The Influence of Collective Opinion on True-False Judgment and Information-Sharing Decision

Huaye Li (hli21@stevens.edu)
Yasuaki Sakamoto (ysakamot@stevens.edu)
Howe School of Technology Management, Stevens Institute of Technology
Hoboken, NJ 07030 USA

Abstract

The purpose of the current work is to examine when and how knowing collective opinion influences people's judgments and decisions in social media environments. In particular, the present work focuses on people's true-false judgment of statements found on websites and the likelihood of sharing these statements. The results from Experiment 1 revealed that, for false statements, collective opinion had little influence on people's true-false judgments, but, for true and debatable statements, their judgments were biased toward collective opinion. The results from Experiment 2 indicated that the likelihood of sharing the true, debatable, and false statements followed the collective opinion, and that people were less likely to share false statements than debatable or true ones without collective opinion. These findings extend past work on social influence and advance understanding of how people make judgments and decisions in social media websites.

Keywords: Collective opinion, true-false judgment, information-sharing decision, social media, social influence

Introduction

Social media technologies, such as Twitter and Facebook, have become part of many people's everyday lives. Using these technologies, people not only acquire new information but also generate content and influence trends. Given the growing use and participatory nature of social media, better understanding of how people behave in such an environment is essential.

The objective of the current paper is to contribute to this need by reporting the results from two experiments that examine how people make true-false judgments on statements found on websites and how they make decisions about whether or not to share these statements in a social media environment. In the current work, sharing of a statement means passing of the statement to others. In particular, the work presented here focuses on how social influence plays a role in people's true-false judgments and sharing decisions in a social media context.

Collective Opinion

One of the main functions of social media is to share opinions with others and collectively make decisions (e.g., Glushko et al., 2008). Collective opinion, such as how many people have liked or shared a message, is part of social media technologies. In Twitter, an example of collective opinion is the number of re-tweets, or the number of people who re-tweeted a particular message. Re-tweeting is a kind of sharing, in which an original tweet, a brief message of 140 characters or less, is broadcast to the re-tweeter's followers through a simple clicking of a re-tweet button. The re-tweeted messages become available to the public as well, and the number of re-tweets associated with a tweet signifies the popularity of the tweet. The more ret-tweets, the more popular. Facebook uses 'like' to indicate the popularity of photos, stories, communities, and so on. Many review websites allow users to indicate their opinion about the usefulness of a particular review.

Despite the abundance of collective opinion in social media websites, when and how it affects people's judgments and decisions in such an environment is not well understood. However, there are classic studies on social influence in face-to-face environments, and more recent work on social influence in online environments, whose findings indicate that people use collective opinion to make their judgments and decisions in various situations.

Social Influence

Past research in face-to-face environments has shown that people have a strong motivation to compare their opinions with others (Festinger, 1954), and they often adopt the decisions of others (e.g., Cialdini & Goldstein, 2004; Deutsch & Gerard, 1995; Gureckis & Goldstone, 2006) due to their desire to make correct responses under uncertainty (Sherif, 1935) or their desire to be liked by others (Asch, 1955). By relying on others' opinions, individuals can learn and entertain solutions that they would not have even considered otherwise (Bandura, 1965).

More recent work has shown that knowing other's decisions also influences people's decisions in online environments. In an online market experiment, whereas good music was always downloaded by many and bad music was always unpopular, the popularities of the pieces in between varied depending on whether or not people knew the number of downloads the pieces had (Salganik, Dodds, & Watts, 2006). In another set of online experiments, subjects liked the same online news stories more when the stories had many existing supporters than when the stories had only a few supporters (Sakamoto et al., 2009). Subjects even switched their preferences when the experimenter flipped the assumed numbers of previous supporters (Sakamoto, 2010; Salganik & Watts, 2008). These past studies on social influence suggest that people's liking and rating can follow collective opinion in social media

environments. The current research extends this past work on social influence to true-false judgments and sharing decisions in a social media environment.

Hypotheses

Social influence may be especially strong in social media environments, as people experience a lot of information whose factual accuracy is unclear, and they rely on collective opinion in an attempt to reduce uncertainty. During crises, for example, uncertainty is high and people are under pressure mentally. People generate a large amount of information in an attempt to make sense of the situation, and they readily share this information without verifying its factual accuracy, resulting in the dissemination of false rumors (e.g., Allport & Postman, 1947; DiFonzo & Bordia, 2007). Consequently, a large amount of debatable information appears during responses to disasters.

