

Identifying Opinion Leaders in Social Media during Brand Crises: A Case Study on Haidilao Hot Pot

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ABSTRACT

In social media, opinion leaders are those who can make strong influence on the public, by posting and reposting information through online platforms. To better understand the characteristics of online opinion leaders, we propose and test a conceptual model to identify online opinion leaders, based on social impact theory and the theory of two-step flow communications. Particularly, in this paper we conduct a case study on Haidilao Hot Pot involved in a recent food-safety-related crisis. For predicting opinion leaders during the crisis, we rely on user attributes, such as number of followers and number of Weibo posts, as well as content-based features of 520 sample posts appeared on Sina Weibo, which is a dominating microblogging website in China. From these posts, using the metrics of: 1) number of reposts, 2) number of comments, and 3) number of likes, we nominate 54 opinion leaders. In a two-step analysis, a multiple regression model first proposes several promising factors to predict opinion leaders. Then, a logistic regression model further confirms the characteristics of opinion leaders in this event. Finally, we summarize our results and discuss the theoretical and practical implications of this study.

Keywords: Opinion Leader, Brand Crisis, Online Marketing Communications, Social Media.

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1. INTRODUCTION

Social media has become an integral part of our life. Tens of millions of people use social media every day to read breaking news, discuss social issues, and share personal opinions. As a prominent and unique form of social media, microblogging services enable users to create and share short messages on a real time basis. With the unique feature of instant messaging, microblogging websites such as Twitter (twitter.com) can generate voluminous heated communications regarding emerging society-wide topics. As a form of news media, Twitter is probably the best-known microblogging website in

the world, while in China a large population use Sina Weibo (weibo.com), which is a Twitter-like social media platform. Past research has widely recognized that social media can facilitate online marketing communications. Following this line of research, in this paper we aim to research the communications regarding a recent brand crisis on Sina Weibo.

Although social media can be leveraged by marketing managers to engage consumers in online communications, bad news widely spread on the internet can be disastrous. During a brand crisis, bad news can trigger significant societal percussions and threaten the public relations between a firm and its consumers. As suggested in past research, bad news travel faster and reach wider than good news (Hornik, Satchi, Cesareo, Pastore, 2015; Subramanian, Druschel, Chen, 1997). Thus, a better understanding of the viral communications about a brand crisis in social media becomes essential for both marketing practitioners and scholars.

In contrast to traditional media for marketing purpose, social media can allow marketers and consumers to interact with each other more directly and effectively. Meanwhile, some particular individuals play the role of opinion leader, given the wide influence they can make on the public. According to literature, opinion leaders in general are the important disseminators of information (Weimann, Tustin, Van Vuuren, Joubert, 2007). In online marketing communications, opinion leaders are referred to certain individuals and agencies who have product knowledge and serve the information needs of others (Leonard-Barton, 1985). Past studies have claimed that online word-of-mouth communications can be more trustworthy than brand messages (Berkman, Gilson, 1986). This is indicating that opinion leaders should play an important role in the online communications in a brand crisis. Consequently, it is theoretically important for marketing researchers to learn how to identify opinion leaders in social media, thereby providing better insights into future marketing practices.

Based on our literature review, although opinion leadership has been widely discussed in marketing literature focusing on mass media communication as well as e-WOM (Hennig-Thurau, 2004; Richins, Root-Shaffer, 1988), little is known about how to identify opinion leaders in social media environment, especially on a microblogging platform such as Sina Weibo. Therefore, we are motivated to develop this research on identifying opinion leaders in Sina Weibo, by conducting a case study of a recent brand crisis.

Specifically, we investigate a brand crisis that suddenly emerged in August, 2017. Using computational approaches, we explore whether user attributes (e.g., verification, number of posts) can help us identify opinion leaders who have the power to influence the public responses to a crisis occurred to Haidilao (haidilao.com), a famous hot pot chain restaurant originated from mainland China. We are wishing that our research would render theoretical contributions to the existing though limited literature on opinion leaders in social media, but also provide practical recommendations for marketing professionals.

2. LITERATURE VIEW AND THEORETICAL DEVELOPMENT

2.1 An Overview of Opinion Leaders

Opinion leaders are referred to individuals who have expertise in one specific area and tend to give information and provide advice to their followers (Weimann, Tustin, Van

Vuuren, Joubert, 2007). Dating back to 1940s, scholars have already recognized the significance of opinion leaders in forming public predilections, informing public audience, and influencing public perceptions and behaviors (Nisbet, Kotcher, 2009). Despite being originated from political campaigns, opinion leader is considered as a broad concept, which has been applied in various areas where informational flow occurs between more than two parties, such as innovation diffusion and marketing communications (Chaney, 2001; Leonard-Barton, 1985).

