

Research Article

The Influence of Prosocial and Antisocial Emotions on the Spread of Weibo Posts: A Study of the COVID-19 Pandemic

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This study investigates the influences of the prosocial and antisocial tendency of Weibo users on post transmission during the COVID-19 pandemic. To overcome the deficiency of existing research on prosocial and antisocial emotions, we employ a web crawler technology to obtain post data from Weibo and identify texts with prosocial or antisocial emotions. We use SnowNLP to construct semantic dictionaries and training models. Our major findings include the following. First, through correlation analysis and negative binomial regression, we find that user posts with high intensity and prosocial emotion can trigger comments or forwarding behaviour. Second, the influence of antisocial emotion on Weibo comments, likes, and retweets are insignificant. Third, the general emotion about prosocial comments in Weibo also shows the emotion trend of prosocial comments. Overall, a major contribution of this paper is our focus on prosocial and antisocial emotions in cyberspace, providing a new perspective on emotion communication.

1. Introduction

Since the outbreak of the new coronavirus in late 2019, more than 200 countries and billions of people worldwide have been severely impacted. As a result, “social distancing” has been implemented in most parts of the world. This leads to more interactions through social media.

As a diversified social media in China, Weibo (microblog) can meet people’s demands for obtaining, spreading, and expressing information. During the pandemic, the use of Weibo increased significantly. In 2020, Weibo platform users hit a record in the first quarter. According to its first quarter earnings data, active users were 550 million per month, including 241 million users who used frequently. Social media, such as Weibo, provide freedom and convenience for online discussion but also become an outlet for public catharsis. Eisenberg and Mussen [1] put forward the concept of prosocial and antisocial behaviour, in which prosocial behaviour can be summarized as “voluntary action aimed at helping or benefiting another person or group of people.” Antisocial behaviour is a general term for acts that

infringe upon the interests of individuals and society and is usually described as destructive behaviour. Online antisocial behaviour has also begun to become widespread and persistent with the widespread use of online social media in recent years. This behaviour was once called cyberbullying in 2000, but it is now also referred to as cyber “sprays.” In Weibo discussions on the pandemic, we anticipate encouragement and comfort but cannot ignore hatred and abuse. The spread of pro-(anti-) social emotions not only affects our experience in the Weibo community but also relates to how we get through the crisis. However, few studies have focused on the spread of online pro-(anti-) social emotions. In existing studies, these emotion expressions are often simply classified as negative and positive. However, in fact, a few words in cyberspace can rise to prosocial and antisocial levels. They also have an incalculable impact on our online community experience and real-life experience. For instance, as Weinstein and Ryan [2] proposed, both the giver and the recipient of the network’s prosocial emotion can feel more happiness, such as positive optimism, vitality, and self-esteem. While the network’s

antisocial feelings such as malice and hatred which bring destructive influence are self-evident, cases of depression caused by network violence are enough to show its negative impact. As for explaining the causes of prosocial and antisocial tendencies, the general intuition and consensus are that they are caused by personality and growth in the environment. People with a positive attitude are more willing to show prosocial tendencies, while arrogant people without empathy are more likely to have antisocial personalities. However, anyone may show altruistic behaviour. This is a new perspective adopted in this paper. In addition, we analyze whether prosocial and antisocial emotions in cyberspace stimulate more attention and response, intensify emotions, and infect each other.

