Feelings and Perspective Matter: Sharing of Crisis Information in Social Media

Rongjuan Chen
Stevens Institute of Technology
rchen@stevens.edu

Yasuaki Sakamoto
Stevens Institute of Technology
ysakamot@stevens.edu

Abstract

Why do people spread disaster-related news in social media? To address this question, we analyzed people's tendency to share information discussing the Great East Japan Earthquake and the feelings that they experienced after reading the information in three conditions: when they were asked to think about themselves in a disaster center, when they were asked to think about another person, John, in a disaster center, and when they were not asked to take any perspective. A previous work showed that people who imagined themselves in a disaster center, Fukushima, Japan, were more likely to share related information. We successfully replicated the previous work and extended it by suggesting that feelings could predict the likelihood of information sharing. In this paper, we reported our new findings, proposed a model of information sharing during disaster response, and provided practical implications for advancing the effective use of social media technologies for crises management.

1. Introduction

According to a recent report, the number of monthly active users of Twitter has exceeded 200 millions [43]. Twitter and other social media technologies have become our everyday tools. During an emergency event, such as a natural disaster, social media become increasingly important real-time communication channels, through which people converse with each other and exchange related information [5, 21]. By sharing the information about an event in social media, people not only form their individual opinions, attitudes, and beliefs but also participate in collective behavior in response to the event [9, 35]. For example, on Twitter a local resident might report some damages in the aftermath of an earthquake, by posting a short message, called "tweet", containing 140 or fewer characters. People who read it can repost the message, called "retweet", if they decide to share it.

In social media, credibility of information varies [1, 8]. Although useful information can help people make sense of the world in most situations, there is a chance that misinformation is passed along and negatively affects our societies. Given that information can reach far and wide in social media, a better understanding of how people perceive and why they share information during disasters might be useful. For example, research on how disaster-relevant information is spread can inform us the best practice on how to develop social media technologies that can promote the spread of useful information while minimize the spread of harmful information [8, 22, 37].

Many studies on diffusion of disaster-relevant information in social media have examined the collective behavior in response to crises within a particular social media system such as Twitter and Sina-Weibo [29, 35]. However, less is known about whether certain psychological factors, such as subjective feelings, can influence the behavior of sharing information. Decision-making literature suggests that emotion interacts with cognition and they together determine human behavior [31, 32, 48]. Different types of feelings will focus individuals' attention on different aspects of information and therefore direct their decisions [46]. In other words, how people perceive and feel about a message posted on social media can influence their decision about whether or not to share it. In the current work, we investigated the relationship between the feelings that people experienced after reading a tweet about the Great East Japan Earthquake and their likelihood of retweeting the tweet.

Our work has made several theoretical and practical contributions. First, we developed a model that could predict the likelihood of sharing disaster-related news on Twitter. Second, we extended past research on feelings [17, 31, 32, 33] and perspective taking [14, 15] to information sharing. Third, we tested the usefulness of past work on classifying

978-1-4799-2504-9/14 $31.00 © 2014 IEEE
DOI 10.1109/HICSS.2014.248

feelings [11] in predicting the spread of information in social media. Finally, we provided practical suggestions for using and managing social media content during disasters.

2. Background

2.1. Information sharing

Social media have been widely recognized as important real-time communication tools. During disasters, information posted in social media becomes more accessible thanks to the development of mobile technologies. In particular, Twitter has played a critical role of broadcasting information and coordinating responses during a series of disasters caused by the Great East Japan Earthquake, which occurred on March 11, 2011. However, the spread of false rumors on Twitter caused stress of citizens and interfered with disaster management by the government [1, 36, 37]. Given these observations, it is essential to study how people share disaster-relevant information in social media.

Spreading information in social media is not so effortful. For example, retweeting is a well-known function on Twitter, with which people can broadcast news to their followers. The public can also view the news if reposted. Related to retweeting behavior, a past study has suggested that people would be more likely to share the information that has been previously shared by many [30]. Understanding why people share information in social media can help us predict information virality and find a possible means to direct public opinions particularly in critical situations.

Of course, there are many variables that could influence information sharing behavior such as involvement in the disaster and the ability to think critically during the disaster [36, 37]. In the current work, we focused on people's distance from the disaster center and the feelings they report as factors that might affect the sharing of disaster-relevant information [10]. Moreover, we investigated how distance might relate to feelings.

2.2. Social distance

According to construal-level theory, social distance between self and other can influence how people construe information and make decisions [28, 40, 41]. Past research has confirmed a significant effect of social distance on human decision-making [25, 47]. Also, perspective-taking research, in which researchers typically instructed subjects to focus on self or other, has also demonstrated the effect of social distance [14, 15].

In a previous study on how people spread news, a researcher found that people were more likely to pass along news when they perceived themselves more involved in the event [20]. When considering self in a disaster center, would people be more engaged in understanding a disaster situation and consequently become more likely to spread related news? Our past work has found a significant effect of social distance on information sharing, and we were interested to see if the results could be replicated in the current work.