Past researchers have discussed numerous interesting facts about opinion leaders. Lazarsfeld and colleagues (1948) have depicted that opinion leaders usually track public trends and pay attention to various affairs of their interest; also, they believe opinion leaders are equipped with high self-efficacy in persuading others to adopt their opinions. Other researchers have claimed that, opinion leaders are highly involved in mass media (Myers, Robertson, 1972; Troidahl, Van Dam, 1965), highly motivated to share information with others (Weimann, Tustin, Van Vuuren, Joubert, 2007), widely connected with other users in social network (Park, Thelwall, 2008), and they may have more access to ample information sources and more platforms readily accessible to disseminate a wide range of information (Himmelboim, Gleave, Smith, 2009).

In social media contexts, opinion leaders can make a strong influence on the public, by actively participating in the flow of online information, such as posting and reposting the latest news on a website. Particularly, opinion leaders have larger scales of social network and higher levels of civic involvement (Rogers, 2003; Vishwanath, Barnett, 2011). With easy access to online information, nowadays ordinary users can potentially become opinion leaders and influence mass audiences while sharing opinions with others (Himmelboim, Gleave, Smith, 2009). Past studies have suggested that, opinion leaders can not only produce and spread information for the public, but also induce others to disseminate the related information (Cha, Haddadi, Benevenuto, Gummadi, 2010; Phelps, Lewis, Mobilio, Perry, Raman, 2004; Weimann, Tustin, Van Vuuren, Joubert, 2007).

2.2 Two-Step Flow of Communications

In the existing literature addressing opinion leaders, the most celebrated conceptual model for studying opinion leadership is the classical theory of two-step flow communications. Two-step flow theory posits that opinion leaders are capable of influencing their close personal ties by exerting social pressure and social support (Lazarsfeld, Berelson, Gaudet, 1948). According to literature, opinion leaders have the four main facets as follows (Dubois, Gaffney, 2014).

- 1) Opinion leaders have considerable amount of followers to serve as a receiver for opinions and information from them.
- 2) Opinion leaders are trusted by followers as an expert in a specific area.
- 3) Opinion leaders hold expertise in a specific area, which is greater or better than average audience.
- 4) Opinion leaders are connected with their followers in a community.

As discussed earlier, opinion leader concept, tightly connected with word-of-mouth of products, can be further applied in marketing practices. The rationale behind the importance of opinion leaders in marketing communications can be explained by the theory of two-step flow communications. For instance, brand messages sent by

marketing professionals transmit to opinion leaders who receive the information and further forward to their followers. Given the relatively high levels of trustworthiness of opinion leaders, they can make a difference in influencing consumer behaviors and attitude towards the products and the brands (Buttle, 1998). In a brand crisis situation, the role of opinion leaders can be further accentuated, as they can either reinforce or mitigate the disastrous or favorable effects of certain online discussions related to the crisis. Overall, the theory of two-step flow communications justifies the significance of opinion leaders in social media, but also proposes some important attributes of opinion leaders.

2.3 Social Impact Theory

In social media, opinion leaders are tantamount to online influentials who exert excessive social influence on others (Baskshy, Hofman, Mason, Watts, 2011). Social impact theory, focusing on the social influence of other parties on individuals, can well explain the characteristics of opinion leaders.

Social impact theory indicates that for one individual, his or her feelings, attitudes and corresponding behaviors can be positively or negatively influenced by other individuals in the society (Latané, 1981). Social impact from actions made by certain influentials can possibly entail alterations, in one's behaviors in a physiological way, in one's feelings in an emotional and psychological way, and in one's values in a cognitive way (Latané, 1981; Nowak, Szamrej, Latané, 1990). According to social impact theory, the magnitude of social impact is determined by the three factors as follows.

- 1) Strength of the source: social presence can have different pervasive power in terms of different authorities and positions of one individual. With greater strength of the source, the social impact tends to be larger.
- 2) Social size: the size of the influential can increase the social impact one has on others while it is not limited to physical size.
- 3) Immediacy: a time lag exists between the time when some information is sent or certain actions are taken and the time when the information is received by one individual. With a more immediate source, the social impact tends to be larger.

The appeal of this theory arises from its generalizability in various contexts and a testable nature to be further tested using a particular case. In a study of communication about social events, the theory can indicate how influentials are involved in the events and how influentials influence others over time. In particular, one's influence on others through social media can be specified as informational influence, which refers to the influence realized by one's accepting information from others (Deutsch, Gerard, 1955; Kwak, Ge, 2012). In social media, one can search for information via keywords, gain knowledge from posts, and make decisions regarding whether or not to accept the belief or the knowledge of other individuals. According to social impact theory, individuals are physiologically, psychologically, and cognitively influenced by opinion leaders. In particular, opinion leaders can be important during a brand crisis, as consumer decisions (e.g., purchase intention) are practically crucial to firms (Komaladewi, Indika, 2017).

2.4 Conceptual Framework

We believe that opinion leaders have certain attributes that can differentiate them from average audiences, and those with such attributes can potentially make strong influences



Figure 1. A sample post discussing Haidilao event on Sina Weibo

on the public. Given the important role and unique features of opinion leaders, in this study we aim to explore the attributes that identify opinion leaders in social media.