Sina Weibo is the largest open social platform in China at present. Under the connection of stranger relationships, the evolution of popular public opinion is often not only limited to the event itself but also the emotion communication and confrontation of the public opinion in discussions. The driving factors behind users' likes, comments, and forwarding of microblog posts are very complex. In the research on the influencing factors of microblog forwarding, they are summarized into two dimensions: one is the characteristics of users, such as users' interests, account years, and social influence and the other is the text characteristics of microblog, such as emotional expression, topic reference, and URL. Wang et al. [4] established an information communication model based on the SIR model to study information communication in Weibo's network. They considered the different influencing factors such as credibility and network weight. This paper mainly focuses on the influence of prosocial and antisocial emotion expressions in Weibo posts on Weibo likes, comments, and retweets and on emotion tendencies in comments. Emotion characteristics have attracted more research attention. For example, Stieglitz and Dang-Xuan [5] investigated whether the emotions in political tweets on Twitter have an impact on their forwarding volume. As early as 1992, Hatfield et al. [6] proposed emotion contagion with the development and popularity of social media or computer-mediated communication, and the study of online emotion communication began to prevail. Many researchers, based on the concept of emotion contagion in [6], carried out research in political, economic, cultural, and social fields. However, the existing studies on emotion communication pay little attention to prosocial and antisocial emotions in social media. Prosocial and antisocial behaviours are not only a topic worthy of attention in offline society but also have important research value in online social networks. They can bring new ideas to the governance of cyberspace and the guidance of public opinion, especially during public health emergencies like the COVID-19 pandemic. It also provides a new angle for understanding the information dissemination path of social media. As the phenomenon of network violence occurs more frequently, the causes and effects of network antisocial tendency need more in-depth research. In addition, previous studies on social media emotion communication used offline experiments or questionnaires to measure the behavioural characteristics of users. To control the experimental errors in

these aspects, this study uses a web crawler to collect user data from the real Weibo environment. In particular, it uses natural language processing (SnowNLP) to automatically score emotion tendencies and avoid the subjective effects of artificial coding to ensure the objectivity of the study. This research is not only closely related to the discussion of the epidemic event of COVID-19 but also through this major public crisis to explore the common prosocial phenomenon in cyberspace. Through exploring the role of prosocial emotion in Weibo information transmission and arousing the attention of online users from all walks of life to be aware of this antisocial phenomenon, the creation of a more directed online environment can actively encourage the expression of prosocial emotion. This is a major contribution of this research.

2. Literature Review

2.1. Prosocial and Antisocial Emotions in Cyberspace. Two opposing kinds of behaviour, prosocial and antisocial, first appeared in research topics based on criminal behaviour in the middle and late twentieth century which were concerned by scholars in sociology, psychology, social psychology, and psychiatry. The study of prosocial and antisocial behaviours in cyberspace comes into being with the vigorous development of the network society. In recent years, these concepts have been gradually applied to the research and description of the network society. There are no essential differences between prosocial and antisocial behaviours in cyberspace or social media and real society, but the background, environment, and form of behaviour have changed. These differences make the study of prosocial and antisocial behaviours in the Internet have some theoretical background support, but there is also space for exploration and innovation.

Earlier network prosocial research started in [7]. Researchers explored the relationship between altruism and prosocial behaviour through network games. They applied the generalized reciprocity theory [8], joint construction theory, and strengthening spiral model [9] to the interpretation of network prosocial behaviour. In the network community, they explored the interpersonal relation establishment and maintenance and perceived the mutual benefit win-win criterion. For example, Erreygers et al. [10] believe that when people observe the prosocial behavior of others or are actively treated by others, they will also show their prosocial behavior. This behavior has more communication power in online situations, such as social media websites or post bar forums, than offline behavior, because online behavior has greater potential to reach a wider range of the public. There are different definitions of different research topics about the measurement of network prosocial behaviour. For example, Lapidot-Lefler and Barak [11] studied whether situational factors cause online self-disclosure and prosocial behaviour, assessing the extent of prosociality by analyzing whether experimental participants help others in the chat text, praising chat partners, and creating a positive atmosphere. Wang and Feng [12] analyzed prochild altruistic behaviour in the network, where the

online prosocial behaviour is divided into the following categories: technical services, information consultation, online resources, spiritual support, game support, and social assistance. This classification comprehensively summarizes the manifestations of online prosocial behaviour.

