Organization or conversation in Twitter: A case study of chatterboxing

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Background to the present study

Informal observations:

- undergraduate student use of the hashtag gesture in f2f conversation
- use in Facebook
- use in advertising, news media, etc.

What do we really know about the use of hashtags in Twitter? And how can we study it?
Agenda

- Rationale
- Review of the literature
- Research Questions
- Methodology
- Results
- Discussion
- Limitations
- Conclusion
Rationale

This study seeks to answer the fundamental question: Is it possible to say that Twitter #hashtags can be organizational in nature, or are they purely conversational?

- To explore this question, this case study uses chatterboxing during the Super Bowl to identify differences between #hashtags and @mentions.
  
  - *Chatterboxing*: discussion about a real-time televised event through the use of a second screen connected to a social media outlet such as Twitter or Facebook or to other electronic means of communication such as email (TV Licensing, 2012).

- Labeling posts correctly in Twitter is essential for chatterboxers if they want to participate in the conversation.
Review of the literature

Twitter as a Social Medium for Communication:

- Twitter is a noisy medium (Jackoway, Samet, & Sankaranarayanan, 2011; Honeycutt & Herring, 2009),

Primary Labeling Conventions within Tweets

- **#hashtag**: #Hashtags in Twitter are short labels with a hash mark or pound sign preceding the characters of the text string. #Hashtags either serve as a label like social tags in sites like Flickr, or they function as a prompt for comment (Huang, Thornton, & Efthimiadis, 2010, p. 3). Weng, Lim, He, and Leung (2010) see #hashtags as keywords or phrases that may or may not be interesting or adopted (p. 1121).

- **@mention**: @Mentions on Twitter add the at sign immediately preceding a user’s Twitter handle (user name). The use of @mentions provides coherence in an otherwise seemingly disorganized system where posts are displayed in chronological order (Honeycutt & Herring, 2009).

  - Honeycutt and Herring (2009) interpret any use of @mentions as promoting conversation and potentially collaboration. Within an hour of being tweeted, 31.2% of tweets with @mentions received a public response indicting that mentions promote conversation (Honeycutt & Herring, 2009).

- **RT**: Retweets, posts copied (and potentially modified or commented, often giving attribution to the original poster) as studied by boyd, Golder, and Lotan (2010) may include #hashtags and @mentions; they are generally considered conversational.
Review of the literature, cont.

#Hashtags as Aboutness: Theoretical Considerations

- #hashtags have the potential to describe or interpret the content of a tweet expressing aboutness as indexers understand the term (Maron, 1977) and as folksonomies might be understood (Peters and Stock, 2007).
  - #hashtags function as pointers to these conversations.
- #hashtags seem to share the same benefits and problems as Peters and Stock (2007) note regarding folksonomies
  - Benefits: a type of low cost indexing, identification of communities, and so forth
  - Problems: uncontrolled vocabulary, language merging, and so forth

- Conversation and Organization on Twitter: For the purpose of this study, conversation implies information sharing between and among interlocutors while organization implies curation, analysis, and assumed retrieval.
  - Huang, Thornton, and Efthimiadis (2010) raised the question of conversation versus organization in relation to #hashtags, concluding that a priori #hashtags are not organizational in nature because users are not indexing for retrieval at a later date. They feel that the goal of #hashtag use is different from a posteriori tagging in social media sites (p. 1); instead, Twitter users use #hashtags to join and participate in a discussion (p. 5).
  - Efron (2010 & 2011) assumes #hashtags to be organizational, lending themselves to the study of retrieval of tweets.

If @mentions and #hashtags are both conversational as some researchers suggest, then we theorize they will be used in a way that is consistent within chatterboxing tweets.
Review of the literature, cont.

Mobility and Geographic Location

- Tweets posted via:
  - apps installed on mobile devices or tablets
  - posted through the Twitter web interface on a web browser or client

- Mobility can help us understand the nature of #hashtags: We theorize that users coordinating events in real-time will direct their tweets to particular users through the @mention and that users describing and organizing their own personal tweets will tend to use #hashtags.

- Location-based aspects of Twitter can contribute to the richness of the data (Jackoway, Samet, & Sankaranarayanan, 2011). It is possible to know who in proximity is tweeting and to see the content of those tweets.

