralidharan et al. 2011), with a flow of information that the media cannot cover in real time (Shan et al. 2019), although an excess of exposure to the media in order to be informed about a health crisis can increase anxiety and stress (Garfin et al. 2020).

In the smog emergency in 2013, the comparison between Weibo content and Twitter content in the US reflected that Chinese users rarely used humour and were less likely to develop an increasingly affective connection with the emergency situation, as it started to be controlled and finally resolved (Lin et al. 2016). From a predictive point of view, Weibo has also been used to spatially group zones of infection, as happened in the dengue fever crisis (Ye et al. 2016).

Other studies on serious viral diseases, such as HIV/AIDS or drug treatments, identified that the searches in the Chinese language, on the main search engines in that country, provided few results, and between 25% and 40% of the results were unreliable in terms of the quality of the information (Niu et al. 2016; Zhu et al. 2018). When considering social networks, such as Twitter or its equivalent in China, Weibo, a high number of followers is a predictor of greater perceived credibility when reading

health-related content (Lee and Sundar 2013), and there are many people with HIV/AIDS who are seeking social support through Weibo (Han et al. 2018).

In the case of the health crisis of the coronavirus COVID-19, which started in December 2019 in China and was continued as SARS-CoV-2 and declared a pandemic on 11 March 2020 (Hua and Shaw 2020), Weibo has become a social network for information and help for people who had self-identified symptoms compatible with the coronavirus infection (Huang et al. 2020). Similarly, 70% of the messages published on Weibo were identified as negative in the field of communication and health, in the sense that they were identified as threats to people who displayed unhealthy behaviour and posed a danger to other citizens (Yu).

From a medical and psychological point of view, the public did not have a good understanding of the implications in the first phase of the SARS and MERS epidemics, an issue that improved in the case of COVID-19, despite the fact that the literature has not yet examined what caused the outbreak in terms of crisis management, hiding information, or mitigating public panic (Shangguan et al. 2020). Negative emotions, such as fear and stigmatisation of those infected by the virus, have been constant in these three health crises (Li et al. 2020a), and social networks and search engines have become relevant information sources that identify those issues of concern, as well as inform or entertain citizens in China, during the rise of COVID-19, one the most important worldwide pandemics that has occurred in recent decades.

## 2. Materials and Methods

The general objective of this research was to determine the trends that emerged from the topics searched on the Internet and published on social networks in China during the COVID-19 health crisis. It should be noted that in order to compare this period with one of relative “normality” or non-COVID-19 period (month of August, 2019), we have also undertaken an analysis of the topics posted on these social media platforms.

The specific objectives were to:

- identify and categorise the topics of greatest interest published in Baidu and Weibo,
- analyse the content derived from searches and posts in Baidu and Weibo,
- conduct a sentiment analysis based on the topics searched and posted in Baidu and Weibo,
- compare the topics identified during the COVID-19 period in comparison to a non-COVID-19 period.

Considering the overall objectives of the research, social networks make public concerns publicly visible (Papacharissi 2010) and act as an adequate source of information for investigators that want to know trends in relation to topics of interest from the content expressed in the publications and interactions of their users. Content analysis is a technique that serves to describe, in an objective and systematic way, the content of communication in all its forms (Berelson 1952). Content analysis is also useful for explaining behaviours and social discourse by identifying the concepts that are repeated (Strauss and Corbin 1990; Benavides-Delgado 2005) and more so in searches conducted online or in publications that show greater interaction, such as on social networks.

For the purposes of this investigation, we undertook, using the following social listening tools (Baidu Tophub Today App and for Weibo and YunHe Hot Topic Searching Mini Program), an analysis of the top 10 most popular topics that were searched and posted on Baidu and Weibo respectively on a weekly basis in China, from 15 December 2019 to 15 March 2020. This analysis was undertaken after the investigation period and the results were all tabulated on 23 March. Additionally, with the objective of facilitating the understanding, as topics where in Chinese and identifying key trends, the top 10 topics were subsequently classified into 6 different categories including Social, National News, International News, Economy, Chinese New Year (CNY) and COVID-19.

Initially the investigation also included WeChat, which, as previously described, is one of China’s leading social media platforms (Table 1); however, unfortunately WeChat does not disclose information

in regard to trending topics, and thus, we were not able to include it in this investigation. Hence, the other popular social media channel “Weibo” and the leading search engine “Baidu” form the core of the investigation in relation to understanding the general role of these platforms in China by way of identifying the main category of topics conveyed through them, during the COVID-19 outbreak. Furthermore, it should be noted that by using the tools available in this research and given the time analysis limitations imposed by these specific online applications, we have had to limit the monitoring of topics during a non-COVID-19 period to the online platform Weibo.

**Table 1.** Leading apps by monthly active user number in China as of March 2020 (in millions).

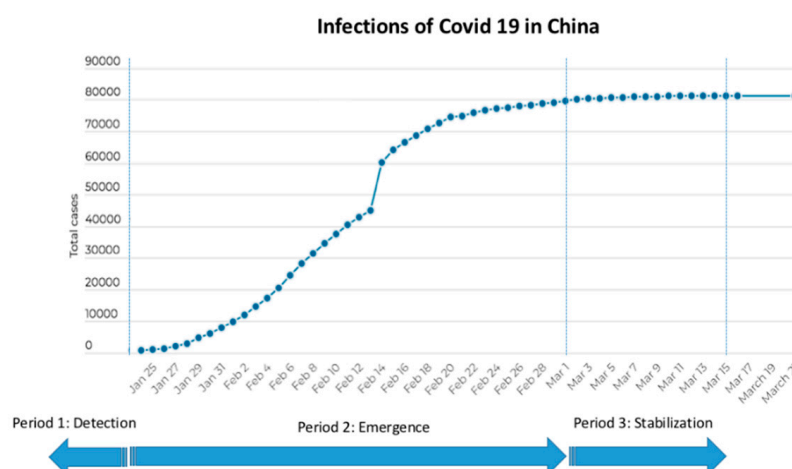
App	Monthly Active Users (Millions)
WeChat	983.18
Weibo	419.62
Baidu	373.28

Source: [Analysys \(2020\)](#) and elaborated by the authors.