Several other terms describe online antisocial behaviour, for example, the word “Troll” mentioned by Bishop [13] is one of the fastest-moving computer-related jargon of the twenty-first century. As an extension of the Internet, Troll describes people who make inflammatory, repugnant, or destructive statements to distract from the topic, disrupt online discussions, or try to provoke others. In addition, there are words such as malice, hatred, discrimination, attack, provocation, and confrontation. Moor defines “malicious” as showing hostility by insulting or using other offensive languages. There is no formal definition of hate speech, but there is a consensus that it targets vulnerable social groups. Jacobs and Potter and Walker [14, 15] put forward this similar point of view. Grigg [16] defines it as intentional injury to individuals or groups of any age, whose acts are offensive, derogatory, and harmful. These descriptions of different meanings are specific emotion manifestations of online antisocial behaviours, which are violence in cyberspace. Usually, these antisocial behaviours have specific objects to attack, such as individuals or groups. They may be one-to-many, one-to-one, or more-to-many.

2.2. Emotion Polarity and Information Dissemination Power.

The research on the communication effect has been a very mature branch in the field of communication. In the closed loop of communication, it cannot be separated from the analysis and consideration of the communication effect. As early as the 1930s and 1940s, scholars of social sciences such as communication and psychology studied persuasion techniques and communication effects. Guo [17] summarized in his writings that scholars argued that “touching” objects in the way of “appealing to feelings” was an important reason for the influence of communication effects. This is mainly by creating a certain atmosphere or using strong emotion words to infect the object to seek a specific communication effect. In the Internet age, speech is almost the most important medium of communication in mass communication and interpersonal communication. Also, the feelings carried in the process of communication become one of the key factors that affect information dissemination. The emotion state of the content may affect whether the information will be shared or not [18], and the way it affects changes with different Internet situations.

The social attributes of Weibo and the transmission path of information are mainly commenting, forwarding, and likes. As a social platform with two main functions of understanding real-time information and social interaction, Weibo’s information dissemination itself has a strong social gene, and the influence of emotion in the process of communication is significant, which is reflected in the frequency of comment forwarding. There are many cases about the relationship between emotion factors and network information dissemination at home and abroad. Why is specific online content faster and wider than others in information

dissemination? Berger and Milkman [19] gave corresponding responses from a psychological perspective through empirical research, and their findings suggest that content containing highly positive (exclamatory) or negative (angry or anxious) emotions are more communicative. However, Godes and Mayzlin [20] assert that negative information which is more propagative is inaccurate. Goodman [21] believes that similar research is mainly an understanding of what type of news people encounter, rather than what people are spreading. Zhang et al. [22] studied the spread of rumors in social networks from the perspective of the influence of communicators. They think it is of great significance to find out the influential spread of rumors to prevent and control the spread. On this basis, this study considers that identifying the emotions contained in network information is also a reliable way to control the effective and safe dissemination of information. With the development of the Internet and social media, people’s opportunities to share and disseminate information actively increase, so the emotions contained in the content spread in cyberspace have research value. In addition, it will bring new thinking about sharing important information online or developing marketing strategies.

Emotion also plays a very important role in the political communication of social media. Stieglitz and Dang-Xuan [23] analyzed 64,431 political tweets on Twitter in 2012 and found a positive correlation between the vocabulary of one tweet expressing the emotion dimension and the forwarding rate. The forwarding and commenting functions of Twitter, although simple, are also powerful information diffusion mechanisms and have the potential to increase political participation, which may be the idea behind Trump’s Twitter usage. In [24], this information diffusion mechanism was found to be widespread in major social platforms. With behavioural feedback, Joyce and Kraut [25] investigated the emotions triggered by information on social platforms. They found that positive emotions of information strengthen the platform or community awareness of users and encourage their continuous participation, while negative emotions generate feedback through interactions including antisocial tendencies such as hostility and insult. Xu et al. [26] studied the dynamic relationship between online sentiment and stock market performance and found a power-law cross-relationship between financial market and network sentiment in some developed countries and all developing countries. This indicates that sentiment in Internet information can affect investors’ behaviour in financial markets. In addition, studies have also found that emotions (positive or negative) expressed in posts from different social media platforms (such as Weibo and forums) may spread in subsequent corresponding comments or responses.