2.3. An empirical work on distance effects on information sharing

Chen and Sakamoto's work (2013) has revealed a significant effect of social distance on information sharing [10]. In their experiment, subjects were first presented a tweet (see Figure 1). Then they were: (1) asked to think about themselves in Fukushima, Japan, and report how they would feel about the tweet, (2) asked to think about another person, John, in Fukushima, Japan, and report how John would feel, or (3) not asked to take any perspective but were asked about their feelings about the tweet. We presented 200 tweets in a random order in each condition. The main finding of this work was that subjects who imagined themselves in a disaster center were more likely to retweet the tweet.

> RADIATION leaking from FUKUSHIMA power plant should be monitored more closely http://bit.ly/ii3ikI

Figure 1. An example tweet subjects read

One goal of the current work was to successfully replicate the previous work. While past work has discussed some preliminary analyses of feelings, no clear conclusion has been made. So, another goal of the current work is to explain the relationship between feelings and information sharing behavior.

2.4. Feelings-as-information

Emotion is contagious in social media [18]. An individual creates a message to express attitudes, opinions, and beliefs. Others who read the message would most likely generate some feelings as feedback [19, 27, 39].

The feelings-as-information theory proposes that feelings can influence various judgments, including people's perceptions of truthfulness, risk, intelligence, and liking (see [17, 31, 32, 33] for

reviews). Similarly, feelings might affect people's intention to share these messages.

People experience certain feelings when reading news about the Great East Japan Earthquake. Using tweets subjects saw as examples, a message addressing "FUKUSHIMA caused world's worst sea pollution" might make people angry while another message mentioning "TSUNAMI aid not reaching victims" might make people sad. Past research in psychology suggests two general classes of feelings that can affect people's information sharing behavior: valence and arousal.

Feelings vary on valence. Feelings can be positive (e.g., happy) or negative (e.g., sad). Past research proposed that positive and negative emotions would result in different behaviors [44]. In particular, people prefer to spread bad news more than good news [20, 24]. This indicates that valence of feelings, being positive or negative, can predict the likelihood of sharing information.

Feelings also vary on physiological arousal [34]. Some feelings, such as anger and anxiety, are more closely linked to activity, or high arousal. Other feelings, such as sadness and depression, are more closely related to relaxation, or low arousal. In a past work, researchers classified the emotions expressed by Twitter users and found significant associations between different types of emotional states and various user behaviors, such as frequency of usage, sociality, and activity level [11]. A study on information virality found that both valence and arousal could explain why certain contents were more likely to be shared in social media [4]. The researchers claimed that an article published on *the New York Times* (*www.nytimes.com*) that made people feel angry or anxious was more likely to be recommended to friends via email. This indicates that arousal of feelings, being excited or calm, can predict the likelihood of sharing information.

In short, past research supports a classification of feelings based on valence and arousal and suggests that feelings will affect information sharing behavior.

3. Hypotheses

Although a previous work indicated that thinking about self in a disaster center would result in people's negative feelings and therefore increase their likelihood of sharing, no direct evidence has been provided [10]. In this paper, we directly tested whether feelings vary across three conditions: (1) when subjects were asked to think about themselves in Fukushima, Japan, (2) when they were asked to think about another person, John, in Fukushima, Japan, and (3) when they were not asked to take any perspective. We also tested the relationship between feelings and information sharing. We proposed that the likelihood of spreading disaster-related news could be affected by distance and feelings. We then developed the following hypotheses:

H1: People are more likely to share disaster-relevant information when they experience negative feelings.

H2: People are more likely to share disaster-relevant information when they experience feelings with high arousal.

H3: Thinking about self versus other affects people's feelings on (a) valence and (b) arousal after reading disaster-relevant information.

H4: Thinking about a disaster center versus a default location affects people's feelings on (a) valence and (b) arousal after reading disaster-relevant information.

4. Method and Results

4.1. Data collection

We recruited 408 workers who resided in the USA from *Amazon Mechanical Turk* (*https://www.mturk.com*). We used the materials and procedure identical to what we used in a past work [10]. Subjects were first introduced to background information, then read a message (see Figure 1 for an example), and finally answered two questions [10]. Specifically, we asked subjects to describe how they felt if they were in Fukushima, Japan (in "Self in Fukushima" condition) or how John felt if he were in Fukushima, Japan (in "Other in Fukushima" condition) or how they felt without being asked to take any specific perspective (in "Control" condition). Subjects were randomly assigned to one of the three conditions and asked to rate how likely they would pass along the message using a 7-point Likert scale (1 = not likely at all, 7 = very likely). Each subject was allowed to work in one condition repeatedly. For each tweet, we collected answers from 10 subjects.