Weibo has previously been used as a social network from which to extract the context and stories of major crises, through the use of content analysis and discourse analysis, derived from messages published by its users, which are public testimony that sometimes challenge the official stance of the Chinese Government, which imposes a strong regulation of online spaces ([Wu and Montgomery 2019](#)). Previous research identified that WeChat users seek social and affective satisfaction, while Weibo users prioritise information satisfaction and hedonic gratifications ([Gan 2018](#)), an issue that could be altered in the context of a prolonged health crisis, like the one analysed in this research.

It should be noted that we will make reference to the term topics, which for the purpose of this investigation refers to the subject matter posted or searched on Weibo and Baidu respectively and that has been classified into 6 different categories including Social, National News, International News, Economy, Chinese New Year (CNY) and COVID-19.

To facilitate the content analysis, we separated the investigation period into three phases, which broadly replicate the evolution of the confirmed cases of COVID-19 in China and that were taken from the World Health Organization ([World Health Organization 2020](#)) latest situation dashboard (Figure 1). The first period of detection represents a minor portion, given that in terms of the number of confirmed COVID-19 cases, at this early stage, it was relatively low and less than 500. Hence this period could be regarded as a “normal” period, before the onset of the major outbreak of cases.



**Figure 1.** The evolution of COVID-19 infections in China during the investigation period. Source: Based on the World Health Organization (WHO) statistics of COVID-19 infections (2020) and elaborated by the authors.



- Period 1: Detection of COVID-19 confirmed cases: 15 December to 5 January (500 or less cases confirmed).
- Period 2: Emergence and growth in COVID-19 confirmed cases: 6 January to 1 March (501–80,000 cases confirmed).
- Period 3: Stabilisation of COVID-19 confirmed cases: 2 March to 15 March (80,001–81,000 cases confirmed).
- Extra-period Non-COVID-19: August 2019 (0 cases confirmed).

In addition to the three COVID-19 periods, we have also incorporated a non-COVID-19 period, defined during the month of August 2019.

For the purpose of this analysis, we also separated and classified the topics into six different categories based on the relevant topic which predominates in the information analysed. In this context, six different topic categories have been defined, including:

- Social: Related to those topics that deal with social gossip and lifestyle facts and stories related to local Chinese celebrities and prominent leaders of opinion and politicians.
- National news: Includes those topics related to relevant information on social, cultural, political, and daily aspects of interest within China.
- International news: Includes those topics related to relevant information and activity on social, cultural, political, and daily aspects of interest originating from outside of China, on an international level.
- Economy: Related to topics in reference to the state of the economy in China.
- Chinese New Year (CNY): Relates to topics associated to the new year celebrations in China.
- COVID-19: Relates to topics associated to the coronavirus outbreak.

From a preliminary analysis undertaken by the authors of the top 10 topics and search subjects reviewed on both Weibo and Baidu on a weekly basis, during the period of investigation, it became apparent that classifying these into the broader categories outlined above would not only allow for a better description and understanding of these topics, but it would also facilitate the identification of trends during the period and aid in the subsequent content analysis undertaken. The language in which the search on Weibo and Baidu was undertaken was Chinese and later translated into English. We were able to access social listening tools, such as the Baidu: Tophub Today APP and the Weibo: Yun-He Hot Topic Searching Mini Program, to identify and classify the topics being posted during the period under investigation as well as and translate them from Chinese to English.

As part of the investigation, the authors also undertook a sentiment analysis of the topics posted and searched, during the period of study. The headlines analysed was classified into three categories including positive, neutral, and negative sentiments. Sentiment analysis was undertaken using the online tool MonkeyLearn. However, this did not prove reliable in terms of ascertaining the sentiment being expressed through the topics tested. In fact, there was only a 48% correlation between the identified sentiment using the MonkeyLearn APP and the recommended sentiment classification, which was directly undertaken by the authors using an expert peer review of the topics.

Additionally, the major events taking place in China and the world during the period of investigation (Table 2) were identified to improve the grouping of topics for the methodological definition of the investigation.

**Table 2.** Chronology of events during the COVID-19 pandemic in China.

<b>Period 1: Detection of COVID-19 Confirmed Cases: 15 December to 5 January (500 or Less Cases Confirmed)</b>
16 December 2019—The first documented admission to a hospital in the city of Wuhan China.
31 December 2019—Chinese authorities inform WHO's China office of pneumonia cases in Wuhan City, Hubei province, China, with unknown cause.
1 January—Officials close the Huanan seafood market, suspected to be the source of the mystery disease, as some of the patients presenting with the pneumonia-like illness were dealers or vendors at the market.
3 January—China reports a total of 44 suspected patients with the mystery disease.
<b>Period 2: Emergence and Growth in COVID-19 Confirmed Cases: 6 January to 1 March (501–80,000 Cases Confirmed)</b>
7 January—China identifies the new coronavirus as cause of the outbreak.
9 January—China reports the first death linked to the new coronavirus, COVID-19.
12 January—China shares the genetic sequence of the novel coronavirus, helping countries in testing and tracing any potentially infected people.
18–19 January—Chinese authorities report a spike in COVID-19 cases, including the first confirmed cases in Shenzhen (1 case) and Beijing (2 cases), bringing the total to 204 confirmed cases.
21 January—WHO confirms human-to-human transmission of the virus. The total number of cases is now 222, including infections among health-care workers. Chinese authorities have also reported a fourth death.
23 January—The city of Wuhan shuts down public transportation, closing the airport and railway stations.
30 January—WHO declares the COVID-19 outbreak a public health emergency of international concern.
1 February—In China, the confirmed cases now total 14,380 and the death toll rises above 300.
7 February—Li Wenliang, who tried to raise the alarm on COVID-19 in December, dies. His death causes further angry sentiments in China, where he has been hailed a hero, with some calling for “freedom of speech” in a country where communication is tightly controlled by the government.
1 March—China has 79,968 confirmed cases (579 new) 2873 deaths (35 new).
<b>Period 3: Stabilisation of COVID-19 Confirmed Cases: 2 March to 15 March (80,001–81,000 Cases Confirmed)</b>
3 March—China confirms 125 new cases, the lowest number of new cases since January, bringing the total number to 80,151. A total of 31 new deaths were also confirmed, bringing the total to 2943.
11 March—WHO declares the global COVID-19 outbreak a pandemic.
14 March—China reported 20 new cases, up from 11 cases a day earlier. 16 of the cases were overseas travelers. In response, the Beijing authorities announced that everyone arriving from overseas would be quarantined for 14 days.

