

A Semantic Network Analysis of Twitter Reaction to the Ferguson Grand Jury Decision: Implications for Framing and Deliberation

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Abstract - *The current study investigates Twitter reaction to the Ferguson grand jury decision using the semantic network analysis. Four days after the decision was released, a total of 10,297 tweets containing hashtag “#FergusonDecision” were identified from the sample provided by Twitter streaming API. Twenty-one concepts were included in the semantic network. Results show that “Black”, “White”, and “police” were the three most central ideas in the semantic network based on their indegree and outdegree centrality, suggesting that the race and identities of the two people involved in the shooting were salient in public’s discussion of the decision. Findings also provided empirical evidence for the use of the conflict frame in the Twitter discussions. The study has implications for online deliberation and framing research. Limitations and future directions were also discussed.*

Keywords: semantic network analysis, framing, Twitter, race, Ferguson decision, public opinion

Twitter has become an increasingly important platform for news sharing, political expression, and social mobilizing (Larsson & Moe, 2011). Correspondingly, growing attention has been drawn to investigate the public’s political expression on Twitter (Himmelboim, McCreery, & Smith, 2013; Meraz & Papacharissi, 2013). Although Twitter content may not always be an accurate indicator of the overall public opinion (Mitchell & Hitlin, 2013), its potential to reflect the offline political landscape has been well documented (Tumasjan, Sprenger, Sandner, & Welp, 2010). In light of this, the current study aims to understand public’s interpretation of the Ferguson grand jury decision by analyzing

Twitter discussions following its release. Announced in November 24, 2014, the grand jury decision that the police officer Darran Wilson would not be responsible for the shooting death of Michael Brown elicited lots of attention, including protests, all over the United States (Eligon, 2014). Notably, Officer Wilson was a white male, and Brown was an African American teenager.

What is unknown is the frames people used to discuss this decision. Twitter content is believed to be great resources for assessing frame formation (Meraz & Papacharissi, 2013; Wasike, 2013). Its 140-character length limit prompts users to convey important ideas in condensed

expression. With this in mind, the current study will place emphasis on related Twitter discussions and the emerging frames. Furthermore, by using a semantic network analysis (SNA) approach, this study can shed light on the central concepts and important themes that emerged in Twitter discussions, which may provide unique insights into the frames used by the public.

Framing

Framing is typically defined as a selective presentation of certain aspects of an issue, so that they could be more salient in the meaning-making process (Entman, 1993). As such, frames often determine how a problem is defined, the cause is diagnosed, the responsibility is attributed, and the judgment is made (Iyengar, 2005). According to Gamson and Modigliani (1989), frames are considered as an “interpretive package” containing a set of “central organizing ideas” (p. 3). Therefore, when looking into people’s cognitive network in response to a certain issue, frames in use could be identified by the central concepts in the network.

Equally important is the interrelationships between the central concepts. According to Scheufele and Tewksbury (2007), the key of framing effects lies in the provided connection between two concepts. This connection serves to guide individuals’ interpretation of the issue of interest. Since frames are realized through the hierarchical association between concepts (Pan & Kosicki, 1993), the co-occurrence of two concepts in the same communication context is potentially a indicator of their cognitive association. Conceptually, one concept preceding another highlights the sequence in which the salience of the concepts would be activated. Thus, the order of occurrence coincides with the associative hierarchy between concepts (Smith & Parrott, 2012). Taken together, the structural positions of the central concepts in

a cognitive network can help us infer the frames people use to consider the issue at hand. Following this logic, the semantic network analysis (SNA) will be used to assess the structural positions of concepts discussed in Tweets to identify frames emerged in Twitter discussions about the Ferguson decision.