2.3. Social Media’s Prosocial and Antisocial Emotion Contagion.

Prosocial and antisocial behaviours in cyberspace are usually characterized by extreme emotion or specific behaviour, which is confined to the virtual characteristics of network media, especially emotion expression. For example, prosocial behaviour is often manifested in positive encouragement, praise, and information sharing

[27]. In several aspects, antisocial behaviour covers a variety of Internet behavioural chaos and has been widely concerned within academic circles and other domains, such as hatred, provocation, discrimination, and malice. The most widely accepted concept in China is the online jargon “keyboard man,” meaning a shy person. The above behaviours are published and disseminated on social networks in the form of text containing strong emotions, with positive or negative effects. According to [6], there is a broad concept of emotion transmission. More researchers have extended it to the study of emotion communication in cyberspace, such as [28]. The receiver can perceive the publisher’s emotion state through text content and emotion clues.

Specifically, the role of pro- (anti-) social emotion in social media is not only to contribute to the dissemination of information but also an important factor in the spread of pro- (anti-) social behavior. Thirlwall et al. [29] revealed that events that trigger a strong response on Twitter are associated with increased emotion expression. In a later study, Kramer et al. [30] proved the hypothesis empirically. An experiment with people using Facebook found that when positive expression decreased, people produced fewer positive comments and more negative comments, while when negative expression decreased, the opposite situation occurred. This further shows that emotion states can be transmitted to others through an emotion contagion mechanism and make others feel the same emotion unconsciously.

Overall, most of the existing research on the emotion communication of social media is based on positive and negative emotions in a broad sense. However, there are few cases about the spread and influence of prosocial or antisocial emotions in social media. This is a research gap in the current era of social networks. To fill this gap, this study explores the role of prosocial and antisocial behaviours or emotions in the information dissemination of cyberspace.

3. Research Questions and Hypotheses

As an emotion expression, prosocial and antisocial behaviours in social media have even stronger communication power and effect than general emotion communication. Prosocial behaviour is more easily recognized in an online network environment with redundant information. This is because these behaviours express very strong emotions and can easily lead to empathy and more feedback and response. In the face of the COVID-19 crisis, in Weibo, there is no lack of gratitude to medical staff and encouragement to patients. However, there are also a lot of malicious speculations about the source of the virus and discrimination against the people in the epidemic area. Prosocial speech makes people feel better during the epidemic, and antisocial feelings cause harm to society. This study aims to identify prosocial and antisocial behaviours in the Weibo platform during the pandemic and to explore their role in transmission and contribution to Weibo transmission. According to the information dissemination characteristics of Weibo, the influence of a Weibo post can often be judged by its number of comments, forwarding numbers, and likes. On this basis, this study puts forward the following hypotheses.

Hypothesis 1. Weibo posts have pro-(anti-) social feelings, and the stronger the emotion is, the more the comments, retweets, and likes they receive.

Hypothesis 2. Weibo posts have pro-(anti-) social feelings, and the stronger the post emotion is, the overall emotion of the comments is also more pro-(anti-) social feelings.

In Hypothesis 1, considering that the number of Weibo bloggers’ fans and the number of Weibo are also factors affecting the number of comments they receive, the number of fans directly affects the number of comments [31]. The frequency of Weibo releases may lead to more dialogue and discussion [32]. In the analysis of the communication influence of official Weibo, the number of fans and the number of posts represent the amount of Weibo radiation and the activity of Weibo, respectively, in the evaluation index system of the government Weibo communication influence, so in the research model of this paper, it is also considered as an independent variable, but not the focus of this paper.

Hypothesis 2 relates to the process of predicting and analyzing the overall emotion of comments, in addition to taking the pro-(anti-) social emotion intensity of the original Weibo as the main independent variable. The original Weibo word number and whether there are @ symbols are also involved in the model construction. This is because the number of words on Weibo is related to the richness of the content, and the use of the @ symbol tag emphasizes the social element of Weibo. This means interactivity, as Honeycutt and Herring [33] mentioned, which enables Weibo to be used very effectively for dialogue and collaboration. Figure 1 illustrates the research hypotheses and the core variables in this research.