Source: Elaborated by the authors using information taken from [Devex \(2020\)](#).

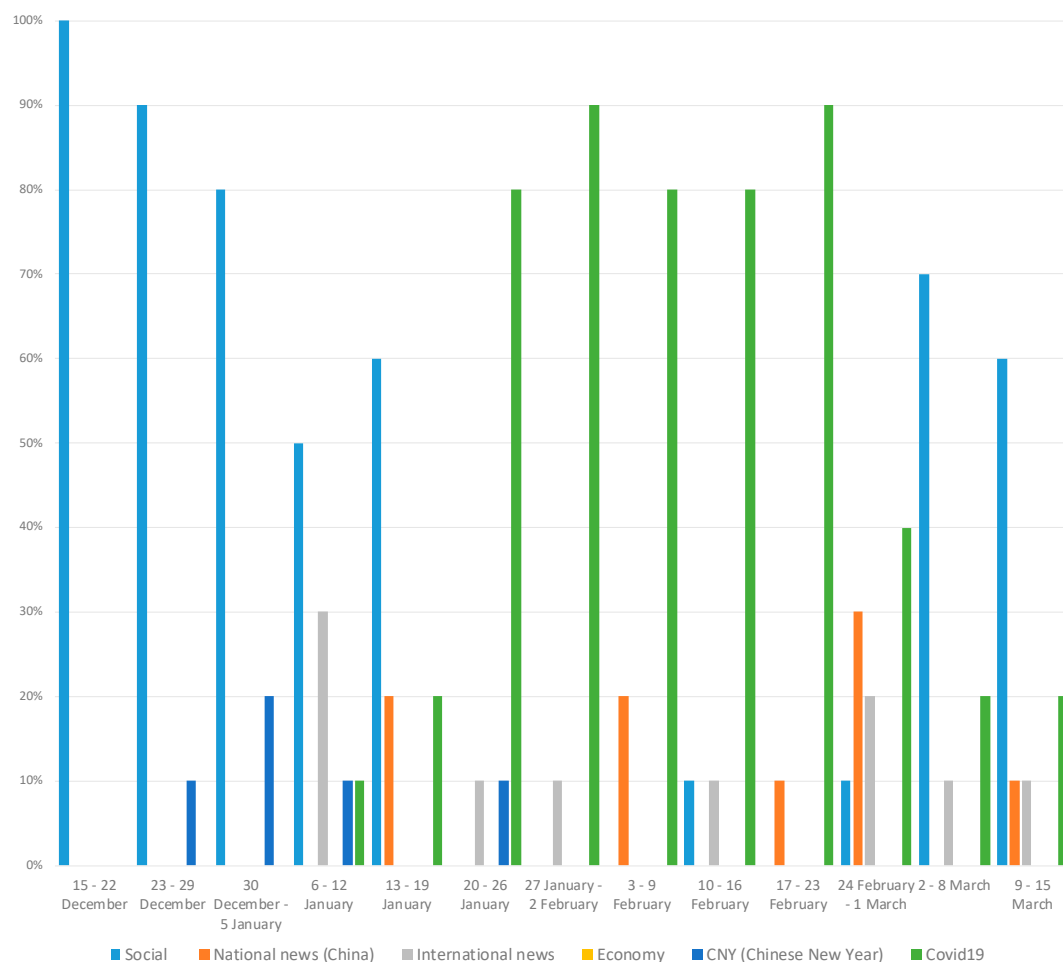
### 3. Results

#### 3.1. Weibo Content Analysis

During the first period of analysis (Figure 2), 90% of the topics posted on Weibo were dedicated to social news regarding the lives of leading films stars and local celebrities. One of the most frequently posted topics was the sudden death of a famous Chinese film actor, Gao Yixiang on the set of a TV series he was shooting. The resulting 10% of topics posted during this period were dedicated to Chinese New Year preparations, which would be celebrated on the 25th of January. At this early stage, there was no mention of COVID-19.

We found that 61% of the content posted on Weibo during the second period was dedicated to the COVID-19 outbreak and its consequences, whilst only 16% was in relation to social topics, and 20% was related to national and international topics. One of the most recurrent topics on international topics was the death of the National Basketball Association (NBA) player Kobe Bryant, after the 26th of January as well as the shooting down of a Ukrainian passenger plane. A total of 3% of the topics identified during this period on Weibo were in relation to Chinese New Year and, finally, there were no topics being posted related to the national economy.

During the third period of analysis, there was a complete reversal with regard to the topics being posted, with almost 65% being dedicated to social topics and only 20% dedicated to the COVID-19 virus. In fact, some of the topics related to the virus recounted the positive progress and gradual return of schools back to class in some areas in China. We found that 15% was dedicated to international and national news and once again there was no mention of the economic development of the country.