4.2. Likelihood of information sharing

The results of one-way ANOVA analysis revealed that subjects were more likely to share information when thinking about self in Fukushima, Japan, than when thinking about another person, John, in Fukushima (4.85 vs. 3.59, $p < 0.001$). Moreover, the sharing likelihood of the subjects who were thinking about John did not significantly differ

from the sharing likelihood of subjects who were not taking any specific perspective (3.59 vs. 3.45, p = 0.1). These results replicated the results reported in a previous study [10].

4.3. Classification of feelings

Given the past findings that feelings can influence people's judgments [17, 31, 32, 33], we tested if feelings could predict information sharing behavior. Following past work in psychology [23, 26] and information transmission [3, 4, 11, 24], we classified self-reported feelings according to valence and arousal.

Table 1. Analytical tools for classifying feelings

Tools	Methods
ANEW (Affective Norms for English Words), [6]	A set of English words with the ratings of Valence and Arousal (Mean and SD) provided. We used ANEW to rate feeling words.
LIWC (Linguistic Inquiry and Word Count), [38]	A program that identifies emotion-related words as positive, negative, or neutral. We used LIWC to label valence of feeling words.
PANAS-X (Positive and Negative Affect Schedule – Expanded Form), [45]	Scales to assess self-rated affect as positive or negative. We used PANAS-X to validate our valence ratings based on ANEW and LIWC.
The ***Merriam-Webster*** Dictionary of Synonyms and Antonyms, [7]	A dictionary that presents English words with similar or dissimilar meanings. We used the dictionary to comprehend feeling words.

Table 1 shows the tools that we used to analyze feelings. While most feeling words could be rated using ANEW (see Table 1), a few words have not been encoded by this lexicon. For the word missing in ANEW, we gave the valence and arousal scores of a semantically similar word. For example, "*glad*" was often reported by subjects but not included in ANEW. So, we rated the valence and arousal of "*glad*" as 8.21 and 6.49, which were the scores originally given to "*happy*" by ANEW. We validated similarity of meanings of a pair of words by referring to Merriam-Webster (see Table 1).

The 233 feelings classified in this work were not equally distributed in the four quadrants defined by the two dimensions of valence and arousal [cf. 11]. Overall, we found more negative feelings than positive feelings reported by subjects (see Figure 2-1). This is reasonable because subjects would be more likely to feel negative when hearing news about a natural disaster. The pattern of valence was similar in all three conditions. In contrast, the pattern of arousal was different in the three conditions. In the Self in Fukushima and Other in Fukushima conditions, there were more positive scores on arousal than in the Control condition. Imagining the disaster center made subjects perceive messages as more exciting (see Figure 2-2).

4.4. Regression analyses on feelings

Table 2 shows the variables related to valence and arousal, which we used in regression analyses to predict the likelihood of information sharing. The values of valence and arousal were based on ANEW as mentioned previously and the scores of other variables were calculated based on the formulas developed in past work [3, 11, 16]. For example, if 10 subjects reading a tweet report 5 positive feelings, 2 negative feelings, and 3 neutral feelings, then positivity will be 1, negativity will be 0.25, subjectivity will be 2.33, polarity will be 3, and positive-negative ratio will be 2.5.

Table 2. Predictors used in regression analyses

Predictors	Value range	Descriptions
Valence	1-10	Mean of valence scores rated by ANEW
Arousal	1-10	Mean of arousal scores rated by ANEW
Positivity	0-10	$\frac{\#\text{ of positive}}{\#\text{ of negative and neutral}}$
Negativity	0-10	$\frac{\#\text{ of negative}}{\#\text{ of positive and neutral}}$
Subjectivity	0-10	$\frac{\#\text{ of positive and negative}}{\#\text{ of neutral}}$
Polarity	0-10	Absolute value of (# of positive - # of negative)
Positive-Negative Ratio	0-10	$\frac{\#\text{ of positive}}{\#\text{ of negative}}$

We first ran correlation analyses to select predictors. Valence rated by ANEW was not significantly correlated to the likelihood of information sharing (rs < 0.05, ps > 0.1). However, positivity was significantly correlated to the likelihood of information sharing (rs > 0.1, ps < 0.05). Arousal was significantly correlated to the likelihood of information sharing (rs > 0.25, ps < 0.001). Thus, we included positivity, as a measure of valence, and arousal in regression analyses.

Table 3 shows the results of regression analyses for three conditions separately. Figure 2-1 and Figure 2-2 illustrate how positivity and arousal relate to the likelihood of information sharing in (1) Self in Fukushima, (2) Other in Fukushima, and (3) Control conditions.