4. Analysis

4.1. Data Collection. In this study, the COVID-19 pandemic was taken as the research context, and the dataset obtained by web crawler was used to study the public opinion of this public health event in Weibo. First of all, this study obtained data samples from January 20 to March 18, 2020. The main reason is that this time interval is the main period from the full outbreak to the basic control of the epidemic situation in China. Secondly, we selected a series of terms that were used more frequently during the epidemic as keywords for data crawling, including “unknown pneumonia,” “epidemic,” “virus,” “new coronavirus,” and “human-to-human transmission.” The choice of these keywords is based on the popular search terms on the Weibo platform, news reports, and the everyday expressions of COVID-19. In addition, after cleaning, reloading, and removing nonpersonal accounts such as media accounts, the remaining data were used as samples of experimental analysis.

It is worth noting that when processing data, we have considered the official website media, government spokespersons, and other related Weibo accounts. This is because the official information is often more neutral, positive, and authoritative, which will interfere with the reliability of the experimental results. Therefore, we first deleted the contents of government microblog accounts on the Sina Weibo

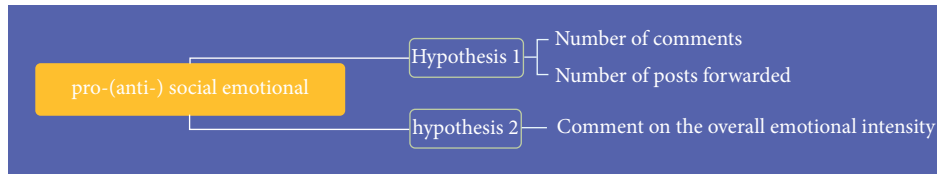


FIGURE 1: The research hypotheses and the core variables.

platform. The names of the accounts come from official statistics and the verification of Weibo search engines, including the Weibo of central government agencies, courts, procuratorates, public security Weibo, and party and government news release Weibo. These accounts are mainly derived from the statistics and disclosure data of the official website's government affairs Weibo, and they have high dissemination and influence. There is a total of about 70 accounts, and the accounts that need to be excluded from our original data are 34. Secondly, we also collected the Weibo account names of relevant media such as the People's Daily and other central government official media and local official media, including 18 central government media and local government media in various provinces and cities. Regarding the removal of media accounts, we believe that the relevant information released by the official media or ordinary media will interfere with the accuracy of the experimental results. Therefore, in data cleaning, all have been deliberately eliminated. The method of removal is the same as that of government Weibo.

4.2. Text Analysis. The object of text emotion analysis is the short text data from Weibo. The text content is usually concise, and the number of words is not more than 140. These text features are important factors to be considered in the process of research. Especially in the analysis of prosocial and antisocial emotions, the lexical database is directly related to the accuracy of the analysis results.

In the experiment, we use the Python natural language processing package SnowNLP to classify the captured Weibo text data into antisocial-prosocial emotion tendencies. SnowNLP can make up for the lack of prosocial and antisocial semantic recognition through the analysis model needed for text corpus training. During this process, this study used more than 360,000 Sina Weibo text data with emotion tagging as a prosocial and antisocial sentiment analysis corpus. This Weibo dataset is a collection of posts with pronounced emotional characteristics collected from the Weibo platform through multiple crawls. Out of a total of 363,324 Weibo posts, the final usable training set obtained by de-duplication and cleaning is 361,279. Among them, prosocial content contained about 201,170 emotion corpuses such as joy, positive, and optimistic, and antisocial content contained about 160,109 emotion corpuses such as anger, disgust, malice, and insult. After replacing and retraining the corpus set of the original model, the obtained model is used as the main emotion analysis tool in this study. SnowNLP return value represents the polarity of emotion, and the value ranges from negative 0.5 to positive 0.5. Being closer to 0.5 means being more prosocial. Being closer to -0.5 means

being more antisocial. Through many trials, adjustments, and tests of the new model, the emotion score is more reasonable than the original model. For example, the statement "I am depressed today" has an emotion score of -0.1485 in the original model and -0.0509 in the retrained model. Therefore, the latter score can describe the emotion state of "I am depressed today" more accurately. The new model is suitable for the analysis of pro-(anti-) social emotion. Table 1 shows 10 examples of pro- and antisocial Weibo posts on the COVID-19 pandemic. The texts under the English translation are the original Chinese expressions.