**Figure 2.** Topic categories on Weibo. Source: Created by the authors.

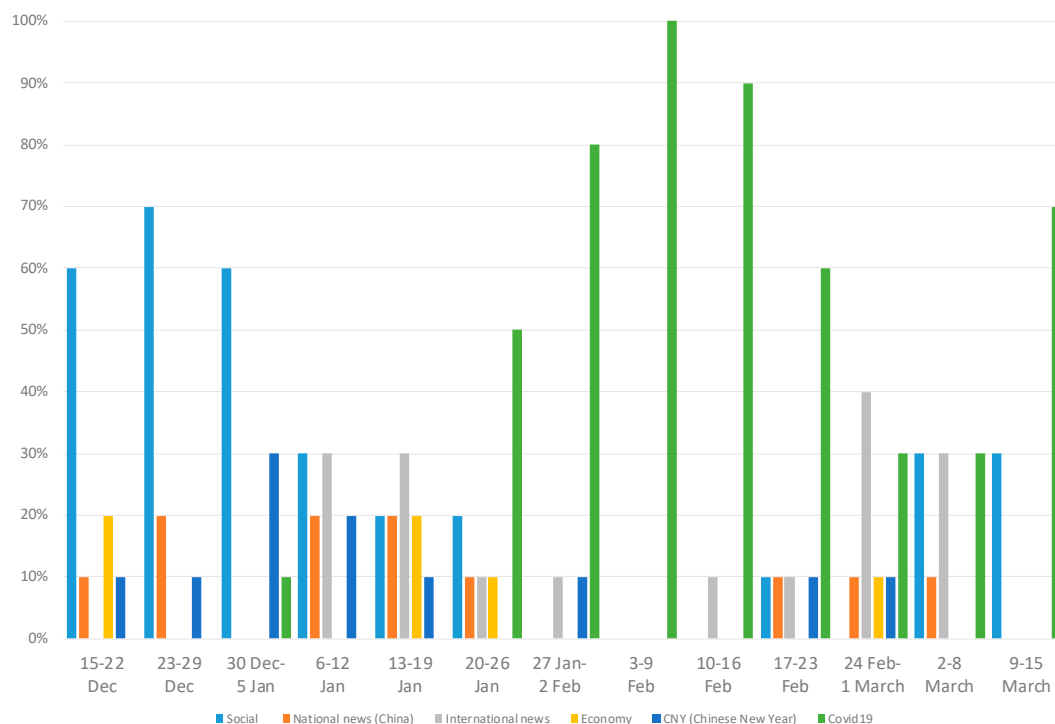
The channels demonstrated an important emphasis on social topics in reference to the lives of celebrities within Chinese society. Only during the most challenging times of the outbreak did the topics circulating on Weibo concentrate on COVID-19. During the third period of analysis, when the number of confirmed cases of COVID-19 began to subside, the rate at which social topics once again began to circulate on Weibo was much faster than on Baidu, reaching similar levels (65%) as when the outbreak occurred.

There was a notable absence of topics being shared on the platform in reference to the nation's economy and potential impact of the virus on jobs and livelihoods. It is unclear whether this is because of the country's strict censorship laws in reference to discussing "sensitive" issues on social media or just simply the fact that the channel and its target group and users did not consider this subject to be of importance for sharing their views and opinions through this particular social media platform.

### 3.2. Baidu Content Analysis

The most searched topics on the Chinese search engine Baidu (Figure 3) during the first period, were related to social news, with some 63% being dedicated to browsing this type of topics. In comparison to Weibo, the emphasis on searching these types of topics is lower, given that during the same period, 90% of topics were in reference to social news. Chinese New Year celebrations were searched 17% of the time on Baidu vs 10% on Weibo, and national news and information on the economy was also actively searched on Baidu, whilst on Weibo these two themes did not register during this first period of analysis.





**Figure 3.** Topic categories on Baidu. Source: Created by the authors.

During the second period, COVID-19 registered 51% of the searches on Baidu vs 61% of the postings on Weibo. International news was the second most important topic searched, registering 18%, with the most frequent news being that of the death of basketball player Kobe Bryant. Then there was a relatively similar search online via Baidu for social news (10%), national news (9%) and the Chinese New Year (8%). Additionally, topics on the economy were also recurrently searched (5%) during this second period of analysis.

The most searched topic using Baidu during the third period was still COVID-19 with 50% of the searches vs Weibo, which registered only 20%. News of a social nature took second place (30%), compared to Weibo, which achieved 65% popularity during the same period. Additionally, news from a national and international level registered 20% of searches on Baidu vs Weibo, which only registered 15%. Finally, for both Baidu and Weibo, there were no topics regarding the economy and the Chinese New Year celebrations during this period of analysis.

Through the analysis of content searched on Baidu we concluded that topics on social lifestyle were not as popular on Baidu as they were on Weibo. COVID-19 remained an important topic searched on Baidu during both Periods 2 and 3 of this analysis, whilst in comparison to Weibo, the relevance was less in Period 3. News, both at an international and national level, was consistently reviewed during all three periods of analysis on the Baidu search engine. The economy also appeared as a topic searched through Baidu, whilst on Weibo it was not a topic reviewed or discussed during all three periods of analysis.

### 3.3. Sentiment Analysis

From the analysis undertaken for the sentiment analysis in the top 10 topics identified on Weibo and Baidu (Table 3), during the period of investigation, we concluded the following:

- There was a higher occurrence of topics with negative sentiment related to COVID-19 published on both Baidu and Weibo when compared with social topics published during the same period on both platforms.