Table 3. Results of regression analyses for three conditions (Self in Fukushima, Other in Fukushima, Control)

Independent variables	Predictions			Models		Experimental conditions
	β	t	p	Adjusted R^2	F-value	
Positivity	1.88	2.79	0.01	0.22	19.25 ($p < 0.001$)	Self in Fukushima
Arousal	0.96	4.03	< 0.001			
Arousal x Positivity	-0.31	-2.45	0.02			
Positivity	1.62	2.39	0.02	0.37	39.55 ($p < 0.001$)	Other in Fukushima
Arousal	1.11	9.73	< 0.001			
Arousal x Positivity	-0.24	-1.94	0.05			
Positivity	1.64	1.90	0.06	0.10	8.661 ($p < 0.001$)	Control
Arousal	0.77	4.03	< 0.001			
Arousal x Positivity	-0.27	-1.66	0.1			

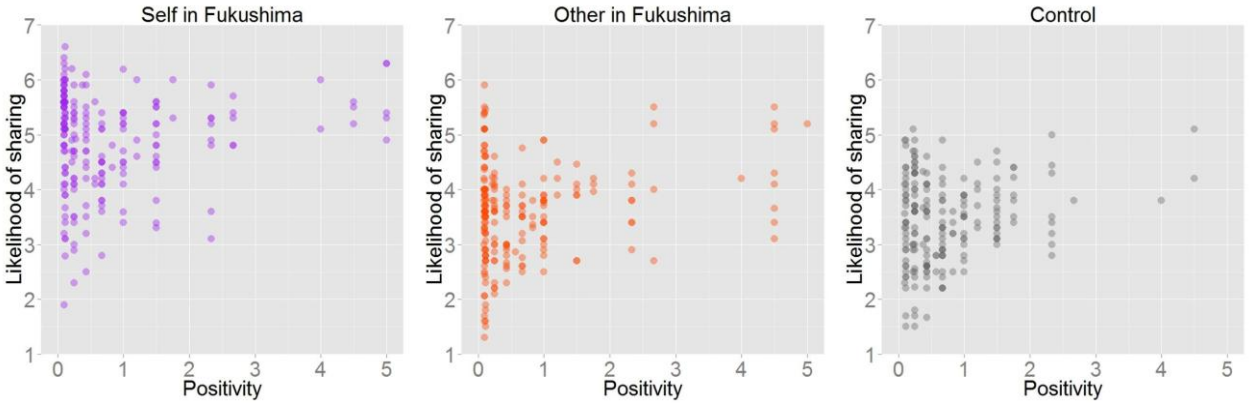

Figure 2-1. Likelihood of sharing and positivity of 200 tweets

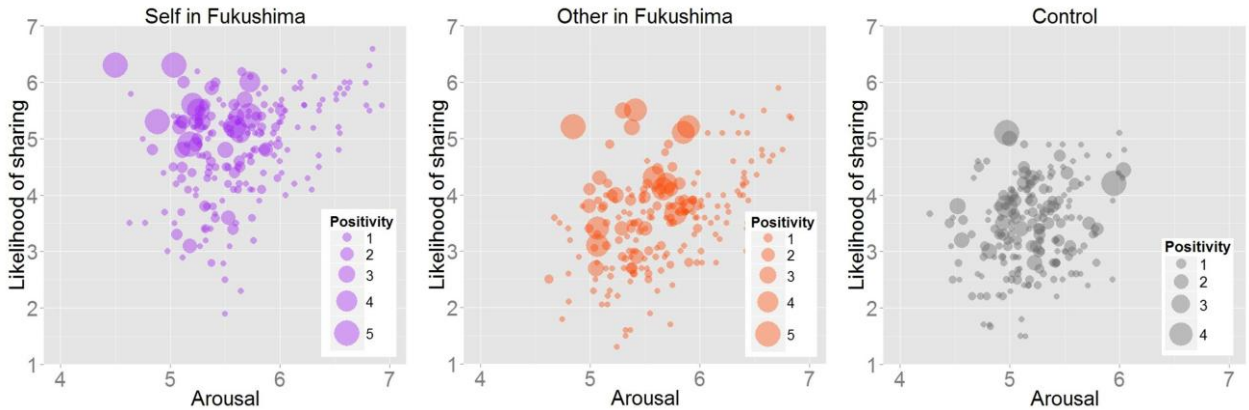

Figure 2-2. Likelihood of sharing, positivity, and arousal of 200 tweets

As shown in Table 3, the main effects of positivity and arousal were both significant (ps < 0.05). This suggested that people were more likely to share disaster-relevant information when they felt positive (with relatively higher positivity, see Figure 2-1) and aroused (with relatively higher arousal, see Figure 2-2). Figure 2-1 similarly demonstrated that people were more likely to spread good news as they experienced positive feelings rather than bad news as they experienced negative feelings; moreover, people's likelihood of sharing bad news showed greater variability. As shown in Table 3, there was also a significant effect caused by the interaction between positivity and arousal (ps < 0.1). Figure 2-2 explained this effect – people's likelihood of sharing bad news (represented by smaller dots) would largely depend on whether they felt aroused or not; in contrast, people's likelihood of sharing good news (represented by larger dots) was not significantly related to arousal. ***H1*** and ***H2*** were both partially supported: people were more likely to spread bad news only when they experienced negative feelings with high arousal. For example, a message that causes anger (low positivity and high arousal) would be more likely to be passed along, compared to a message that results in sadness (low positivity and low arousal). For another example, a message that causes happiness (high positivity and high arousal) would be equally likely to be spread, compared to a message that results in relief (high positivity and low arousal).