In relation to debatable information, one focus of the current work is to examine how collective opinion influences people's judgment about whether a statement is true, false, or debatable. The statements used in the current research were related to health advice. A statement is true when the advice in the statement is supported by clear evidence according to health professionals. A statement is false when it contains information identified as incorrect by health professionals. A statement is debatable when health professionals cannot verify its factual accuracy because evidence is mixed or missing. *The first hypothesis is that the true-false judgment of debatable statements will be most prone to social influence because their factual accuracy is unclear; people will adopt collective opinion in an attempt to make a correct decision when they encounter debatable statements.* In contrast, people's perceptions of true and false statements are relatively strong and hard to change, just as good and poor pieces of music were immune to social influence in Salganik et al.'s (2006) research.

Another focus of the present work is to examine how collective opinion influences people's intention to share a statement differently depending on whether the statement is true, debatable, or false. Because it is unlikely that people strongly feel that they should or should not share the health-related statements used in the present work, they will rely on collective opinion to make their decision. *The second hypothesis is that social influence takes place for true, debatable, and false statements; people's decision will follow the collective opinion.* If this is the case, there will be a positive social influence, in which increasing the value of collective opinion increases the likelihood of sharing.

An alternative account is that people want to share information that others have not shared. There is evidence in consumer research that some people want to be unique and differentiate themselves from others (Berger & Heath 2007; Snyder & Fromkin 1980; Tian, Bearden, & Hunter 2001). According to this view, in deciding whether or not to share a statement in social media, people will go against the information about the number of people who already shared the statement. This leads to a negative social influence.

It is unclear whether positive or negative social influence takes place in information sharing decisions. In the information transmission literature, researchers focus mainly on how factors such as valence and source credibility relate to the spread of information (e.g., Fragale & Heath 2004; Ha & Ahn 2011; Heath 1996; Rene et al. 2012). Those who study social dimensions tend to examine how social network structures, including the number of followers and position in the social network, affect information diffusion (e.g., Cha et al. 2010; Huberman et al. 2009; Kwak et al. 2010; Xin et al. 2012) and how to maximize the spread of influence through online social networks and the extent to which one could predict online popularity (Kempe, Kleinberg and Tardos, 2003; Kim, Kim & Cho, 2011). Social influences on sharing decisions are not well studied.

Another important question the current work can address is whether people are more likely to share true, debatable, or false information, without knowing collective opinion. Although this question does not involve the main topic of social influence, the answer will be useful. Here, we borrow an idea from the rumor psychology literature. *The third hypothesis is that debatable statements result in a higher likelihood of sharing than false and true statements because debatable statements will induce informational ambiguity and anxiety by being disputable.* Ambiguity and anxiety are proposed to be strong predictors of rumor spread (Anthony 1973; Shibutani 1966).

Experiment 1

The main purpose of Experiment 1 is to examine how collective opinion influences people's judgment about whether a statement is true, false, or debatable.

Method

Participants In return for a nominal fee, 227 workers of Amazon's Mechanical Turk (https://www.mturk.com) completed the experiment. The mean age was 36. Using Mechanical Turk, a few research groups have replicated classic psychological phenomena and have shown that researchers can collect high-quality data (e.g., Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2011; Paolacci, Chandler, & Ipeirotis, 2010). We followed their recommendations.

Materials From Discovery, Food Networks and National Institute of Health (NIH), 120 statements about health advice were selected with two constrains: each statement was clearly identified by health professionals as true, debatable, or false, and the information carried by each statement was familiar to most people. Of 120 statements, 40 were true, 40 were debatable, and 40 were false.

Design and Procedure Subjects were instructed to read a health-related statement online, and to rate the extent to which the statement was true using a 7-point scale, where 1 was definitely false and 7 was definitely true. A response

around the middle of the scale indicated debatable. The 120 statements were presented sequentially in a random order.

There were three conditions.