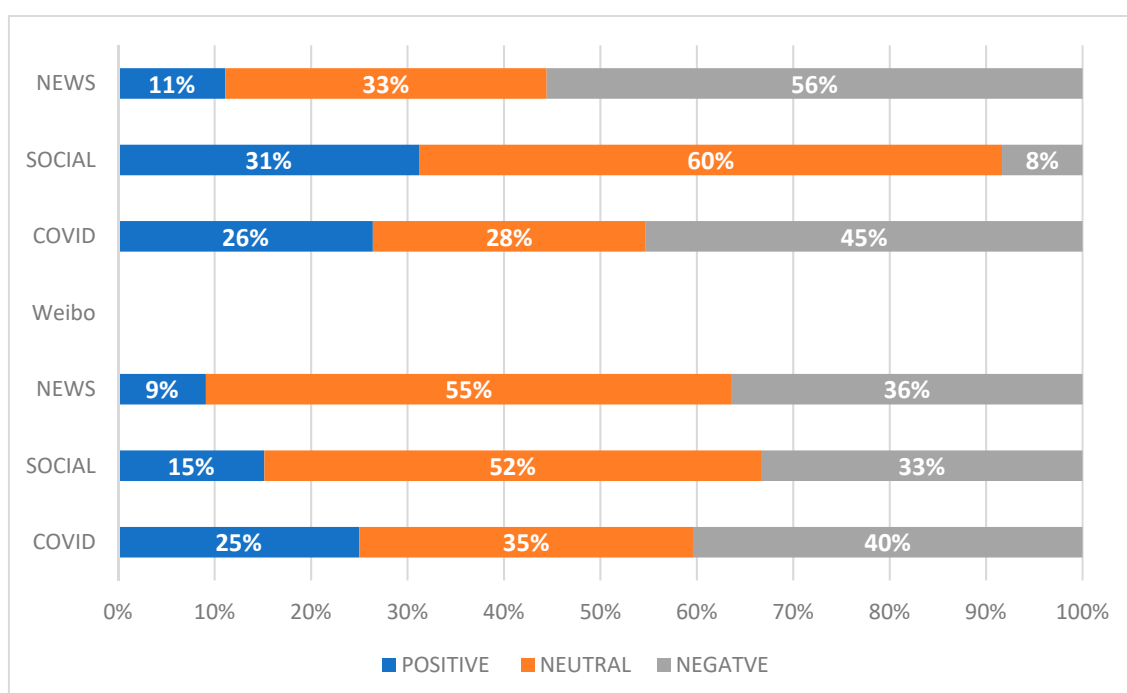
- There was a consistently higher level of neutral sentiment topics published on both Weibo and Baidu, in relation to social orientated information and general news topics, during the period of analysis of the investigation, in comparison with COVID-19 related topics on both online platforms, Weibo and Baidu.
- During the period of investigation, the results indicated a higher percentage of positive sentiment topics related to COVID in comparison to topics of general news orientation, for both Baidu and Weibo.

**Table 3.** Summary of sentiment analysis (%).

Baidu	Positive	Neutral	Negative
COVID	25%	35%	40%
Social	15%	52%	33%
<i>Dif. COVID/Social</i>	10%	−17%	7%
News	9%	55%	36%
<i>Dif. COVID/News</i>	16%	−20%	4%
Weibo	Positive	Neutral	Negative
COVID	26%	28%	45%
Social	31%	60%	8%
<i>Dif. COVID/Social</i>	−5%	−32%	37%
News	11%	33%	56%
<i>Dif. COVID/News</i>	15%	−5%	−10%

Source: Created by the authors.

Unfortunately, both the nature of the topics and its translation from Chinese (Mandarin) to English were important contributing factors to the recurrent prevalence of neutral sentiment associated with the topics. To undertake a more accurate classification of the underlying sentiment that was conveyed through the analysed content, further analysis would be required of each piece of actual topic developed for the individual posts and articles searched (Figure 4).

**Figure 4.** Sentiment analysis. Source: Created by the authors.

An additional analysis was undertaken of the topics posted on the Weibo platform during the complete month of August 2019, with the objective of analysing a non-COVID-19 period of information prior to the emergence of the pandemic. From the monitoring of topics on Weibo during the month of August, we were able to identify very similar trends, such as the Period 1 (Detection) and Period 3 (Stabilisation) phases of the investigation. During this analysis on Weibo, social topics represented 73% of the most popular content posted during August, whilst 20% of topics were related to national news and 8% regarded international news. During the period, there were no topics associated to economic topics identified and understandably themes related to CNY (Chinese New Year Festival) and COVID-19 were not reported to that date. In reference to Baidu, similar information as the that obtained during the period of investigation was not accessible for previous months.

#### 4. Discussion and Conclusions

The main outstanding topics (Table 4) that were published and searched during the first period of analysis of this investigation (15 December to 5 January) included topics related to social and lifestyle matters. These types of topic were mainly focused on the lives of local celebrities. In the case of Weibo, this type of topic was of greater popularity (90%) in comparison to Baidu (63%).

**Table 4.** Topic categories on Weibo/Baidu in China (15 December 2019 to 15 March 2020).

Topic Category	Period 1		Period 2		Period 3	
	Weibo	Baidu	Weibo	Baidu	Weibo	Baidu
Social news	90%	63%	16%	10%	65%	30%
National news (China)	0%	10%	10%	9%	5%	5%
International news	0%	0%	10%	18%	10%	15%
Economy	0%	7%	0%	5%	0%	0%
Chinese New Year (CNY)	10%	17%	3%	8%	0%	0%
COVID-19	0%	3%	61%	51%	20%	50%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: Created by the authors.

During the second period of analysis (6 January to 1 March), the main focus was on the COVID-19 outbreaks on both Weibo (61%) and Baidu (51%) and this coincided with the period of the most infections in China (World Health Organization 2020). The second most important topic circulating on these platforms included international news, with information on the death of NBA star Kobe Bryant being a recurrent topic. The third most important topic that was recurrent during this period included social and lifestyle news.

Finally, during the third period of analysis (2–15 March), news and information regarding social and lifestyle topics once again ranked as the most popular topic on Weibo. The information on COVID-19 during this period was positive and conveyed examples of the slow return to normality and the reduction of the case of infections of the virus. This could explain why users of these types of platforms were actively sharing “lighter” and more entertaining types of content. In relation to Baidu, although the incidence of social news searches rose (30%), the main topic searched continued to be COVID-19 (50%); however, the tone of the topics searched in relation to the virus changed in reference to other two periods of investigation. For example, the searches on Baidu related to COVID-19 were in relation to its spread to other countries, including Japan, the United States of America, Germany, and Italy.