Before we start to discuss the potential attributes of opinion leaders, we should first briefly discuss the interface and basic functions of Sina Weibo as a specific platform. In general, Sina Weibo is a microblogging website similar to Twitter, where people read and spread news as well as participate in wide discussion. As shown in Figure 1, a sample post reporting the Haidilao's hygiene and cleanliness issues has been published on Sina Weibo on August 25, 2017.

For research purposes, we can collect message-related information as displayed, including: 1) number of reposting, 2) number of comments, 3) number of likes, and 4) time of posting. Also, we can retrieve user attributes from account profiles, including: 1) number of followers, 2) number of following, 3) number of Weibo posts, and 4) verification status. Additionally, content-based features can be obtained, including: 1) URL, 2) mention (@), and 3) hashtag (#). Then, we propose to research the behavioral constructs of opinion leaders in a comprehensive model. In the following sub-sections, user attributes, content-based features, as well as the indicators of the influence of opinion leaders are discussed separately. With the proposed conceptual model, we then conduct an empirical case study on Haidilao brand crisis.

2.4.1 Number of Followers

Number of followers, counts the number of followers that one user has. In Sina Weibo, users can receive updated messages from those they follow. Past studies on Twitter and Sina Weibo have noted that, number of followers is a robust measure for social influence. Moreover, researchers have adopted number of followers as an indicator of online opinion leader (Zhang, Zhao, Xu, 2015). Furthermore, number of followers, is considered an appropriate measure of “social size” according to social impact theory and “have a following” based on two-step flow hypothesis.

2.4.2 Number of Following

Number of following measures how many accounts one user follows to receive updated information. In particular, number of following can measure the social embeddedness addressed in two-step flow hypothesis. How many accounts one is subscribing suggests the size of virtual community and how widely the user is connected with others. Past research has noted that number of following can be an indicator of opinion leaders too, but it is less robust than number of followers (Zhang, Zhao, Xu, 2015).

2.4.3 Number of Weibo Posts

Number of Weibo posts measure how many posts on Sina Weibo one user has posted since the start of user life. Although number of posts is not directly originated from both theories in our literature review, it is a meaningful factor because it measures social activeness of users. Also, we consider a sub-indicator – number of Haodilao posts, referring to how many Haidilao-related posts a user has posted during user life. The rationale is that opinion leaders have expertise in a specific area, as suggested in two-step flow of communications.

2.4.4 Verification Status

The capitalized “V”, a distinctive function of Sina Weibo, indicates whether one person is verified and what status one has. Different verification status has different colors of the letter “V” displayed after username. Verification status recognized on Sina Weibo includes: 1) verified institution, 2) verified individual, 3) verified Daren, 4) verified Member, and 5) non-verified. The qualification for Daren (English: Elite) and Member is looser than the process to become verified institutions and verified individuals.

According to social impact theory, verification status of users indicates one dimension of social impact, strength of the source. Past studies on Sina Weibo have adopted such feature as a typical measure of social influence through social media (Nip, Fu, 2016; Zhang, Zhao, Xu, 2015).

2.4.5 Content-based features (URL, #Hashtag, @, and Length of Weibo Posts)

First, the variable URL measures whether URL is included in a post. Typically, the website link embedded in a Weibo post directs individuals to the website for detailed information. Second, #Hashtag is operationalized as a dummy variable pertaining whether any hashtag is present in the post. The variable @ is also a dummy variable with respect to the existence of “@” to directly mention someone on Sina Weibo. Last, length of Weibo posts is referred to the count of the characters in a post, indicating the informativeness of the post. Although in this study we mainly focus on user attributes as

discussed earlier, content-based features have been commonly recognized in past research, and thus, we include these factors in our exploratory analysis.

2.4.6 Time Cycle of Event

In the whole lifespan of an event, time cycle considers the exact time when a post is published. We suppose that the full timeframe of an event can be divided into several stages and indicate the immediacy of one's posting and reposting related information, according to social impact theory. In particular, individuals publishing a short message immediately after the occurrence of an event can get considerable attention from the public.

Based on the discussion above, Table 1 lists the promising indicators of opinion leaders in social media during a brand crisis.

Indicators	Social Impact Theory	Two-Step Flow Hypothesis
Number of followers	Social Size	Have a following
Number of following		Social embeddedness
Verification status	Strength of the source	
Length of Weibo posts		Expertise
URL		Expertise
#Hashtag		Expertise
@		Social embeddedness
Time Cycle	Immediacy	Expertise
Number of Haidilao posts		Expertise

Table 1. A list of opinion leader indicators based on past literature

2.4.7 Repost, Comment, and Like

In this study, we regard repost, comment, and like as the three metrics to differentiate opinion leaders from ordinary users. Considering how many reposts, comments, and likes that one individual receives from a post, the person can be defined as opinion leader versus non-opinion-leader. These measures of opinion leader have commonly been adopted to capture the magnitude of social impact through social media (Borge Bravo, Esteve Del Valle, 2017).

Taken together, a conceptual framework is presented in Figure 2, in attempts to detect opinion leaders in social media.