1. **Control**: Statements were presented with no social information. Fifty unique subjects rated each statement. Figure 1 shows an example of the actual screen used in the control condition.
2. **Real**: Each statement was presented with real collective opinion, which was the mode of the 50 ratings from the control condition. We used the mode because it preserved extreme ratings. With mean and median, the ratings tended to go toward the middle of the scale. Figure 2 shows an example.
3. **Invented**: Each statement was presented with invented collective opinion. We transformed the observed mode as follows: 1 → (became) 7, 2 → 6, 3 → 5, 4 → 7 if the mean was smaller than 4, 4 → 1 if the mean was larger than 4, 5 → 3, 6 → 2, and 7 → 1. Figure 3 shows an example.

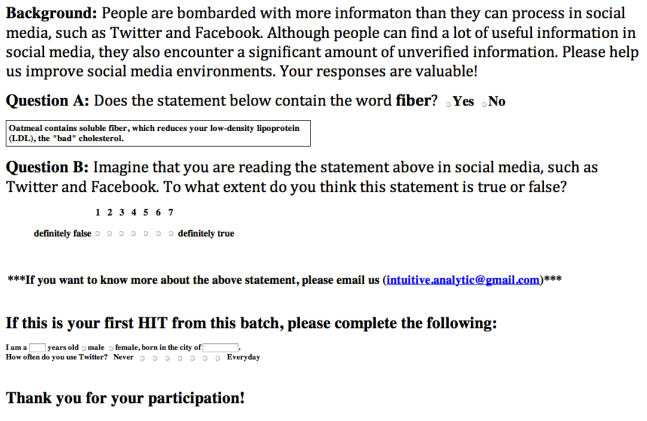


Figure 1. Example of Experiment 1's control condition

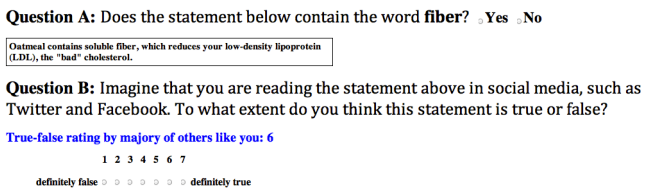


Figure 2 Example of Experiment 1's real condition

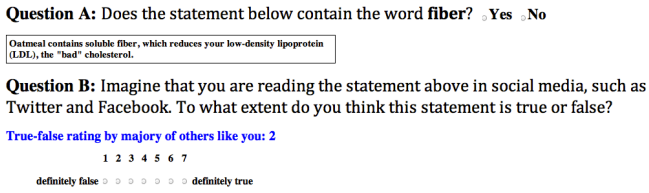


Figure 3. Example of Experiment 1's invented condition

Table 1 shows how the collective opinion observed in the control condition was used to generate the collective opinion shown to subjects in the real and invented conditions.

Table 1. Collective opinion

Observed in the control condition	Used in the real condition	Used in the invented condition
1	1	7
2	2	6
3	3	5
4	4	1 or 7
5	5	3
6	6	2
7	7	1

Results and Discussion

All participants were included in the analyses. The main interest of Experiment 1 was whether and how collective opinion might influence people's true-false judgments. Figure 4 shows the overall pattern of the results.

A 3 (statement: true, false, debatable) by 3 (condition: control, real, invented) analysis of variance (ANOVA), with true-false ratings as a dependent measure, revealed a significant main effect of statement, $F(2, 117) = 33.95$, $p < .001$. Collapsing across condition, the true-false ratings for true (5.05), debatable (4.72), and false statements (3.62) differed significantly. There was also a significant main effect of condition, $F(2, 396) = 26.65$, $p < .001$. Collapsing across different types of statements, the true-false ratings in the control (4.97), real (5.53), and fake conditions (4.64) conditions differed significantly, indicating that there might be some sort of social influence. The statement by condition interaction was significant, $F(2, 234) = 11.28$, $p < .001$, indicating that the pattern of social influence differed depending on the statement type.

Given the significant interaction between statement and condition, we further analyzed social influence within each statement type using a one-way ANOVA with condition as independent variable and true-false ratings as a dependent measure. Within true and debatable statements, the control, real, and invented conditions differed significantly in the true-false ratings, $F(2, 117) = 18.29$, $p < .001$, and $F(2, 117) = 5.601$, $p < .001$, respectively. However, within false statements, there was no significant difference across the three conditions, $F < 1$.