Topics related to the economy and the predicted impact that COVID-19 would have in China were not widely posted or searched. In fact, on Weibo during the three periods of investigation, these did not appear amongst topics analysed. Finally, the traditional and very popular Chinese New Year Festival had limited popularity on both Weibo and Baidu in comparison to other topics; however,

it would be necessary to compare the level of popularity CNY receives in other years of “normality” to make any objective affirmation in this regard.

Weibo and Baidu have an important function in terms of gathering and promoting content related to both social and lifestyle topics during both pre- and post- pandemic periods. However, during the critical period of COVID-19 infections in China, the content naturally emphasised those topics related to the rate of infections and advancements made in terms of controlling the pandemic and its consequences not only in China but also in its spread abroad. This finding is in line with other preliminary research undertaken on Chinese social networks on COVID-19 that identified the negative emotion of indignation along with the classic emotions of anxiety and depression, tied to a greater concern for health and family at the expense of leisure and friendships (Li et al. 2020b).

As part of the investigation, we were able to observe a significant absence of information posted and searched in relation to economic news and events. Further analysis may be required to understand the specific reasons behind this absence and lack of topics on Weibo, as well as the reduced searches on the Baidu browser. Additionally, the topics identified during the investigation were in no way linked to official government statements or guidance on the unfolding situation. Government agencies in China only adopted the very traditional form of press conferences, information conferences, and even government official website releases, all forms of indirect communication, which rarely meets the psychological needs of direct communication directed through social media (Weixin 2020).

Additionally, throughout the investigation, we were able to identify a reduced number of specific notes, on both Weibo and Baidu, of content shared and searched in relation to the traditional Chinese New Year Festival (CNY). The relatively low level of exposure in reference to this festival, in comparison to other topics identified in the analysis would suggest that further analysis should be undertaken to compare the level of popularity CNY receives through the studied channels, during other years of “normality”, in order to draw any relevant conclusions.

As part of the investigation, we were able to observe a significant absence of information posted and searched in relation to economic news and events. Further analysis may be required to understand the specific reasons behind this absence and the lack of commentary on Weibo, as well as the reduced searches on the Baidu browser. However, at the same time, we also identified that not only was there a lack of specific content during the main period of the pandemic, but also that the topics and themes searched were very much influenced and dominated by leaders of opinion, given the lack of direction in the discourse and information distributed by the Chinese government on social media.

According to Weixin (2020), many government agencies lack the infrastructure and communication capabilities to communicate directly through social media and, for example, some early decisions and actions of relevant departments in Wuhan caused important outrage on social media, which could have been minimised if the relevant authority had responded quickly and effectively to calm the anxiety and pressure generated through social media.

It should be noted that from the additional analysis was undertaken of the topics posted on the Weibo platform during the complete month of August 2019, we were able to identify very similar trends as those periods in the COVID-19 period of investigation, including Period 1 (Detection) and Period 3 (Stabilisation) phases of the investigation.

As part of the investigation, the authors also undertook a sentiment analysis of the headlines of the topics posted and searched, during the period of study. The topic headlines analysed were classified into three categories, namely positive, neutral, and negative sentiments. Unfortunately, given both the nature of the content and its translation from Chinese (Mandarin) to English, there was a recurrent prevalence of neutral sentiment associated to the content. Further analysis would be required of each piece of actual content developed for individual posts and articles searched, in order to undertake a more accurate classification of the underlying sentiment that was conveyed through the analysed content.

Additionally, during the course of the investigation, a number of limitations became apparent, including the fact that from the message and subject analysis undertaken, we could not determine

whether there was a pre-selection or bias with regard to the elaboration of the ranking of the topics searched and posted on the Baidu and Weibo platforms. The data used in this investigation was sourced from both platforms, and, for example, in reference to Baidu, the top searched topics were declared to be based on the amount of Internet user searches, taking keywords as the statistical object to scientifically analyse and calculate the weighted sum of the search frequency of each keyword in the web search. In reference to Weibo, the ranking of hot search lists was based on the search popularity, the participation of related topics and the interaction of microblogs on the search results page.

Weibo has been used in the past by unscrupulous third parties (Yang and Yang 2018), who intervened in the topic rankings and either falsely promoted content or deliberately reduced negative news in relation to a person, due to the importance of the Weibo platform as an indicator to gauge a celebrity's popularity and hence attract advertising spend on the part of potential sponsors. However, for the purposes of this investigation, all controllable measures were undertaken to ensure an accurate characterisation of the topics posted and searched on the Weibo and Baidu platforms, during the period of analysis.