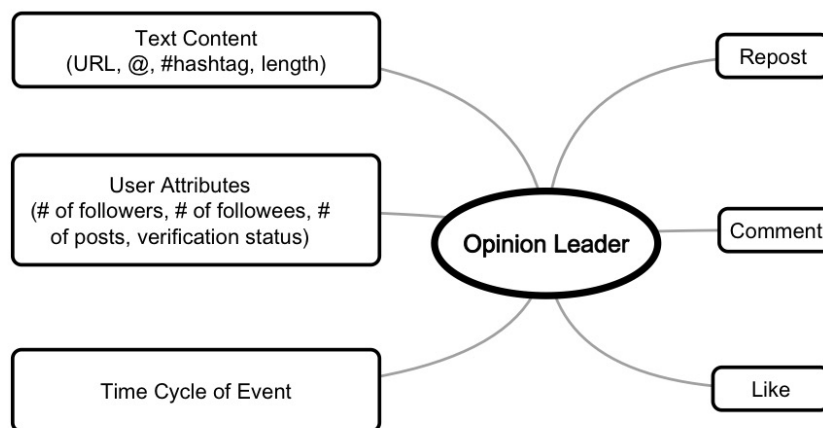


Figure 2. A conceptual model of identifying opinion leaders in social media

Of the factors shown in Figure 2, 1) number of followers, 2) number of following, 3) verification status, 4) number of Haidilao posts are user attributes while 5) length of weibo posts, 6) URL, 7) hashtag, and 8) @ are content features. In addition, 9) time cycle of event can explain how immediately one individual responds to news and share it with others, which is considered an attribute of user behavior on Sina Weibo.

To summarize, a comprehensive research model should include all these factors, yet we are more focused on user attributes. Particularly, we test the hypothesis stating that the factors as mentioned above can significantly influence the likelihood that one's Weibo post is reposted, commented, and liked, indicating whether an individual is opinion leader or not.

3. METHODS

3.1 Case Description

On August 25, 2017, a news report first released by Legal Evening News appeared on Sina Weibo, revealing some serious issues of hygiene and cleanliness related to Haidilao, which is one of the most successful hot pot restaurants in China. In contrast to its positive image of providing superior services to customers, the news revealed the concealed side of a famous brand, such as Haidilao. Specifically, the news showed an inferior level of Haidilao's food and service quality, by displaying several pictures taken by a reporter in its Jinsong and Taiyanggong store, including: 1) mouse appeared in the kitchen, 2) besom washed together with tableware, and 3) soup spoons used for picking up rubbish from the sewer. The unfavorably disgusting images shocked many citizens and massive complaints and criticisms suddenly became viral in social media, which is contradictory to Haidilao's claim for the always best services to customers. These pictures and related comments rapidly spread on Sina Weibo and were widely viewed and forwarded by thousands of times in the following two weeks.

3.2 Data Collection

We collected information about Weibo posts and the corresponding authors, so that user- and content-related data can be tested as the potential indicators of opinion leaders in social media. Within a two-week time frame since the crisis suddenly emerged, 520

Weibo posts addressing Haidilao's kitchen problems were captured by a webcrawler. The data set contains information as follows: username, verification status of user, time of posting, post content, number of reposts, number of comments, and number of likes for each Weibo post captured. For each of the 520 post authors, user attributes such as number of followees, number of followers, and number of total Weibo posts, were also recorded in the data set. Furthermore, additional information about the 520 individuals spreading Haidilao crisis news were retrieved through user profiles available on one's main page of Sina Weibo, including gender, user life, and frequency of posting. Last, as past studies have commonly adopted content-based features such as the use of @ and # as well as the inclusion of an URL.

3.3 Data Analysis

Our analysis aims to explore the factors that can potentially identify opinion leaders in social media during Haidilao brand crisis. We divide the analysis into two steps: 1) use a multiple regression model to explore these factors, and 2) develop a logistic regression to replicate and validate the results obtained in 1).

For multiple regression modeling, we operationalize the independent variables as the information collected from SinaWeibo by the webcrawler. Meanwhile, following past studies we use the behavioral metrics, including number of reposts, number of comments, and number of like, to indicate the relatively strong or weak social influence of individuals through communications on Sina Weibo (Lee, Hosanagar, Nair, 2018; Tafesse, 2016). Accordingly, with large number of reposts, comments, and likes, one is considered an opinion leader while others receiving few responses are not.

In a logistic regression model, we rely on a single binary dependent variable, for each individual to be identified as an opinion leader (= 1) or not (= 0). In contrast to least square estimation in linear regression, logistic regression relies on maximum likelihood estimation with error that conforms to logistic distribution. In this study, logistic regression predicts the probability of opinion leaders, based on the following function:

$$Z = \log\left(\frac{p(x_i)}{1 - p(x_i)}\right) = \beta_0 + \sum_{j=1}^n \beta_j x_{ij}$$

$$L(\beta_0, \beta_i) = \prod_{i=1}^n p(x_i)^{y_i} \{1 - p(x_i)\}^{1 - y_i}$$

where Z is a discriminant score, $p(x_i)$ is the probability that a user is considered an opinion leader, y_i is the binary dependent variable, β_0 is the intercept of the model, β_i is the maximum likelihood estimator. The logistic regression further relies on a numeric technique, Newton method, to approximate β_0 and β_i to maximize $L(\beta_0, \beta_i)$.