Experiment 1 tested the first hypothesis that the true-false judgment of debatable statements would be most prone to social influence. This hypothesis was partially supported. Although, as predicted, people adopted the collective opinion when making true-false judgments for debatable statements, the judgments of true statements resulted in the same pattern. As predicted, there was little social influence for the true-false judgments for false statements. As figure 4 shows, for true and debatable statements, the ratings increased in the real condition and decreased in the inverted

condition relative to the ratings in the control condition, indicating a positive social influence. The true-false judgments followed the collective opinion for true and debatable statements.

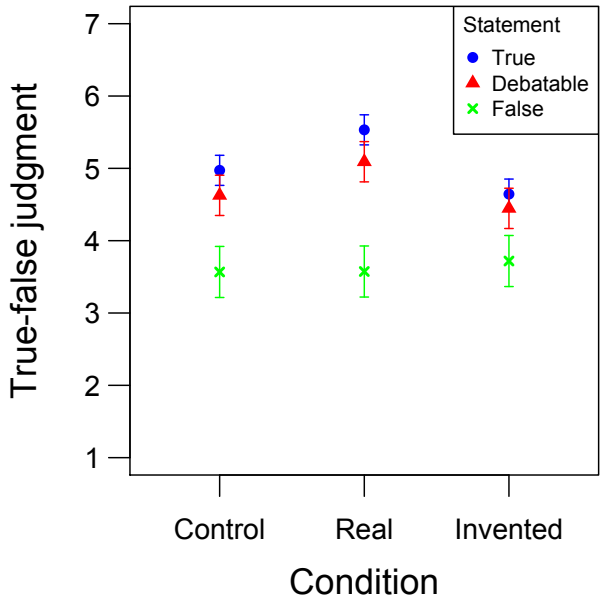


Figure 4. Results of Experiment 1 are shown. Error bars represent 95% confidence intervals.

Experiment 2

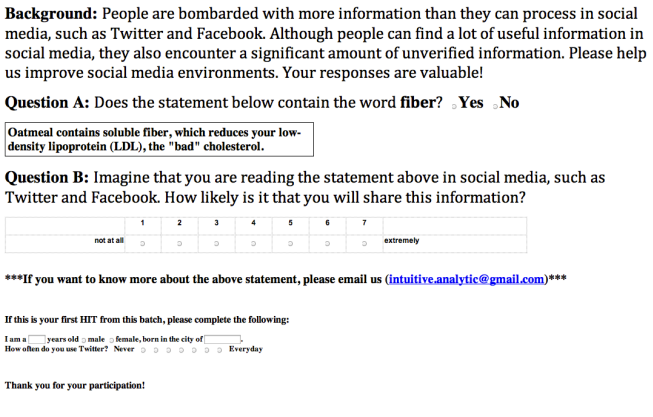
The focus of Experiment 1 was on the effect of collective opinion on people's true-false judgments. The main purpose of Experiment 2 is to examine how collective opinion affects people's likelihood of sharing information in a social media environment. The results from Experiment 2 will also address the question of whether people are more likely to share true, debatable, or false information, without knowing collective opinion.

Method

Participants In Experiment 2, 220 workers of Amazon's Mechanical Turk completed the experiment for a nominal fee. Their mean age was 28.

Materials The same as Experiment 1.

Design and Procedure The same as Experiment 1 except that, in Experiment 2, the question asked how likely it is that subjects will share the information, and the collective opinion indicated information regarding collective likelihood. Figures 5, 6, and 7 show an example of the screen presented to the subjects in Experiment 2's control, real, or invented condition, respectively.


Background: People are bombarded with more information than they can process in social media, such as Twitter and Facebook. Although people can find a lot of useful information in social media, they also encounter a significant amount of unverified information. Please help us improve social media environments. Your responses are valuable!

Question A: Does the statement below contain the word **fiber**? ○Yes ○No

Oatmeal contains soluble fiber, which reduces your low-density lipoprotein (LDL), the "bad" cholesterol.

Question B: Imagine that you are reading the statement above in social media, such as Twitter and Facebook. How likely is it that you will share this information?