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## References

- Analysys. 2018. Available online: <https://bit.ly/2xyXpHE> (accessed on 9 May 2018).
- Analysys. 2020. Available online: <https://bit.ly/2EE1CgX> (accessed on 31 July 2020).
- Auer, Matthew, and King-wa Fu. 2015. Clearing the air: Investigating Weibo censorship in China: New research to show censorship of microbloggers who spoke out about pollution documentary. *Index on Censorship* 44: 76–79. [CrossRef]
- Benavides-Delgado, Juan. 2005. Nuevas propuestas para el análisis del lenguaje en los medios. *Questiones Publicitarias* 10: 13–33. [CrossRef]
- Berelson, Bernard. 1952. *Content Analysis in Communication Research*. Glencoe: The Free Press.
- Business Insider. 2020. Available online: <https://bit.ly/2UndSrA> (accessed on 28 March 2020).
- Business of Apps. 2020. Available online: <https://bit.ly/3bxYKxd> (accessed on 24 March 2020).
- Cairns, Christopher, and Allen Carlson. 2016. Real-world islands in a social media sea: Nationalism and censorship on Weibo during the 2012 Diaoyu/Senkaku Crisis. *The China Quarterly* 225: 23–49. [CrossRef]
- Cheng, Yan. 2020. The social-mediated crisis communication research: Revisiting dialogue between organizations and publics in crises of China. *Public Relations Review* 46: 101769. [CrossRef] [PubMed]
- Chou, Wen-ying Sylvia, Yvonne M. Hunt, Ellen Burke Beckjord, Richard P. Moser, and Bradford W. Hesse. 2009. Social media use in the United States: Implications for health communication. *Journal of Medical Internet Research* 11: e48. [CrossRef]
- Confessore, Nicholas, Gabriel J. X. Dance, Richard Harris, and Mark Hansen. 2018. The Follower Factory. *The New York Times*. Available online: <https://nyti.ms/30jkdar> (accessed on 27 January 2020).
- Devex. 2020. Available online: <https://bit.ly/2DpE4fe> (accessed on 20 March 2020).
- Fu, King-wa, and Michael Chau. 2013. Reality check for the Chinese microblog space: A random sampling approach. *PLoS ONE* 8: e58356. [CrossRef]
- Fu, Jiawei Sophia, and Alice Y. L. Lee. 2016. Chinese journalists' discursive Weibo practices in an extended journalistic sphere. *Journalism Studies* 17: 80–99. [CrossRef]
- Fung, Isaac Chun-Hai, King-Wa Fu, Chung-Hong Chan, Benedict Shing Bun Chan, Chi-Ngai Cheung, Thomas Abraham, and Zion Tsz Ho Tse. 2016. Social Media's Initial Reaction to Information and Misinformation on Ebola, August 2014: Facts and Rumors. *Public Health Reports* 131: 461–73. [CrossRef]
- Gan, Chunmei. 2018. Gratifications for using social media: A comparative analysis of Sina Weibo and WeChat in China. *Information Development* 34: 139–47. [CrossRef]

- Garfin, Dana Rose, Roxane Cohen Silver, and E. Alison Holman. 2020. The Novel Coronavirus (COVID-2019) Outbreak: Amplification of Public Health Consequences by Media Exposure. *Health Psychology* 39: 355–57. [CrossRef]
- Han, Xi, Bei Li, Jiabin Qu, and Qinghua Zhu. 2018. Weibo friends with benefits for people live with HIV/AIDS? The implications of Weibo use for enacted social support, perceived social support and health outcomes. *Social Science & Medicine* 211: 157–63. [CrossRef]
- Hong, Traci. 2007. Information control in time of crisis: the framing of SARS in China-based newspapers and Internet sources. *Cyberpsychology & Behavior* 10: 696–99. [CrossRef]
- Hootsuite and We are Social. 2020. Available online: <https://bit.ly/2QTzvxr> (accessed on 20 March 2020).
- Hou, Juan, Yamikani Ndasauka, Xuefei Pan, Shuangyi Chen, Fei Xu, and Xiaochu Zhang. 2018. Weibo or WeChat? Assessing Preference for Social Networking Sites and Role of Personality Traits and Psychological Factors. *Frontiers in Psychology* 9: e545. [CrossRef]
- Hu, Yue, Jichang Zhao, and Junjie Wu. 2016. Emoticon-Based Ambivalent Expression: A Hidden Indicator for Unusual Behaviors in Weibo. *PLoS ONE* 11: e0147079. [CrossRef] [PubMed]
- Hua, Jinling, and Rajib Shaw. 2020. Corona Virus (COVID-19) “Infodemic” and Emerging Issues through a Data Lens: The Case of China. *International Journal of Environmental Research and Public Health* 17: 2309. [CrossRef] [PubMed]
- Huang, Ronggui, and Xiaoyi Sun. 2014. Weibo network, information diffusion and implications for collective action in China. *Information, Communication & Society* 17: 86–104. [CrossRef]
- Huang, Chunmei, Xinjie Xu, Yuyang Cai, Qinmin Ge, Guangwang Zeng, Xiaopan Li, Weide Zhang, Chen Ji, and Ling Yang. 2020. Mining the Characteristics of COVID-19 Patients in China: Analysis of Social Media Posts. *Journal of Medical Internet Research* 22: e19087. [CrossRef]
- Lee, Ji Young, and Shyam Sundar. 2013. To tweet or to retweet? That is the question for health professionals on twitter. *Health Communication* 28: 509–24. [CrossRef]
- Li, Weiguo, Jing Liao, Qinyuan Li, Muna Baskota, Xingmei Wang, Yuyi Tang, Qi Zhou, and Enmei Liu. 2020a. Public health education for parents during the outbreak of COVID-19: A rapid review. *Annals of Translational Medicine* 8: e628. [CrossRef]
- Li, Sijia, Yilin Wang, Jia Xue, Nan Zhao, and Tingshao Zhu. 2020b. The Impact of COVID-19 Epidemic Declaration on Psychological Consequences: A Study on Active Weibo Users. *International Journal of Environmental Research and Public Health* 17: 2032. [CrossRef]
- Lin, Xialing, Kenneth A. Lachlan, and Patric R. Spence. 2016. Exploring extreme events on social media: A comparison of user reposting/retweeting behaviors on Twitter and Weibo. *Computers in Human Behavior* 65: 576–81. [CrossRef]
- Liu, Brooke Fisher, and Sora Kim. 2011. How organizations framed the 2009 H1N1 pandemic via social and traditional media: Implications for US health communicators. *Public Relations Review* 37: 233–44. [CrossRef]
- Luqiu, Luewi Rose, Michael Schmierbach, and Yu-Leung Ng. 2019. Willingness to follow opinion leaders: A case study of Chinese Weibo. *Computers in Human Behavior* 101: 42–50. [CrossRef]
- Maher, Carol A., Lucy W. Lewis, Katia Ferrar, Simon Marshall, Ilse de-Bourdeaudhuij, and Corneel Vandelandotte. 2014. Are health behavior change interventions that use online social networks effective? A systematic review. *Journal of Medical Internet Research* 16: e40. [CrossRef] [PubMed]
- Muralidharan, Sidharth, Kristie Dillistone, and Jae-Hwa Shin. 2011. The gulf coast oil spill: Extending the theory of image restoration discourse to the realm of social media and beyond petroleum. *Public Relations Review* 37: 220–32. [CrossRef]
- Nguyen, Le T., Pang Wu, William Chan, Wei Peng, and Ying Zhang. 2012. Predicting collective sentiment dynamics from time-series social media. Paper presented at the First International Workshop on Issues of Sentiment Discovery and Opinion Mining, Beijing, China, August 12–16; vol. 6, pp. 1–8. [CrossRef]
- Nip, Joyce Y. M., and King-wa Fu. 2016. Challenging Official Propaganda? Public Opinion Leaders on Sina Weibo. *China Quarterly* 225: 122–44. [CrossRef]
- Niu, Lu, Dan Luo, Ying Liu, and Shuiyuan Xiao. 2016. The Accessibility, Usability, and Reliability of Chinese Web-Based Information on HIV/AIDS. *International Journal of Environmental Research and Public Health* 13: 834. [CrossRef]
- Ouyang, Zhe, Jiuchang Wei, Yu Xiao, and Fei Wang. 2017. Media attention and corporate disaster relief: Evidence from China. *Disaster Prevention and Management* 26: 2–12. [CrossRef]