For developing multiple regression and logistic regression models, the details are presented as below (Table 2).

Independent Variable	Dependent Variable (1. Multiple Regression)	Dependent Variable (2. Logistic Regression)
1) # of followers 2) # of following 3) Verification status 4) # of Haidilao posts 5) Length of Weibo posts 6) URL 7) Hashtag 8) @ 9) Time cycle of event	1) # of reposts 2) # of comments 3) # of likes	1) Opinion Leader (0 = no, 1 = yes)

Table 2. Independent variables and dependent variables used for modeling

Our results are expected to depict the main characteristics of opinion leaders, as extracted from a multiple regression model. Then, results are further tested and confirmed by using a logistic regression model. We suppose that a logistic regression should yield similar results to a multiple regression, but also make our findings easy to interpret and insightful for future research and practices.

4. RESULTS

Our results are presented as follows. First, we make the descriptive statistics of the four user attributes proposed (i.e., # of followers, # of following, # of posts, and verification status) with respect to the three dependent variables in question (i.e., repost, comment, and like). Second, we report the results of two multiple linear regression models for opinion leader identification. Third, the application of logistic regression model in characterizing opinion leaders is discussed.

4.1 Descriptive Statistics

As social impact theory implies the importance of immediacy in determining the magnitude of social impact, we first take a close look at the distribution of reposts, comments, and likes, in the entire time frame of the event. Further, the importance of time in social event progression has also motivated us to explore how crisis-related information is spread across time. Initially, we split the time of the event, totally thirteen days or 312 hours, on a three-hour basis. As commonly used for quantifying data of wide range, we have taken the following adjustments on our dependent variables:

$$(i) \textit{Repost} = \textit{Ln}(\textit{Repost_count} + 1)$$

$$(ii) \textit{Comment} = \textit{Ln}(\textit{Comment_count} + 1)$$

$$(iii) \textit{Like} = \textit{Ln}(\textit{Like_count} + 1)$$

As Haidilao crisis has emerged, progressed, and deceased over time, the overall posts discussing this event gradually reduced in size and eventually disappeared on Sina Weibo, from our observation. Figure 3 presents three graphs realized by summing up

the amount of reposts, comments, and likes in every split time frame of the first four days since the occurrence of Haidilao crisis on August 25, 2017.

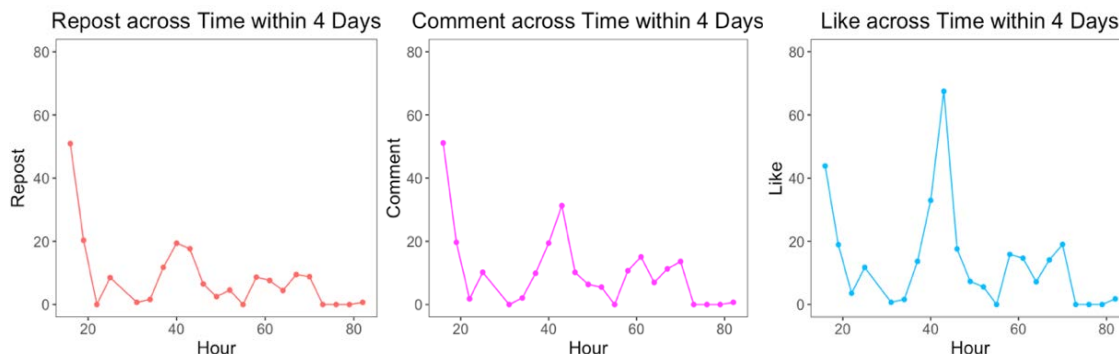


Figure 3. The distribution of reposts, comments, and likes of Haidilao posts

The presented graphs are explicable in terms of the three major conspicuous spikes in the whole time range. Accordingly, to capture time effects on opinion leader detection, we have employed a new variable named “Time Cycle”, by dividing the full life span of Haidilao crisis into four discrete time ranges: (1) Time Cycle 1: 0 to 18 hour since the inception of the event, (2) Time Cycle 2: 18 to 51 hour, (3) Time Cycle 3: 51 to 60 hour, and (4) Time Cycle 4: 60 hour to 312 hour (i.e., until the last day that Haidilao-related posts appeared on Sina Weibo).