1 2 3 4 5 6 7
not at all ○ ○ ○ ○ ○ ○ ○ extremely

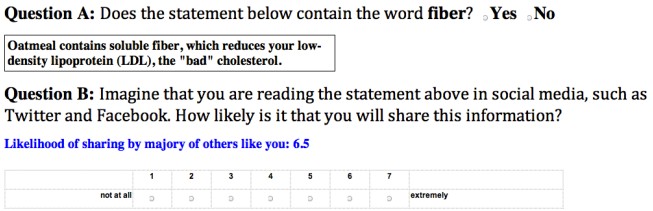
If you want to know more about the above statement, please email us (intuitive.analytic@gmail.com)

If this is your first HIT from this batch, please complete the following:

I am a [ ] years old ○male ○female, born in the city of [ ].
How often do you use Twitter? Never ○ ○ ○ ○ ○ ○ ○ Everyday

Thank you for your participation!

Figure 5. Example of Experiment 2's control condition


Question A: Does the statement below contain the word **fiber**? ○Yes ○No

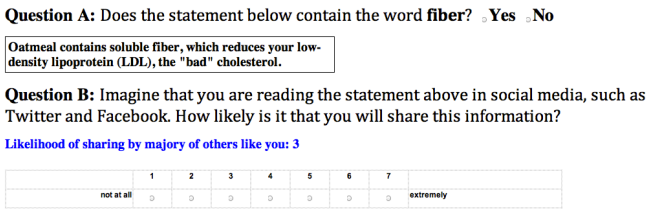
Oatmeal contains soluble fiber, which reduces your low-density lipoprotein (LDL), the "bad" cholesterol.

Question B: Imagine that you are reading the statement above in social media, such as Twitter and Facebook. How likely is it that you will share this information?

Likelihood of sharing by majory of others like you: 6.5

1 2 3 4 5 6 7
not at all ○ ○ ○ ○ ○ ○ ○ extremely

Figure 6. Example of Experiment 2's real condition


Question A: Does the statement below contain the word **fiber**? ○Yes ○No

Oatmeal contains soluble fiber, which reduces your low-density lipoprotein (LDL), the "bad" cholesterol.

Question B: Imagine that you are reading the statement above in social media, such as Twitter and Facebook. How likely is it that you will share this information?

Likelihood of sharing by majory of others like you: 3

1 2 3 4 5 6 7
not at all ○ ○ ○ ○ ○ ○ ○ extremely

Figure 7. Example of Experiment 2's invented condition

Results and Discussion

All participants were included in the analyses. The main interest of Experiment 2 was whether and how collective opinion might influence people's sharing decisions. Figure 8 shows the overall pattern of the results in Experiment 2.

A 3 (statement: true, false, debatable) by 3 (condition: control, real, invented) ANOVA, with people's likelihood of sharing as a dependent measure revealed a significant main effect of statement, $F(2, 117) = 12.99$, $p < .001$. Collapsing across condition, the likelihood of sharing true (4.27), debatable (4.39), and false statements (3.96) differed significantly. There was also a significant main effect of condition, $F(2, 396) = 10.55$, $p < .001$. Collapsing across statement, the likelihood of sharing in the control (4.29), real (4.46), and invented conditions (3.87) differed significantly, indicating the presence of social influence. Moreover, there was a significant statement by condition interaction, $F(2, 234) = 11.16$, $p < .000$. The pattern of social influence differed depending on the type of statement.

We analyzed social influence within each type of statement using a one-way ANOVA with condition as independent variable and the likelihood of sharing as a dependent measure. Within true, debatable, and false statements, the control, real, and invented conditions differed significantly in the likelihood of sharing, $F(2, 156) = 13.92$, $p < .001$, and $F(2, 156) = 10.58$, $p < .001$, and $F(2, 156) = 4.399$, $p = 0.005$, respectively.

The results from Experiment 2 show that collective opinion affects people's likelihood of sharing information, and support the hypothesis that a positive social influence takes place for true, debatable, and false statements. In Experiment 2, people's intention to share information followed the collective opinion. In addition, Experiment 2's results partially supported the third hypothesis that debatable statements would result in a higher likelihood of sharing than false and true statements. Although people were more likely to share debatable statements than false statements in the control condition, the likelihood of sharing debatable and true statements did not differ significantly, as can be seen in Figure 8.