- Papacharissi, Zizzi A. 2010. *A Private Sphere: Democracy in a Digital Age*. Cambridge: Polity.
- Ren, Yuan. 2018. Know Your Chinese Social Media. *The New York Times*. Available online: <https://nyti.ms/39xm1OE> (accessed on 27 January 2020).
- Romenti, Stefania, Grazia Murtarelli, and Chiara Valentini. 2014. Organizations' conversations in social media: Applying dialogue strategies in times of crises. *Corporate Communications. An International Journal* 19: 10–33. [CrossRef]
- Shan, Siqing, Feng Zhao, Yigang Wei, and Mengni Liu. 2019. Disaster management 2.0: A real-time disaster damage assessment model based on mobile social media data—A case study of Weibo (Chinese Twitter). *Safety Science* 115: 393–413. [CrossRef]
- Shangguan, Ziheng, Mark Yaolin Wang, and Wen Sun. 2020. What Caused the Outbreak of COVID-19 in China: From the Perspective of Crisis Management. *International Journal of Environmental Research and Public Health* 17: 3279. [CrossRef]
- Sprout Social. 2020. Available online: <https://bit.ly/2WRAXV5> (accessed on 29 March 2020).
- Statista. 2020a. Available online: <https://bit.ly/2JpE5zv> (accessed on 3 March 2020).
- Statista. 2020b. Available online: <https://bit.ly/2QTD0UK> (accessed on 29 March 2020).
- Strauss, Anselm L., and Juliet M. Corbin. 1990. *Basics of Qualitative Research: Grounded Theory, Procedures and Techniques*. Newbury Park: Sage.
- Wang, Hongyu, and Fayong Shi. 2018. Weibo use and political participation: The mechanism explaining the positive effect of Weibo use on online political participation among college students in contemporary China. *Information, Communication & Society* 21: 516–30. [CrossRef]
- Weixin. 2020. Available online: <https://bit.ly/3fIWsmg> (accessed on 3 March 2020).
- Wigley, Shelley, and Maria Fontenot. 2010. Crisis managers losing control of the message: A pilot study of the Virginia tech shooting. *Public Relations Review* 36: 187–89. [CrossRef]
- World Health Organization. 2020. Available online: <https://bit.ly/2JosFvK> (accessed on 19 March 2020).
- Wu, Xiaoping. 2018. Discursive strategies of resistance on Weibo: A case study of the 2015 Tianjin explosions in China. *Discourse Context & Media* 26: 64–73. [CrossRef]
- Wu, Xiaoping, and Martin Montgomery. 2019. Witnessing in crisis contexts in the social media age: The case of the 2015 Tianjin blasts on Weibo. *Media Culture & Society*. [CrossRef]
- Xie, Yungeng, Rui Qiao, Guosong Shao, and Hong Chen. 2016. Research on Chinese social media users' communication behaviors during public emergency events. *Telematics and Informatics* 34: 740–54. [CrossRef]
- Yang, Yuan, and Yingzhi Yang. 2018. Celebrity Ban Exposes Fake Rankings on China's Twitter. *Financial Times*. Available online: <https://on.ft.com/3bj9mRC> (accessed on 30 August 2020).
- Ye, Xinyue, Shengwen Li, Xining Yang, and Chenglin Qin. 2016. Use of Social Media for the Detection and Analysis of Infectious Diseases in China. *ISPRS International Journal of Geo-Information* 5: 156. [CrossRef]
- Yu, Guihua. *Public Opinion in the Chinese Society: Annual Report 2011*. Beijing: People's Daily Press.
- Zeng, Jing, Chung-Hong Chang, and King-wa Fu. 2017. How Social Media Construct "Truth" Around Crisis Events: Weibo's Rumor Management Strategies After the 2015 Tianjin Blasts. *Policy and Internet* 9: 297–320. [CrossRef]
- Zhang, Yi, and Jianguo Lu. 2016. Discover millions of fake followers in Weibo. *Social Network Analysis and Mining* 6: e16. [CrossRef]
- Zhu, Xi, Xiangmiao Qiu, Dingwang Wu, Shidong Chen, Jiwen Xiong, Hongxuan Du, Zihao Dai, Jami Hoang, Anjiao Peng, Shixu He, and et al. 2018. Reliability of information about the use of antiepileptic drugs during pregnancy from three major web search engines in China. *PLoS ONE* 13: e0208783. [CrossRef]