According to de Vreese (2005), frames can be broken down into two types: issue-specific frames and generic frames. Issue-specific frames offer greater degree of specificity with regard to the issue under investigation, whereas generic frames are more generalizable and without thematic limitations. This characteristic of generic frames allows for interpreting the content in a broader context. Semetko and Valkenburg (2000) explicated five frequently used generic frames for interpreting or presenting an issue: conflict, economic-consequences, morality, responsibility, and human-interest. The conflict frame directs attention to the disagreement between individuals and social groups. Therefore, if a conflict frame is used to discuss the Ferguson decision, it is expected to find the central concepts highlighting different racial groups and their confrontations, since the issue involved a White policeman and an African American teenager. The economic consequences frame focuses on profits and losses. If this is used, the central concepts in Twitter reaction will be probably focused on economic topics, using words such as wages, insurance, gain, poverty, and so on. The morality frame highlights the moral values. Hence, if this is prevalent in the discussions, the central concepts will be related to virtues, such as integrity, dignity, decency, honor; or the opposite of virtues, for instance, evil, sin, and so on. The responsibility frame discusses the attribution of responsibility. In this scenario, the Twitter reaction should be surrounded by concepts such as responsibility, liability, culpability, blame,

fault, and so on. Finally, the human-interest frame adopts an emotional and humanistic angle. Therefore, if this is the dominant frame, the Tweets will likely include great emotional expressions, such as angry, outrageous, shocking, surprising, and so on. Notably, some concepts would show up in multiple frames, but their order and strategic positions would not. With the ability to analyze the structural positions of concepts in a network, the semantic network analysis is useful in identifying which frames people are using to interpret the Ferguson decision.

Both the potential for concepts to prime other concepts, and their potential to be activated by other concepts are important in considering the structural positions of the concepts in a semantic network. While the former highlights the prominence of the concept in terms of triggering related thoughts, the latter suggests that the concept might be at a convergent position of varying ideas. In a semantic network, indegree reflects the tendency of the word to be activated by other words; outdegree indicates the tendency of a given word to prime other words. As a network summary, the centralization indegree and outdegree were estimated. By definition (Wasserman & Faust, 1994), centralization indegree pertains to the degree to which the words can be equally primed by other words, whereas centralization outdegree refers to the degree to which the words can equally activate other words in the network.

The study attempts to answer the following research questions:

RQ1: What are the most-frequent concepts discussed in Twitter users' reactions to the Ferguson grand jury decision?

RQ2: What are the most central concepts in the network?

RQ3: Among the five issue-specific frames, which frames are used in Twitter discussions?

Methods

Data Collection

The TOPSY analytics (see Figure 1) indicate that the release of the grand jury decision caused a peak of Ferguson-related discussions on Twitter immediately. The word "Ferguson" was mentioned for around 1,400,000 times on November 24th. This frequency dropped to a moderate and stable level (less than 200,000 times) on November 28th and maintained for a while since then. We collected Twitter real-time data on November 28th, four days after the announcement of the decision. In so doing, we hope to avoid collecting the initial tweets that were simply sharing and broadcasting this news, and focus more on the tweets containing reflections and discussions.

The tweets were collected through DiscoverText, a tool gathering live tweets from a sample provided by the Twitter Streaming API service. The data were fetched 10 times at hourly intervals. From 10am to 7pm, a total of 10297 tweets containing hashtag "#FergusonDecision" were collected. Considering that retweeting reflects users' agreement with or perceived importance of the original tweet (Lee & Sundar, 2012), retweets were maintained in the data.

Semantic Network

Concepts. The semantic network included concepts representing distinct ideas in the Tweets. To obtain the important words that should be included in the analysis, the following procedures were performed: First, a MATLAB program developed by the researcher generated the frequency counts of words in the dataset. Second, the researcher went through the word list to correct identifiable spelling errors and to combine words expressing the same concept (e.g., "police" and "cops" were reduced to "police"). Third, words that could not be directly interpreted on their own were dropped (see Smith & Parrott, 2012), including articles (e.g., "a", "the"), pronouns (e.g., "I", "we", "you"), auxiliary verbs (e.g.,

“has”, “did”, “is”), and adverbs expressing directions (e.g., “in”, “out”, “up”). Fourth, in order to keep the network as parsimonious as possible, words appearing less than 250 times were dropped. Finally, 21 words were included in the analysis.

Ties and Matrix. After identifying the key 21 words, the MATLAB program was used to generate the directional matrix based on word co-occurrence. The relational ties between pairs of words were decided by their co-occurrence in one tweet, maintaining the order of occurrence. For example, if the word “black” was found to precede the word “killed” in at least one tweet (e.g., “**Black** 21X more likely to be **killed** #FergusonDecision”), the corresponding cell in the matrix (black-killed) would be coded as “1.” If two words never co-occurred, the corresponding cells would be coded as “0”. As such, the relational ties are directed and dichotomous. The directional matrix was imported into UCINET 6.538 (Borgatti, Everett, & Freeman, 2002) to generate the semantic network and compute network estimates.