To further test whether or not social distance between self and other can predict information sharing behavior, we introduced a dummy variable that represented perspective in a combined regression [13]: 0 for other-perspective and 1 for self-perspective. The results of a regression analysis combining "Self in Fukushima" and "Other in Fukushima" conditions are shown in Table 4. Perspective is a significant predictor of information sharing, along with positivity and arousal.

Table 4. Results of combined regression analysis (Self in Fukushima, Other in Fukushima)

Independent variables	Predictions		
	β	t	p
Positivity	1.81	3.70	< 0.001
Arousal	1.13	9.63	< 0.001
Arousal x Positivity	-0.27	-3.09	0.002
Perspective (0, 1)	2.46	2.66	0.008
Overall, Adjusted R^2 = 0.53; F-value = 75.28 (p < 0.001)			

Next we compared the mean scores of positivity and arousal in the three conditions to examine if perspective taken by subjects could direct self-reported feelings. As for positivity, there was no significant difference across conditions – "Self in Fukushima", "Other in Fukushima", and "Control" (0.82 vs. 0.74 vs. 0.73, ps > 0.1). As for arousal, we found no significant difference between "Self in Fukushima" and "Other in Fukushima" conditions (5.65 vs. 5.66, p > 0.1); but arousal in "Control" condition was significantly lower than that in "Self in Fukushima" condition (5.20 vs. 5.65, p < 0.001) and that in "Other in Fukushima" condition (5.20 vs. 5.66, p < 0.001). The results indicated that social distance did not cause any significant difference of positivity or arousal between "Self in Fukushima" and "Other in Fukushima" conditions. Thus, ***H3*** was rejected. Physical distance between a disaster center, Fukushima, Japan, and a default location resulted in a significant difference of arousal but no difference of positivity between "Self in Fukushima" (or "Other in Fukushima") and "Control" conditions. Thus, ***H4*** was partially supported. These results suggest that perspective and feelings are independent of each other when affecting the likelihood of information sharing.

4.5. A model of information sharing during disasters

We developed a model to explain why people would share disaster-relevant information, which included (1) perspective (self vs. other), (2) valence of feelings (low to high positivity), and (3) arousal of feelings (low to high arousal), as shown in Figure 3. As social distance had no influence on feelings, we proposed that perspective, valence (measured by positivity), and arousal were all directly linked to information sharing behavior.

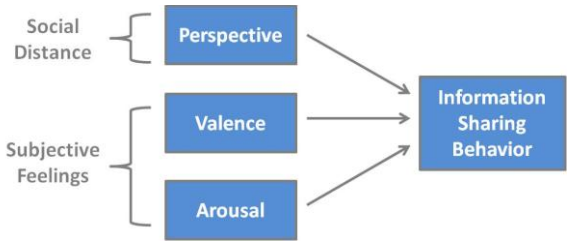

Figure 3. A model of information sharing during disasters

To validate, we tested the model in all three conditions using potential predictors. Specifically, we included low-level content-based features, such as word length, presence of URLs, hashtags, @signs,

and inclusion of numeric values (e.g., magnitude, time, date) as well as high-level content-based features, such as topics (e.g., earthquake, nuclear, tsunami) and sentiment encoded by LIWC, along with arousal, positivity, and social distance. The results showed that none of the variables other than perspective, positivity, and arousal was significantly associated with the likelihood of information sharing. We also performed regression analyses separately for three conditions, in which we included the top 20 feelings that were most frequently reported in each condition. Overall, the effects of these feelings were not consistently significant in all conditions, although a few types of feelings correlated with the likelihood of sharing in some conditions. In sum, the model we proposed in Figure 3 was robust using the current data set.

5. Discussion

5.1. Summary of results

In this work, we completed an experiment and explored the relationship between distance, feelings, and sharing of disaster-relevant information in a Twitter-like environment. We examined the effects of social distance and feelings on information sharing in three conditions: (1) when we asked subjects to focus on self in a disaster center, (2) when we asked them to focus on other in a disaster center, and (3) when we did not instruct them to take any perspective. Our main finding was that perspective, positivity, and arousal could explain why people would spread disaster-related news.

We proposed a model of information sharing during a natural disaster – the Great East Japan Earthquake. Our results suggested that, when people considered themselves in a disaster situation and when they experienced negative feelings with high arousal in response to a message posted in social media, they became more likely to share the information.