4.3. Data Analysis. For Hypothesis 1, the dependent variable comment number is discrete data, which is usually more appropriate for Poisson regression model. From the results of descriptive statistics in Table 2, the standard deviation of the number of comments ($N=6,608$) in the model is significantly higher than the average. Therefore, to reduce the influence of heteroscedasticity and extreme value, it is more reasonable to choose negative binomial regression in the regression model of Hypothesis 1.

To ensure that the regression model is meaningful, before the return of variables, several factors affecting the number of comments are analyzed. Based on the characteristics of the dataset, 1,736 Weibo data without noticeable sentiment tendencies are eliminated (within positive and negative 0.1). Then, we separate Weibo posts with positive and negative emotion scores. As a result, the number of prosocial samples is 2,917, and the number of antisocial samples is 1,955. The correlations between pro-(anti-) social emotion and other variables are shown in Tables 3 and 4, respectively.

The results of correlation analysis showed that the prosocial affective tendency of posts had a significant positive correlation with the number of comments and forwarding ($r=0.073$, $pr=0.01$; $r=0.057$, $pr=0.01$). There was no correlation with the number of likes. However, there is no significant correlation between antisocial emotion and post comment number, forwarding number, and likes number. Therefore, we further conduct negative binomial regression on prosocial emotion and post comment numbers and forwarding numbers and analyze the specific degree of influence. The results are shown in Tables 5 and 6. In the negative binomial regression analysis of prosocial emotion, the number of fans and the number of posts on the number of comments and forwarding, it can be seen that when these two variables (the number of fans and the number of microblogs) were added, the tendency of prosocial emotion has a significant positive effect on the number of post comments and

TABLE 1: Examples of prosocial and antisocial Weibo posts and their emotion scores.

	Weibo posts	Emotion tendency	Emotion score
1	Different lantern festival, thanksgiving care. Looking forward to the epidemic early past, about three or five friends together to spring	Prosocial society	0.3321
2	The army's success in developing the new crown vaccine is so exciting	Prosocial society	0.3885
3	Isolate virus does not isolate love ha ha ha ha ha ha ha	Prosocial society	0.3910
4	I hope everyone is well, which country you are! Really!!! The world is beautiful. Don't waste your life on viruses~	Prosocial society	0.3771
5	This time we go out as little as possible, where more people go less, go out must remember to wear masks, prevent and cure virus infection, the new year hope @ Xiao Jie-crazy and roll happy #2020 new year #	Prosocial society	0.3877
6	We sincerely wish to report that dogs are infected with coronavirus and die immediately	Antisocial	-0.3942
7	What is the most terrible is not a virus, not a disease, not a monster, not a ghost or a man	Antisocial	-0.3800
8	Rumors of some celebrity mothers dying of COVID-19	Antisocial	-0.3862
9	Kill bats? Really illiterate? An indispensable important species in the food chain. You say extinction is extinction?	Antisocial	-0.3982
10	May the virus defeat m country at an early date	Antisocial	-0.3905

TABLE 2: Descriptive statistics.

	Number of samples (N)	(M)	Maximum (X)	Average (E)	Standard deviation
Emotion score	6608	-0.399881	0.399609	0.017155	0.223863
Number of comments	6608	0	496	3.20	16.090
Number of fans	6608	0	22141108.0	121912.168	685984.9662
Number of posts	6608	0	570893	8585.80	26427.423
Forwarding	6608	0	575	2.09	19.343
Number of likes	6608	0	9145	15.38	157.977

TABLE 3: Correlation analysis between prosocial emotion and the number of comments.