Measurement

In-degree centrality, According to Wasserman and Faust (1994), indegree centrality is measured in terms of the total number of directed ties that are incident on the node ($\sum_{i=1}^n A_{ij}$).

Outdegree centrality, Outdegree centrality refers to the number of the directed ties that start from the node ($\sum_{j=1}^n A_{ij}$).

Centralization indegree measures the degree to which words in the network can be equally primed by other words.

Centralization outdegree measures the degree to which words in the network can equally prime other words.

Results

RQ1 concerns the most frequent concepts used in Twitter users’ general reaction to the Ferguson decision. Based on the frequency of occurrences in the dataset, the important concepts that emerged in Twitter discussions in rank order were “black”, “mall”, “police”, “closed”, “White”, “now”, “protesters”, “protest”, “people”, “teens”, “west”, “county”, “die”, “unarmed”, “more”, “killed”, “stop”, “nobody”, “shot”, “truth”, “how” (see Table 1 for the top 100 words). The frequency ranges from 254 to 1078.

Among the 420 possible word co-occurrences, 141 unique pairs were found (pairs with same words but varying orders were considered as different). The most frequently mentioned pair (“Black” → “White”) occurred 426 times.

Figure 2 is a visualization of this semantic network that was created using NetDraw (Version 2.141). An arrow between pairs of words indicates their co-occurrence in at least one tweet. The direction of the arrow indicates the order of occurrence, with the first word at the tail and the later word at the arrowhead. The grey arrows are unidirectional, meaning that a particular word activated another word, but the opposite order never appeared. In contrast, the black arrows are reciprocal, suggesting that the two words appeared in both orders. The size of the node represents the in-degree centrality of the corresponding word.

RQ2 asked about the central concepts in Twitter users’ discussions; it was investigated by concepts’ indegree centrality and outdegree centrality. The indegree ($M = 6.71$; $SD = 3.68$) and outdegree ($M = 6.71$; $SD = 3.87$) of the words were provided in Table 2 in alphabetical order. The most central words in the network were “Black” (*outdegree* = 14; *indegree* = 12), “White” (*outdegree* = 13; *indegree* = 14), and “police” (*outdegree* =

11; *indegree* = 14). Notably, the word “truth” had the lowest outdegree (1) and indegree (1); it is relatively disconnected from other concepts in the sampled Tweets. In-degree centralization and out-degree centralization were the same (38.25%). As a reminder, centralization can vary from 0 to 1. These results suggest that the network was somewhat centralized, meaning that priming and being primed by other words were not equally done in the network.

RQ3 asked the type of frames used in the Twitter users’ discussions on Ferguson decision. The results seem to suggest the use of the conflict frame. While three central concepts highlight the different social groups, other words that are directly linked with the central concepts in the network such as “killed”, “protest”, and “stop” indicate confrontation. Taken together, the findings coincide with the operational definition of the conflict frame (Semetko & Valkenburg, 2000). A sample tweet extracted from the dataset lends support for this notion:

“RT @richardhine: Black teens 21X more likely to be killed by cops than white teens #FergusonDecision”

Discussions

The semantic network generated in the study depicts a big picture of highlighted aspects of Twitter users’ discussion of the Ferguson grand jury decision. The most-frequently used words suggest two kinds of concerns. One set, including “police”, “Black”, “White”, “teens”, and “shot,” tap on the important details of the Ferguson shooting. A second set, including “mall”, “closed”, and “protesters,” reflect the ongoing protests all over the country. The semantic network analysis showed that the order of concepts, and their association with other words, most closely represented a conflict frame.

“Black”, “White”, and “police” were the most central concepts in the semantic

network based on their indegree and outdegree centrality, indicating that they prime the greatest number of concepts and also are primed by the greatest number of concepts in the network. They may both serve as the triggers for other concepts and also are at convergent positions among the concepts. All three words are related to the race, ethnicity, and identities of the two people involved in the shooting. The positions of these concepts in the network highlight the fact that race and ethnicity were very salient in Twitter users’ discussions of the Ferguson decision. There has long been a concern that race, ethnicity and other external factors may bias the justice system (Sommers & Goldstein, 2014). The study finding suggests that this concern may still be salient to the public.