Since the range of number of followers, number of following, and number of Weibo posts is considerably large and volatile, we have adjusted these variables in the following similar way as the method applied to number of reposts, comments, and likes:

$$(i) \textit{Followers} = \textit{Log10}(\textit{Number of Followers} + 1)$$

$$(ii) \textit{Following} = \textit{Log10}(\textit{Number of Following} + 1)$$

$$(iii) \textit{Weibos} = \textit{Log10}(\textit{Number of Weibo Posts} + 1)$$

Additionally, since repost, comment, and like are all objective measures for identifying opinion leaders, we have combined them into one dependent variable: Opinion Leader Index. The following formula presents how Opinion Leader Index is computed:

$$\textit{Opinion Leader Index} = \textit{Repost} + \textit{Comment} + \textit{Like}$$

Since we believe a log-like relationship is more reasonable for user attributes and continuous opinion leader index, we will adopt the metrics of: 1) followers, 2) following, and 3) Weibos in the multiple regression to explore the factors for predicting opinion leaders. However, to construct model in a real-world setting, we will use unaltered number of followers, following, and Weibo posts in the logistic regression where we use binary dependent variable rather than opinion leader index.

The following scatter plots, shown in Figure 4, present the relationships between opinion leader index and followers, following, and Weibos, by considering verification status. To clarify, verification status of individuals and agencies is administered by Sina Weibo, including: 1) verified individual, 2) verified institution, 3) verified member, 4) verified “daren” (English: Elite), and 5) non-verified. The exponential-like trend indicates a strong correlation between opinion leader index and these three indicators.

Two-way analysis of variance (ANOVA) indicates that there are significant differences between users with different verification status and varying followers ($p < .001$) and following ($p < .001$); however, there is no significant difference between users with different verification status and Weibos ($p = .954$).



Figure 4. The relationships between opinion leader index and user attributes

We have also noticed relatively small differences between member, daren, and non-verified individuals in terms of opinion leader index, but they tend to be different from verified individuals and institutions. So, we classify them into one group called “Others”, and present the following boxplot in Figure 4 to confirm the significant differences between verified individuals, verified institution, and other groups.

In a nutshell, the descriptive statistics presented above reveal that followers, following, Weibos, and verification status are potentially promising factors for predicting opinion leaders, shedding light on our further analysis.

4.2 Multiple Regression Model

4.2.1 Model 1: a comprehensive model with all proposed factors

Even if heteroskedascity interferes with accurate estimator variance, we checked that the results of ordinary least square and generalized least square regression do not differ in terms of statistical significance. Thus, we employed ordinary least square no-intercept regression, which avoids dummy variable trap. According to Table 3, followers ($p < .001$), following ($p < .05$), Weibos ($p < .01$), length of Weibo posts ($p <$

.05), number of Haidilao posts ($p < .001$), and time cycle ($p < .01$) are shown to be insignificant. However, results suggest that verification status has no significant relationship with opinion leader index. Other content features such as @, #hashtag, and URL are also proved to be statistically insignificant with respect to opinion leader index. Overall, our results present F -Statistic of 33.66, $p < .001$, and adjusted R-square of .45, and turn out to be statistically robust. In addition, we adopted Akaike information criterion (AIC) as an estimator of the relative quality of models, which focuses on the trade-off between goodness of fit and dimensions. The results show an AIC of 2370.00.

Variables	Estimate	Standard Error	Significance
Daren	.27	.85	$t = .32, p = .75$
Verified Individual	-.87	.57	$t = -1.53, p = .13$
Verified Institution	-.52	.58	$t = -.89, p = .37$
Verified Member	-1.08	.74	$t = -1.46, p = .14$
Non-verified	.15	.52	$t = .28, p = .78$
Followers	1.45	.14	$t = 10.74, p < .001$ ***
Following	-.43	.21	$t = -2.02, p < .05$ *
Weibos	-.52	.18	$t = -2.85, p < .01$ **
@	.19	.30	$t = .62, p = .53$
#Hashtag	-.42	.22	$t = -1.88, p = .06$
URL	.03	.35	$t = .09, p = .93$
Length of Weibo Posts	.00	.00	$t = 2.01, p < .05$ *
Number of Haidilao Posts	.06	.01	$t = 5.83, p < .001$ ***
Time Cycle	-.34	.11	$t = -2.99, p < .01$ **
$F(14,503) = 33.66, p < .001$ ***, adjusted $R^2 = .45$, AIC = 2370.00			

Note: Significance level: *** < .001, ** < .01, * < .05.

Table 3. Model 1: a comprehensive model including all factors

4.2.2 Model 2: a simplified model with selected factors

To improve model efficiency, we have attempted to eliminate those statistically insignificant factors from Model 1 and mainly focus on user attributes along with other related factors, such as Weibos, number of Haidilao posts, and length of Weibo posts. Table 4 summarizes the results of the simplified model, including a short list of potentially significant factors of our main research interest. As expected, those statistically strong indicators of opinion leaders have remained the same in the simple model, except length of Weibo posts cannot be considered as strongly significant ($p = .06$) in Model 2. Specifically, our results show F -statistic of 43.21, $p < .001$, adjusted R-square of .45, and AIC of 2368.43. Given that AIC becomes slightly lower but

adjusted R-square is not affected, we believe Model 2 is more efficient as it is simple but remains robust.