Table 5 summarizes our hypotheses and results. Overall, our results partially supported ***H1***, ***H2***, and ***H4***, and rejected ***H3***.

First, this work replicated the results that we obtained in a previous study and confirmed that people were more likely to spread disaster-related news when imagining themselves in a disaster center. This indicated that, our subjects who resided in the USA were more likely to perceive an event that was far away as irrelevant, except that they were asked to think about themselves in a disaster situation.

Second, this work further explored why people became committed to share disaster-relevant information, by analyzing feelings and investigating the effects of feelings on information sharing. We found that feelings, labeled as high or low in positivity and high or low in arousal, would affect people's decision to spread news. In particular, people who experienced negative feelings, were more likely to share only when they felt aroused; rather, those who encountered positive or neutral feelings were equally likely to share regardless of being emotionally aroused or not.

Table 5. Summary of hypotheses and results

Hypotheses	Results
H1: People are more likely to share disaster-relevant information when they experience negative feelings.	***Partially supported.***
H2: People are more likely to share disaster-relevant information when they experience feelings with high arousal.	***Partially supported.***
H3: Thinking about self versus other affects people's feelings on (a) valence and (b) arousal after reading disaster-relevant information.	***Rejected.***
H4: Thinking about a disaster center versus a default location affects people's feelings on (a) valence and (b) arousal after reading disaster-relevant information.	***Partially supported.***

5.2. Theoretical implications

The results summarized above provided a nuanced picture of how perspective and feelings could influence people's decision to share information in social media. The results implied a model of information sharing, which involved perspective, positivity, and arousal. We found that people would share good news more than bad news in a disaster situation and that people would spread bad news only when they were emotionally aroused such as being angry or anxious as opposed to when they were not aroused such as being sad or depressed [20, 24]. Imagining self in a disaster center increased people's likelihood of sharing disaster-related messages.

The current results also add to a growing body of social media research focused on sentiment analysis that feelings are multifaceted [12, 42]. Imagining self vs. other might not influence positivity (valence) or arousal. However, imagining a disaster center might influence arousal but not positivity. These findings shed lights on how people perceive information in social media during disasters.

5.3. Practical implications

This work provided suggestions for citizens, government, and social media designers in preparation for and response to emergency events, such as a natural disaster. First, we suggested social media users be alert in the presence of overwhelming information during disasters. Citizens can contribute to the crowdsourcing of disaster responses by collecting and sharing useful information distributed by credible sources rather than spreading bad news that has not been verified. If people would rather be empathetic by considering the situation of another person in a disaster center, they will be less likely to share some potentially false and harmful information. Second, because people seemed to be more willing to spread good news than bad news during disasters, we suggested officials in public administration make timely clarification of a disaster situation in positive tones. Third, we suggested developers of social media platforms design a communication system, in which some good news could be presented prior to bad news, in order to mitigate the risk that people read too much bad news and then become impulsive spreaders without a concern of any negative impacts on our societies.

In sum, while information and communication technologies have become increasingly important in disaster management, we are facing many challenges. By leveraging social media technologies, we will achieve more effective communication among citizens, communities, and government agencies. With the suggestions provided above, we can build a social media system that could help improve information quality during disaster response.

5.4. Future work

In the current work we examined whether feelings could influence the likelihood that subjects resided in the USA would spread disaster-related news. Although we did not know how easy our subjects could imagine crises in Fukushima, Japan, our manipulation of perspective and location resulted in significant effects. To extend this work, we would like to investigate local residents to see whether our manipulation can induce stronger feelings and therefore influence their information sharing behavior more significantly [cf. 36].

Compared to studies that used a large number of tweets to analyze sentiment in social media, here we investigated information sharing behavior in a controlled experiment by using a small sample of tweets. A fruitful extension of the current work is to test our model using a large dataset.

Another future direction is to evaluate the use of non-experts to comprehend online content for sentiment analysis [2]. Crowdsourcing of sentiment coding using workers of *Amazon Mechanical Turk* in the current work was fine because we were interested in the relationship between their reporting of the feelings and their likelihood of information sharing. However, more work is needed if the goal is to augment natural language processing of tweets using crowds.

While the focus here is on the effects of feelings on information sharing, there are other factors that affect people's sharing of disaster-related news. For example, trustworthiness of information presented, individual differences in motivation to spread news, and cultural differences between different populations, are all important variables that need to be considered to fully explain why people share information in disaster situations.

Finally, future work should design and test a system, in which we can provide real-time information about an emergency event with manipulations similar to the current work, so that we can learn how people behave in real life.

6. Conclusions

Communication in social media can help coordinate disaster response. This work investigated people's sharing of crisis information in a Twitter-like environment. Based on our results, we think that a social media system can be designed to promote the spread of useful information while reducing the spread of harmful information by directing people's focus on self or other in a disaster situation or by directing their feelings in response to the information provided. Such a system will help improve the quality of information provided in social media and make it easier for users to find valuable information in social media during disasters.

7. Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. IIS-1138658 and Grant No. BCS-1244742. The work

presented here is part of RC's doctoral dissertation at Stevens Institute of Technology.

8. References

[1] A. Acar and Y. Muraki, "Twitter for crisis communication: Lessons learned from Japan's tsunami disaster", International Journal of Web Based Communities, vol. 7, 2011, pp. 392-402.

[2] C. Akkaya, A. Conrad, J. Wiebe, and R. Mihalcea, "Amazon Mechanical Turk for subjectivity word sense disambiguation", in Proceedings of the NAAC HLT Workshop on Creating Speech and Language Data with Amazon's Mechanical Turk, 2010, pp. 195-203.

[3] S. Asur and B.A. Huberman, "Predicting the future with social media", in Proceedings of WI-TAT, 2010, pp. 492-499.

[4] J. Berger and K. Milkman, "What makes online content viral?", Journal of Marketing Research, vol. 49, 2012, pp. 192-205.

[5] d. boyd, S. Golder, and G. Lotan, "Tweet, tweet, retweet: Conversational aspects of retweeting on Twitter", in Proceedings of the 43rd Hawaii International Conference on System Sciences, 2010, pp. 1-10.

[6] M.M. Bradley and P.J. Lang, "Affective norms for English words (ANEW): Instruction manual and affective ratings", Technical Report, The Center for Research in Psychophysiology, University of Florida, Gainesville, FL, 1999.

[7] M. Bundlie, The Merriam-Webster Dictionary of Synonyms and Antonyms, Merriam-Webster, Springfield, MA, 1994.

[8] C. Castillo, M. Mendoza, and B. Poblete, "Information credibility on Twitter", in Proceedings of the 20th International Conference on World Wide Web, 2011, pp. 675-684.

[9] A.T. Chatfield, R. Akbari, N. Mirzayi, and H.J. Scholl, "Interactive effects of networked publics and social media on transforming the public sphere: A survey of Iran's leaderless' social media revolution", in Proceedings of the 45th Hawaii International Conference on System Sciences, 2012, pp. 2552-2562.

[10] R. Chen and Y. Sakamoto, "Perspective matters: Sharing of crisis information in social media", in Proceedings of the 46th Hawaii International Conference on System Sciences, 2013, pp. 2033-2041.

[11] M. De Chourdhury, S. Counts, and M. Gamon, "Not all moods are created equal! Exploring human emotional states in social media", in Proceedings of ICWSM, 2012, pp. 66-73.

[12] N.A. Diakopoulos and D.A. Shamma, "Characterizing debate performance via aggregated twitter sentiment", in Proceedings of the 28th international conference on Human factors in computing systems, 2010, pp. 1195-1198.

[13] J. Fox, Applied Regression Analysis, Linear Models, and Related Methods, Sage Publications, Thousand Oaks, CA, 1997.

[14] A.D. Galinsky and G.B. Moskowitz, "Perspective-taking: Decreasing stereotype expression, stereotype accessibility, and in-group favoritism", Journal of Personality and Social Psychology, vol. 78, 2000, pp. 708-724.

[15] A.D. Galinsky, G. Ku, and C.S. Wang, "Perspective-taking and self-other overlap: Fostering social bonds and facilitating social coordination", Group Process & Intergroup Relations, vol. 8, 2005, pp. 109-124.

[16] N. Godbole, M. Srinivasaiah, and S. Skiena, "Large-scale sentiment analysis for news and blogs", in Proceedings of ICWSM, 2007.

[17] R. Greifeneder, H. Bless, and M.T. Pham, "When do people rely on affective and cognitive feelings in judgment?: A review", Personality and Social Psychology Review, vol. 15, 2011, pp. 107-141.

[18] A. Gruzd, S. Doiron, and P. Mai, "Is happiness contagious online? A case of Twitter and the 2010 winter Olympics", in Proceedings of the 44th Hawaii International Conference on System Sciences, 2011, pp. 1-9.

[19] J.T. Hancock, K. Gee, K. Ciaccio, and J.M. Lin, "I'm sad you're sad: Emotional contagion in CMC", in Proceedings of CSCW, 2008, pp. 295-298.

[20] C. Heath, "Do people prefer to pass along good news or bad news? Valence and relevance of news as a predictor of transmission propensity", Organizational Behavior and Human Decision Processes, vol. 68, 1996, pp. 79-94.

[21] A.L. Hughes and L. Palen, "Twitter adoption and use in mass convergence and emergency events", International Journal of Emergency Management, vol. 6, 2009, pp. 248-260.

[22] M. Imran, S. Elbassuoni, C. Castillo, F. Diaz, and P. Meier, "Practical extraction of disaster-relevant information from social media", in Proceedings of the 22nd International Conference on World Wide Web companion, 2013, pp. 1021-1024.