The results also provide evidence for the use of the conflict frame in Twitter discussions, rather than the other four frames proposed by Semetko and Valkenburg (2000). There were almost no concepts highlighting the economic, moral, emotional, and responsibility aspects of the Ferguson decision. If any, they are not at the central positions of the semantic network. Rather, as previously mentioned, the concepts and their interrelationships within the network together emphasize the confrontation between two racial groups.

This emphasis on the conflict between racial groups may be related to the characteristics of the Twitter platform. In the U.S., Twitter users are more racially diverse than general Internet users (Koh, 2014). As a result, Twitter oftentimes functions as an outlet for the political expression of minorities (Bekafigo & McBride, 2013). It is possible that more attention is directed to the racial confrontation in Twitter discussions. Future research should investigate whether the concepts and semantic network generalizes to other discussion venues.

The use of the conflict frame resonates with the protests that happened all over the country (Eligon, 2014). The conflict frame mirrors the offline racial tension perpetuated by the Ferguson shooting and grand jury decision (Wines, 2014). Previous findings have shown that Twitter content can offer a good reflection of offline politics in terms of election results (Tumasjan et al., 2010), the current study extends this notion to other public domains such as racial tensions.

On the other hand, the conflict frame may suggest a relatively low degree of deliberation regarding the Ferguson decision. According to Simon and Xenos (2000), deliberation is about frame competitions. Different frames represent varying contentions and claims to define the situation at hand. The competition between frames promotes the exchange of ideas. The presence of a conflict frame without other frames suggests that a deliberative process may be missing. In this case, to facilitate online deliberation, the study finding suggests that more alternative frames need to be provided and promoted.

Methodologically, the current study also speaks to a possibility of using SNA to investigate the public opinion and online deliberation. In addition to traditional quantitative measures, the semantic network analysis shed light on the important frames that have emerged in online discussion on public issues.

Limitations and Future Research

The findings were limited by timing and sample. First, the data were collected four days after the announcement of the Ferguson decision. Although this is for the purpose of eliminating tweets that simply share the news, a considerable corpus of data was not included in the analysis. Moreover, at the time of data collection, the protests to the Ferguson decision reached a massive level, which may explain why the

conflict frame was so present in the Twitter discussions. Future research may try to capture longitudinal data instead and look into the changes of the semantic network over time. Second, in order to obtain a parsimonious and easy-to-interpret semantic network, words appearing less than 250 times were dropped from the analysis. Adding more nodes to the network will certainly present a more complete picture. However, it will complicate and hinder the interpretation process.

In addition to a longitudinal investigation of the semantic network, it will be interesting for future research to include word pairs and hashtags as the actors of the network. It is both theoretically and methodologically meaningful to explore if they would constitute a different semantic network as compared to single words.

Last but not least, future research may also compare general Twitter users' semantic network with that of news media's Twitter accounts. The current study does not effectively capture news media's reaction on Twitter, largely because the filter #FergusonDecision used for data collection was rarely mentioned by news media accounts. For future studies, the potential structural differences between the two networks may help us understand the interaction between users' discussions and journalists' framing practice on Twitter, which is probably another promising direction for framing research. In addition to facilitating a better understanding of public opinion, these kinds of studies have implications for online deliberation.

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Table 1

Top 100 words (Words in bold were included in the analysis.)