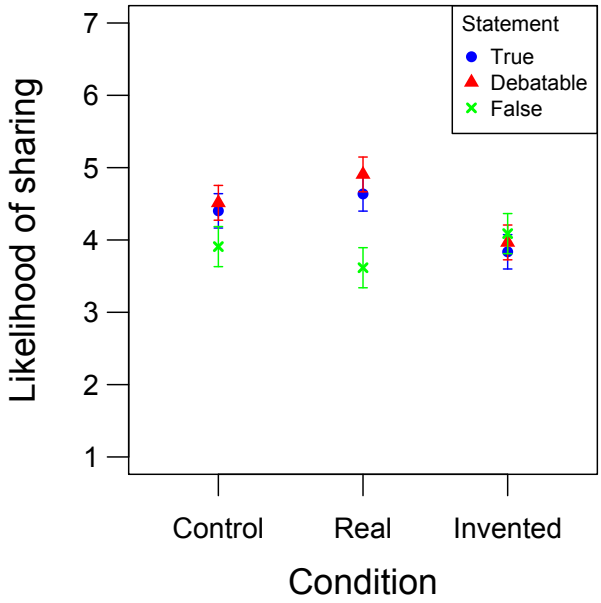


Figure 8. Results of Experiment 2 are shown. Error bars represent 95% confidence intervals.

General Discussion and Implication

In the current paper, we reported results from two experiments that examined how collective opinion might influence people's true-false judgments and information sharing decisions. In Experiment 1, we found that, for false statements, collective opinion had little influence on people's true-false judgments, but, for true and debatable statements, their judgments were biased toward collective opinion. In Experiment 2, we learned that the likelihood of sharing the true, debatable, and false statements followed the collective opinion, and that people were less likely to share false statements than debatable or true ones without collective opinion. The current results reveal that whether or not people adopt collective opinion in social media contexts depends on the type of judgment they make and the type of information they evaluate.

In the real social media environments, collective opinion is updated constantly. Future research may examine several iterations of the current experiments, in which collective opinion is updated after each run based on the ratings of the previous run. By doing so, we can study the evolution of people's ratings and collective opinion. Do the ratings converge or diverge after several iterations? The ratings might diverge when using mode as collective opinion as in the current work, but they might converge when collective opinion takes the form of median or mean.

Another characteristic of social media is that there are diverse kinds of information. The focus in the current work was information related to health advice. Future work should extend the current findings to other kinds of statements. We are currently examining the role collective opinion plays in sharing information related to natural disasters, such as Hurricane Sandy in 2012 and the Great East Japan Earthquake in 2011.

Finally, although we used rating scales in the current work, people's information sharing decisions in social media environments are binary. For example, there is a re-tweet button in Twitter. One extension of the current work might be to measure actual behavior by creating a 'share' button that sends a message to an associated email account when pressed. We can create a button and a Gmail account for each condition in an experiment, and ask subjects to click the button if they want to share the message. Although the measure of intent using a rating scale can provide us information about the strength of intent, it may or may not translate to actual behavior. When stimuli are tweets, one can examine whether or not there is a positive correlation between the likelihood of sharing and the actual re-tweeting number in Twitter. On the other hand, clicking of a share button cannot capture information about how much people want to share.

In conclusion, better understanding of how people make judgment and decision in social media contexts is important. People use social media technologies to share information everyday, even during responses to disasters. More research along this line can help the development of a set of recommendations for enhancing people's social media literacy and for improving the design of social-computational systems to improve the quality of information in social media, and more generally, to increase the productivity and wellbeing of our society. We hope that the present work can stimulate further investigation of social influence in social media environments.

Acknowledgments

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

References

Allport, G.W., & Postman, L. (1947). *The Psychology of Rumor*. Henry Holt and Company, New York, New York.

Anthony, S. (1973). Anxiety and Rumor. *The Journal of Social Psychology*, *89*, 91-98.

Bandari, R., Asur, S., & Huberman, B. A. (2012). The Pulse of News in Social Media: Forecasting Popularity. Arxiv preprint arXiv:1202.0332.

Berger, J., & Heath, C. (2007). Where consumers diverge from others: Identity-signaling and product domains. *Journal of Consumer Research*, *34*, 121-134.