[23] P.N. Johnson-Laird, The Computer and the Mind. An Introduction to Cognitive Science, Fontana Press, London, UK, 1988.

[24] N. Naveed, T. Gottron, J. Kunegis, and A. Alhadi, "Bad news travel fast: A content-based analysis of interestingness on Twitter", in Proceedings of WebSci, 2011, pp. 1-7.

[25] G. Olson and J. Olson, "Distance matters," Human Computer Interaction, vol. 15, 2000, pp. 139-178.

[26] J. Panskepp, "Toward a general psychobiological theory of emotions", The Behavioral and Brain Science, vol. 5, 1982, pp. 407-469.

[27] J. Park, M. Cha, H. Kim, and J. Jeong, "Managing bad news in social media: A case study on Domino's pizza crisis", in Proceedings of ICWSM, 2012, pp. 282-289.

[28] E. Pronin, "How we see ourselves and how see others", Science, vol. 320, 2008, pp. 1177-1180.

[29] Y. Qu, C. Huang, P. Zhang, and J. Zhang, "Microblogging after a major disaster in China: A case study of the 2010 Yushu Earthquake", in Proceedings of CSCW, 2011, pp. 25-34.

[30] Y. Sakamoto, "Following trendsetters: Collective decisions in online social networks", in Proceedings of the 45th Hawaii International Conference on System Sciences, 2010, pp. 764-773.

[31] N. Schwarz and G.L. Clore, "Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states", Journal of Personality and Social Psychology, vol. 45, 1983, pp. 513-523.

[32] N. Schwarz and G.L. Clore, "Mood as information: 20 years later", Psychological Inquiry, vol. 14, 2003, pp. 296-303.

[33] Schwarz, N., & Clore, G. L., "Feelings and phenomenal experiences" E. T. Higgins & A. W. Kruglanski (Eds.), Social Psychology: Handbook of basic principles (2nd ed., pp. 385-407), 2007, New York: Guilford.

[34] C.A. Smith and P.C. Ellsworth, "Patterns of cognitive appraisals in emotion", Journal of Personality and Social Psychology, vol. 48, 1985, pp. 215-228.

[35] K. Starbird, L. Palen, A. Hughes, and S. Vieweg, "Chatter on the red: What hazards threat reveals about the social life of microblogged information", in Proceedings of CSCW, 2010, pp. 241-250.

[36] Y. Tanaka, Y. Sakamoto, and T. Matsuka, "Transmission of rumor and criticism in Twitter after the Japan March 11 Earthquake", in Proceedings of the 34th Annual Conference of the Cognitive Science Society, 2012, pp. 2387-2392.

[37] Y. Tanaka, Y. Sakamoto, and T. Matsuka, "Toward a social-technological system that inactivates false rumors through the critical thinking of crowds", in Proceedings of the 46th Hawaii International Conference on System Sciences, 2013, pp. 649-658.

[38] Y.R. Tausczik and J.W. Pennebaker, "The psychological meaning of words: LIWC and computerized text analysis methods", Journal of Language and Social Psychology, vol. 29, 2010, pp. 24-54.

[39] M. Thelwall, K. Buckley, G. Paltoglou, D. Cai, and A. Kappas, "Sentiment strength detection in short informal text", Journal of the American Society for Information Science and Technology, vol. 61, 2010, pp. 2544-2558.

[40] Y. Trope and N. Liberman, "Temporal construal", Psychological Review, vol. 110, 2003, pp. 403-421.

[41] Y. Trope and N. Liberman, "Construal-level theory of psychological distance", Psychological Review, vol. 117, 2010, pp. 440-463.

[42] A. Tumasjan, T.O. Sprenger, P.G. Sandner, and I.M. Welpe, "Predicting elections with Twitter: What 140 characters reveal about political sentiment", in Proceedings of ICWSM, 2010, pp. 178-185.

[43] www.twitter.com, https://twitter.com/twitter/status/281051652235087872, 18 December 2012.

[44] A. Vaish, T. Grossmann, and A. Woodward, "Not all emotions are created equal: The negativity bias in social-emotional development", Psychological Bulletin, vol. 134, 2008, pp. 383-403.

[45] D. Watson and L.A. Clark, "The PANAS-X: Manual for the positive and negative affect schedule – expanded form", Technical Report, The University of Iowa, Iowa City, Iowa, 1994.

[46] E.U. Weber and E.J. Johnson, "Mindful judgment and decision making", Annual Review of Psychology, vol. 60, 2009, pp. 53-85.

[47] S. Yardi and d. boyd. "Tweeting from the town square: Measuring geographic local networks", in Proceedings of ICWSM, 2010, pp. 194-201.

[48] R.B. Zajonc, "Feeling and thinking. Preferences need no inferences", American Psychologist, vol. 35, pp. 151-175.