	Emotion score	Number of comments	Forwarding	Number of likes	Number of fans	Number of posts
Emotion score	1					
Number of comments	0.073**	1				
Forwarding	0.057**	0.584**	1			
Number of likes	0.017	0.819**	0.437**	1		
Number of fans	0.030	0.412**	0.317**	0.444**	1	
Number of posts	0.066**	0.047*	0.063**	0.034	0.268**	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 4: Correlation analysis between antisocial emotion and the number of comments.

	Emotion score	Number of comments	Forwarding	Number of likes	Number of fans	Number of posts
Emotion score	1					
Number of comments	-0.026	1				
Forwarding	-0.037	0.640**	1			
Number of likes	-0.038	0.742**	0.597**	1		
Number of fans	0.025	0.271**	0.233**	0.296**	1	*
Number of posts	0.013	0.030	0.035	0.076**	0.270**	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

forwarding ($B = 7.285$; $B = 9.905$). In addition, the number of fans and posts of bloggers has a significant impact on the number of comments and retweets, so it is reasonable to include these two variables in the model, which also shows that the factors affecting Weibo transmission are diverse and complex.

To test Hypothesis 2, this study adopts the method of correlation analysis. In addition, in the variable design process, this study will take whether the control variables in Model 2 have @ labels designed as dummy variables 1 (yes) and 0 (no). By filtering the data in the total sample ($N = 6,608$) and removing Weibo with 0 comments and

TABLE 5: Negative binomial regression parameter estimates (prosocial posts and number of comments).

Independent variables	B	Standard error	Hypothesis testing		Logistic likelihood	AIC	BIC
			Wald chi-square value	Significance			
Emotion score	7.285	0.3695	388.847	0.000			
Number of fans	0.982	0.0258	1444.154	0.000	-3954.988	7917.997	7941.905
Number of posts	-0.581	0.0408	202.419	0.000			

TABLE 6: Negative binomial regression parameter estimates (prosocial posts and number of forwarded posts).

Independent variables	B	Standard error	Hypothesis testing		Logistic likelihood	AIC	BIC
			Wald chi-square value	Significant significance			
Emotion score	9.905	0.4214	553.507	0.000			
Number of fans	0.000	0.000	514.103	0.000	-2886.640	5781.280	5805.174
Number of posts	0.000	0.000	22.520	0.000			

TABLE 7: Analysis of the correlations between Weibo prosocial emotion and the overall emotion value of comments.

	Emotion score	Number of Weibo words	Is there a @ tag	Comments on the overall emotion value
Emotion score	1			
Number of Weibo words	0.233**	1		
Is there a @ tag	0.100	0.215**	1	
Comments on the overall emotion value	0.421**	0.093	0.068	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 8: Analysis of the correlations between Weibo antisocial emotion and the overall emotion value of comments.

	Emotion score	Number of Weibo words	Is there a @ tag	Comments on the overall emotion value
Emotion score	1			
Number of Weibo words	0.009	1		
Is there a @ tag	0.020	0.215**	1	
Comments on the overall emotion value	0.393**	0.013	0.041	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Weibo comment settings, the number of remaining samples is 3,120. The related analysis results are shown in Tables 7 and 8. Data show that both prosocial emotions ($r = 0.421$, $p < 0.01$) and antisocial emotions ($r = 0.393$, $p < 0.01$) were positively correlated with the overall emotion value of the comments. Among them, social and emotion contagion is slightly stronger, and Hypothesis 2 holds.

4.4. Visualization Analysis of Pro-(Anti-) Social Posts.

After a statistical analysis of Weibo posts with prosocial or antisocial emotion tendencies, we can test the initial hypothesis that prosocial Weibo posts can promote the transmission and contagion of posts themselves. But how this influence is formed, or what characteristics it has, is also information worth mining. Therefore, this study will mainly show the logic behind this phenomenon through data.