Variables	Estimate	Standard Error	Significance
Daren	.25	.85	$t = -.07, p = .94$
Verified Individual	-.84	.57	$t = -1.91, p = .06$
Verified Institution	-.48	.60	$t = -1.29, p = .20$
Verified Member	-1.04	.75	$t = -1.55, p = .12$
Non-verified	1.66	.53	$t = .07, p = .95$
Followers	1.45	.14	$t = 10.79, p < .001$ ***
Following	-.43	.21	$t = -2.24, p < .05$ *
Weibos	-.53	.19	$t = -2.38, p < .05$ *
Length of Weibo Posts	.00	.00	$t = 1.92, p = .06$
Number of Haidilao Posts	.06	.01	$t = -5.88, p < .001$ ***
Time Cycle	-.34	.11	$t = -2.72, p < .01$ **
$F(10,507) = 43.21, p < .001$ ***, adjusted $R^2 = .45$, AIC = 2368.43			

Note: Significance level: *** < .001, ** < .01, * < .05.

Table 4. Model 2: a simple model mainly focusing on user attributes

Given that verification status alone is not significantly related to opinion leader index, we further draw a regression plot to discover the interaction effect between verification status and followers, as the most significant factor.

As shown in Figure 5, the relationship between followers and opinion leader index holds true only for verified individuals and verified institutions, but not for other groups.

4.2.3 Logistic Regression

After gaining insights from previous multiple regression models, we further apply a binomial logistic regression to identify opinion leader versus non-opinion-leader. Although a multiple regression model can provide conclusive results regarding opinion leader identification, in a real-world situation scholars and practitioners are more inclined to consider a dependent variable that switches from 0 (i.e., not opinion leader) to 1 (i.e., opinion leader). To convert the three metrics, number of reposts, number of comments, and comment of likes, into a dummy variable, we have used the strategy as follows: 1) determine the 7% percentile value in each metric and select observations exceeding the value respectively, and 2) taking the three metrics together, select observations exceeding the 7% threshold value at least in one metric and label as 1 for opinion leader and 0 for non-opinion-leader. We end up with 54 observations standing out as opinion leaders. The model specification is shown in the formula below:

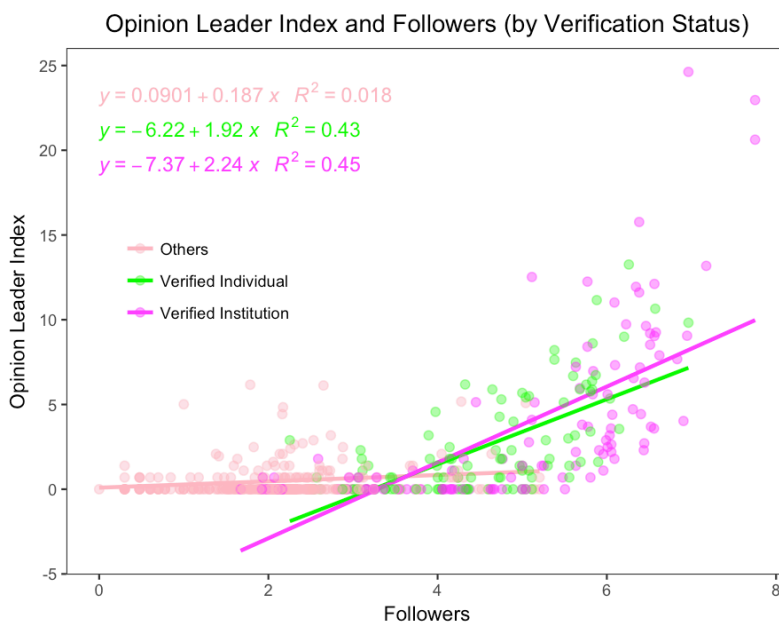


Figure 5. Verification status moderates the relationship between followers and opinion leader index

Opinion Leader

$$= \frac{1}{1 + \exp\{-(\beta_0 + \beta_1 * \text{Number of Followers} + \beta_2 * \text{Number of Following} + \beta_3 * \text{Number of Weibo Posts} + \beta_4 * \text{Number of Haidilao Posts} + \beta_5 * \text{Verification Status} + \beta_6 * \text{Time Cycle})\}}$$

As shown in Table 5, we see McFadden R-square of .38 and AIC of 181.90. The results indicate that verification status, number of followers, and number of Haidilao posts remain to be statistically significant in differentiating opinion leaders from ordinary users. Particularly, non-verified individuals are unlikely to be opinion leaders. For those who have posted numerous posts related to Hadilao in the whole user life, they are more likely to be opinion leaders. In addition, number of followers turn out to be the most statistically robust factor of discriminating opinion leaders versus other individuals.

To evaluate the performance of our logistic regression, we have drawn receiver operating characteristic (ROC) curve to illustrate the discriminating power of the model applied. False positive rate measures Type I error while true positive rate indicates predictive power. Also, we have employed area under curve (AUC), a metric of classification accuracy, to evaluate our model. As shown in Figure 6, AUC is .9274, which is significantly higher than the probability associated with random guess (i.e., .50). The results indicate that opinion leader identification using the proposed logistic regression is promising.