Bond, R. M., Fariss, C. J., Jones, J. J., Kramer, A. D., Marlow, C., Settle, J. E., & Fowler, J. H. (2012). A 61-million-person experiment in social influence and political mobilization. Nature, 489, 295-298.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*.

Cha, M., Haddadi, H., Benevenuto, F., & Gummadi, K.P. (2010). Measuring user influence in Twitter: The million follower fallacy. In *Int'l AAAI Conference on Weblogs and Social Media* (ICWSM).

Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. Annual Review of Psychology, 55, 591–621.

DiFonzo, N., & Bordia, P. (2007). *Rumor psychology: Social and organizational approaches*. American Psychological Association, Washington.

Festinger, L. (1954). A theory of social comparison processes. Human Relations, 7, 117–140.

Fragale, A., & Heath, C. (2004). Evolving informational credentials: The (mis)attribution of believable facts to credible sources. *Personality and Social Psychology Bulletin*, *30*, 226-236.

Glushko, R. J., Maglio, P. P., Matlock, T., & Barsalou, L. W. (2008). Categorization in the wild. Trends in Cognitive Sciences, 12, 129–135.

Gureckis, T. M., & Goldstone, R. L. (2006). Thinking in groups. In S. Harnad & I. Dror (Eds.), Distributed cognition: Special issue of pragmatics & cognition, 14 (pp. 293–311). Amsterdam, The Netherlands: John Benjamins.

Ha, S., & Ahn, J. (2011). Why are you sharing others' Tweets?: The impact of argument quality and source credibility on information sharing behavior. *ICIS 2011 Proceedings*.

Heath, C. (1996). 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*, *68*, 79-94.

Huberman, B., Romero, D., & Wu, F. (2009). Social networks that matter: Twitter under the microscope. *First Monday*, *14*, 1-5.

Kempe. D, Kleinberg. M. J, & Tardos. E, (2003). Maximizing the spread of influence through a social network, KDD, pp. 137–146, ACM.

Kim. S, Kim. S, & Cho. H, (2011). Predicting the virtual temperature of web-blog articles as a measurement tool for online popularity, in IEEE 11th International Conference on Computer and Information Technology (CIT), 31, pp. 449–454.

Kwak, H., Lee, C., Park, H., & Moon, S. (2010). What is Twitter, a social network or a news media? *Proceedings of the 19th international conference on World Wide Web WWW'10*.

Lerman. K., & Hogg. T, (2010). Using a model of social dynamics to predict popularity of news. WWW, 621–630, ACM.

Mason, W., & Suri, S. (2011). A Guide to Behavioral Experiments on Mechanical Turk. *Behavior Research Methods*.

Paolacci, G., Chandler, J., & Ipeirotis, P. G. (2010). Running experiments on Amazon Mechanical Turk. *Judgment and Decision Making*, *5*, 411-419.

Rene, P., Antonios, G., & Frank, S. (2012). Emotional divergence influences information spreading in Twitter. *AAAI 2012*.

Sakamoto, Y. (2010). The impact of collective opinion on online judgment. Annual Meeting of the Cognitive Science Society.

Sakamoto, Y. (2012). Following trendsetters: Collective decisions in online social networks. HICSS 2012.

Sakamoto, Y., Ma, J., & Nickerson, J. V. (2009). 2377 people like this article: The influence of other's decisions on yours. In N. Taatgen, H. van Rijn, L. Schomaker, and J. Nerbonne (Eds.), Proceedings of the 31st Annual Meeting of the Cognitive Science Society.

Sherif, M. (1935). A study of some social factors in perception. Archives of Psychology, 27, 1–60.

Shibutani, T. (1966). *Improvised news: A sociological study of rumor*. Indianapolis, IN: Bobbs-Merrill.

Snyder, C., & Fromkin, H. (1980). Uniqueness: The human pursuit of difference. New York: Plenum.

Soll, J. B., & Larrick, R. P. (2009). Strategies for revising judgment. Journal of Experimental Psychology: Learning, Memory and Cognition, 35, 780-805.

Tian, K., Bearden, W., & Hunter, G. (2001). Consumers' need for uniqueness: Scale development and validation. *Journal of Consumer Research*, *28*, 50-66.

Xin, S., Ying D., & Jerome B. (2012). Multiple spreaders affect the indirect influence on Twitter. *WWW 2012 Companion*, Lyon, France.