First, in order to observe the path of prosocial posts and antisocial posts in the comment feedback and the differences between them, this study based on pro-(anti-) social

Weibo dataset generated the network topology diagram of post comments by Gephi software, as shown in Figure 2. As a whole, the topology shows that both pro- and antisocial posts have a common multidirectional interaction when they trigger comments, retweets, or likes, that is, when users respond to pro- or antisocial posts, they tend to comment, retweet, and like at the same time or respond multiple times to comments, showing more emotion interaction than ordinary posts, which can be observed from nodes of different colours in the topology (different colour nodes represent the frequency of Weibo users in comments, retweets, and likes, where orange represents the frequency of one time, and all other colour nodes represent frequencies of 2 or more). However, from the difference between the two, the orange colour nodes of prosocial posts are less, that is, the users who have comments, likes, and retweets have more secondary or multiple interactions, and the central node radius of prosocial post topology is large. This indicates that the number of comments radiated by posts is more, which is consistent with the related analysis results mentioned in this study.

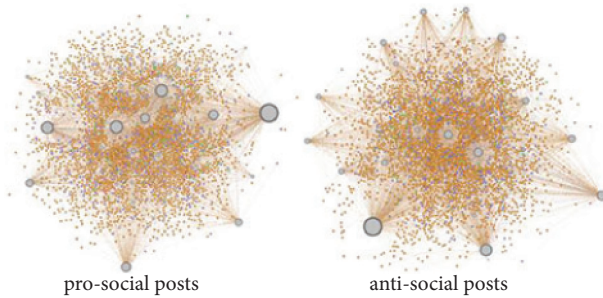


FIGURE 2: Topology of Weibo post comments.

5. Conclusions and Limitations

In the post-truth era, emotions instead of reasoning can become the tipping point of news events. Based on this phenomenon, this study attempts to explore the influence of prosocial and antisocial emotions of users in social media on the Weibo blog communication during the COVID-19 pandemic. By grasping user-related topics and analyzing prosocial and antisocial emotions during the pandemic in China, we found that the prosocial blog posts by Weibo users attracted more comments. Although antisocial blog did not have the same effect in the study, we can conclude that antisocial emotion blogs have similar contributions to the transmission of Weibo in a similar way. However, the transmission effect will have different effects depending on different people who post on microblog. Non-news Weibo prosocial emotions can generate more feedback, and negative or antisocial content in news posts can cause viral transmission. Since there is no significant positive correlation between antisocial feelings and the number of comments in the blog post on COVID-19, this study follows the principle of conservative interpretation. Because the COVID-19 pandemic, a major public health crisis, is a major national event, Weibo users are optimistic, and public opinion as a whole is positive. The public shares positive things on social media, encourage each other, and praise the “devotees” and “retrograde people” during the pandemic. This prosocial behaviour and emotion are also spreading and dominating antisocial emotions. With the continuous strengthening of the “prosocial” trend, the “antisocial” voice gradually falls silent.

In this study, the conclusion also shows that the other manifestation of the influence of social media’s pro-(anti-) emotion on the transmission of information is formed by the mechanism of emotion transmission. Hansen et al. [34] came to the same conclusion in the study on Twitter. In the event of the COVID-19 outbreak, both prosocial and antisocial responses of Weibo users have contributed to the tide of public opinion. Under microblog containing pro-(anti-) social feelings, the comments are generally more pro-(anti-) social. These conclusions are of great value and significance to the guidance of public opinion and to improve the effectiveness of information dissemination.

Compared with other studies on social media emotion communication, this paper chooses the two concepts of prosocial and antisocial emotions, which are helpful to

expand the direction of existing research. In addition, this study adopts the way of network data capture. More realistic network media social situations can avoid other subjective factors of excessive intervention, hence making the conclusions more robust. However, because this study is aimed at the single social event of the COVID-19 pandemic, there are inevitable accidents and differences. Future studies can focus on a wider range of events. The prosocial and antisocial behaviours studied in this paper only lie in the emotion expression behaviour of Weibo texts, which is one of the contents of cyberspace pro-(anti-) social behaviours. However, they cannot represent the general pro-(anti-) social behaviours. Nonetheless, the prosocial and antisocial behaviours in cyberspace are still rich and complex, which are worthy of further research [35].

Data Availability

The data were collected by an Internet web crawler technology and are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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