5198	'the'	462	'via'	260	'out'	208	won't
2263	'to'	455	'it'	259	'truth'	206	'protesting'
1918	'in'	434	'not'	254	'how'	204	'shut'
1618	'is'	388	'protesters'	249	'many'	203	'cares.'
1480	'of'	368	'that'	248	'because'	202	'lit'
1438	'a'	367	'protest'	240	'just'	202	'suspects,'
1369	'and'	363	'people'	240	'chesterfield,'	201	'downtown'
1078	Black'	359	'only'	236	'galleria'	199	'one'
909	'are'	347	'teens'	234	'can't'	198	'stands'
903	'on'	344	'at'	232	'than'	196	'get'
759	'this'	341	'west'	230	'up'	193	'defend'
729	'mall'	341	'has'	229	'as'	191	'alaska'
706	police'	340	'county'	228	'they'	189	'it's'
681	'you'	335	'die'	227	'fire'	185	'don't'
680	'i'	325	'unarmed'	222	'down'	185	'wilson'
679	'about'	309	'was'	222	'still'	183	'demonstration'
671	'for'	308	'm'	222	'care'	182	'any'
629	'so'	307	'more'	218	'justice'	181	'anchorage'
609	closed'	297	'killed'	218	'please'	181	'targets'
558	'white'	284	'your'	218	'daily'	181	'marching'
517	'we'	280	'have'	216	'with'	180	'all'
480	'no'	277	'stop'	214	thugs'	179	'from'
479	'by'	266	'my'	213	basis'	176	'likely'
469	'be'	264	'nobody'	212	'night'	176	'can'
465	'now'	262	'shot'	210	'what'	174	'race'

Table 2

Summary of nodal outdegree and indegree centrality

	Outdegree	Indegree
Black	14	12
closed	1	5
county	3	1
die	3	5
how	11	8
killed	7	8
mall	5	8
more	10	9
nobody	2	7
now	6	8
people	10	8
police	11	14
protest	9	4
protesters	7	4
shot	8	6
stop	4	7
teens	4	5
truth	1	1
unarmed	8	6
west	4	1
White	13	14

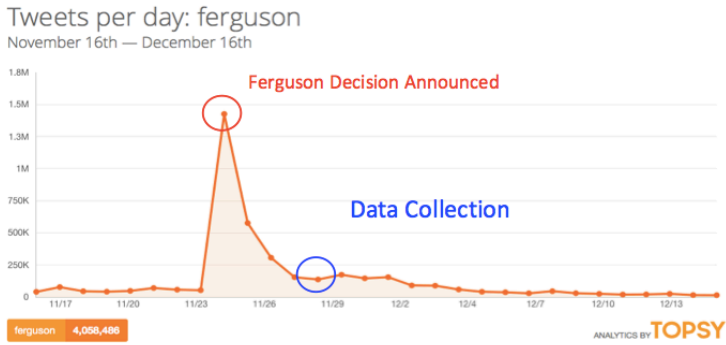
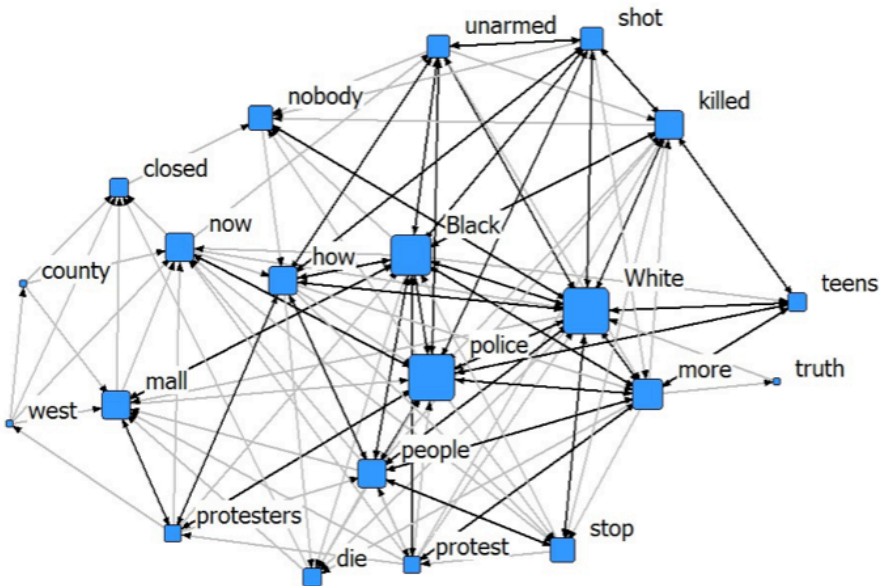


Figure 1. A time series plot of number of tweets mentioning “Ferguson” from November 16th to December 16th. (Retrieved from: <http://topsy.com/analytics?q1=ferguson&via=Topsy>)



Notes: The size of the nodes represents indegree centrality. The black ties are reciprocal, and the grey ties are unidirectional.

Figure 2. The semantic network of Twitter reaction to Ferguson decision