Variables	Estimate	Standard Error	Significance
Daren	-4.09	1.35	$z = -2.64, p = .01^{**}$
Verified Individual	-.32	.72	$z = .83, p = .41$
Verified Institution	-1.11	.80	$z = -1.39, p = .16$
Verified Member	-.93	1.20	$z = -.78, p = .44$
Non-verified	-3.66	1.18	$z = -3.11, p < .01^{**}$
Number of Followers	.00	.00	$z = 10.79, p < .001^{***}$
Number of Following	.00	.00	$z = .17, p = .87$
Number of Weibo Posts	-.00	.00	$z = -1.14, p = .25$
Number of Haidilao Posts	.03	.01	$z = 2.23, p = .03^{*}$
Time Cycle	.20	.24	$z = .83, p = .41$
McFadden $R^2 = .3815$, AIC = 181.90			

Note: Significance level: *** < .001, ** < .01, * < .05.

Table 5. Logistic regression for predicting opinion leaders

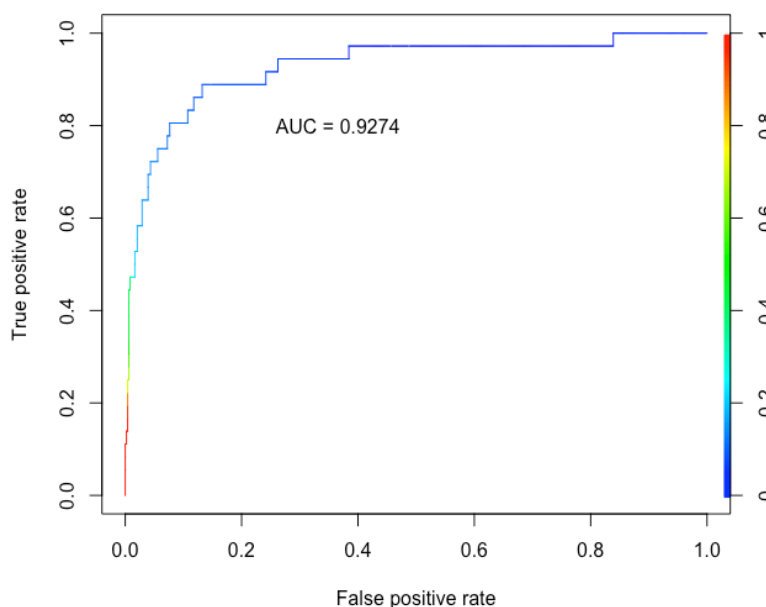


Figure 6. ROC plot of logistic regression

5. GENERAL DISCUSSION

In this study, we have proposed to test the two-step flow communications and social impact theory, by conducting a case study on Haidilao brand crisis. We have gathered

information from Sina Weibo and developed multiple regression and logistic regression models to identify opinion leaders during the crisis. Our results present significant indicators of opinion leader, including: number of followers, number of following, number of Weibo posts, number of Haidilao posts, and time cycle of the event. These findings provide evidence to accept or reject what has been suggested by past research mainly addressing social impact theory and two-step flow communications.

Furthermore, verification status turns out to be insignificant for identifying opinion leaders using multiple regression model; however, according to logistic regression, verification status, at least being non-verified, is significantly related to opinion leaders. Also, there is an interaction between number of followers and verification status in determining opinion leaders. To extend this discussion, in the future we can directly capture the effect of verification status on opinion leadership, as well as the interplay of verification status and other user attributes in predicting opinion leaders. In addition, several content-based features are found to be significantly related to opinion leader in social media. Although in this study we are more focused on user attributes, the characteristics of Weibo posts along with the attributes of the corresponding authors remain to be interesting topics for future research to explore.

The contributions of this research are threefold. First, given the lack of attention to social media communication, this study provides empirical evidence for us to better understand brand crisis communication in social media contexts. In the academia of brand crisis communication, a large body of studies have long been focused on communication strategies rather than the influence of individuals (e.g., Coombs, 2006; Coombs, Holladay, 2012; Liu, Kim, 2011). Our study has addressed this limitation. Second, past researchers on marketing communications have overlooked the whole event across a wide time span. In this study, we seek the opportunity to contribute to existing literature, by studying brand crisis communications in the lifespan of the crisis event. Third, to our best knowledge, we are the first one to combine two-step flow hypothesis and social impact theory in a study to conceptualize opinion leaders in social media during a brand crisis.

There are several limitations to be addressed. First, in this study we have focused on quantitative data, such as number of followers and number of reposts, but have not yet analyzed any qualitative data collected. A future study can rely on the available data and conduct content analysis to gain more insightful findings, so that one can better understand how opinion leaders influence their audiences in social media. With the expected findings, marketers can learn how to facilitate marketing communications by recognizing the important role of online opinion leaders. Second, for the results to be more generalizable, a larger sample should be collected and analyzed. Particularly, future research can explore additional cases in different settings, by considering different cultures and different social media platforms, in attempts to replicate and validate the current findings. Third, as marketing communications in social media are usually two-way and involve multiple parties, including firms, general audience, and influential individuals such as opinion leaders, a future study is suggested to examine the influence of opinion leaders in a dynamic social media environment.

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