Location and mobility contribute to the overall quality of the chatterboxing interaction on Twitter.
Chatterboxing

- Chatterboxing is prevalent among those who watch television
- At the time of writing, 173,753 users had checked in to Super Bowl XLVI on GetGlue
- BlueFin reported the Super Bowl as being the largest social TV event recorded at the time, with a total of 12.2 million social media comments during the game. This number represented a growth of nearly 600% over social media comments in the previous year’s game (BlueFin, 2012).
- TrendrrTV reported a higher number and one that focused on Twitter instead of on social media in general: Mark Ghuneim of TrendrrTV reported 15.8 million tweets during the Super Bowl in 2012, up from 3.01 million in 2011 (Kafka, 2012a).
- Twitter as a medium provides a venue where the “public interplay of voices […] give[s] rise to an emotional sense of shared conversational context” (boyd, Golder, & Lotan, 2010, p. 1)
Qualitative Analyses of Tweets

- Inferring meaning based on tweets is an uncertain task. Topics of tweets are difficult to ascertain because tweets themselves are ungrammatical and internally noisy (Michelson & Macskassy, 2010). Content analysis and other qualitative analyses of tweets are nonetheless undertaken in studies of Twitter usage, often on subsets of tweets as a way of gathering a richer data pool.

  - Huang, Thornton, and Efthimiadis (2010) used qualitative methods to analyze the content of a subset of 224 tweets but did not report on the results in the paper we consulted.

  - Honeycutt and Herring (2009) analyzed the functions of @mentions in a subset of 200 tweets, to address questions of language of the tweet. Another subset of 50 tweets in English was analyzed to count specific instances of the @mention in tweets (Honeycutt & Herring, 2009).

  - In Michelson & Macskassy, user topics of interest were analyzed, with a pilot of four users’ tweets being compared against Wikipedia to test the topicality of the content (Michelson & Macskassy, 2010).

  - As with other studies where an online user-created artifact is analyzed, Twitter studies that are qualitative in nature are unable to state with certainty the topic of a given tweet or the intention of the user.
Research questions

RQ1: Are @mentions and #hashtags in posts (tweets) different enough to represent two different labeling conventions?

- To address the question of differences, tweets were taken from specific locations during a chatterboxing event where half of the locations implied more active involvement on the part of Twitter users.

RQ2: To what extent do #hashtags indicate aboutness in tweets?
Methodology

2012 Super Bowl held February 5, 2012

TwitteR (Gentry, 2012) fo the R stastical language was used to search and retrieve tweets via the Twitter API for date range from February 5 to 6, 2012.

Aimed to pull a maximum of $n=1500$ tweets per location with #superbowl, 7 "locations" were identified using geographic coordinates (or, were location-independent)

1. Locations with an invested interest
   - Boston (team)
   - New York City metro area (team)
   - Indianapolis (host city)

2. Locations (geographically dispersed) with football teams but a non-invested interest
   - Dallas
   - Miami
   - Seattle

3. Location-independent tweets for the location-independent qualitative study
Data collection

In the first part of the analysis, the overall goal was to compare the invested-interest group against the non-invested-interest group to test for differences in the uses of the two labeling conventions.

Purpose

- understand the extent of the relationship between the two conventions
- determine whether there is justification for testing each separately in the succeeding group tests.

If there is no statistical or substantial relationship between the two, then we assume that @mentioning and #hashtagging are two separate actions and should be examined separately.
Data collection

Next, we examine and compare the three locations within the invested-interest group (Boston ~ NY Metro area ~ Indianapolis).

- Goal: to understand whether there is reason to believe that these three locations are similar or come from similar populations.

- If, based on the relationship test between #hashtag use and @mentioning, we have reason to believe that the two have separate functions, we test each separately.

We repeat this process for the three locations within the non-invested-interest group (Dallas ~ Miami ~ Seattle) in order to determine whether these locations are similar.
Data collection

Finally, based on the previous two tests there is a reason to believe that members in the invested-interest group are similar and members in the non-invested group are also similar, we examine and compare the two groups to each other (between the two conversation groups and between the two organization groups, separately).

- This final statistical test will also say something about the influence of location on Twitter users in their posts during a real time nationally televised event. An analysis of the platform used to post the tweets, when possible, will also be analyzed in a small random sample of tweets to assess the potential degree of mobility of users.
Data collection

Qualitative methods: By studying a small random sample of tweets (n=100) we can develop a richer understanding of the character of content in Twitter while addressing one of our research questions.

93 complete and unique non-location-dependent #superbowl tweets retained

1. content themes for tweets identified

2. aboutness and placement of #hashtags in relation to the content of the tweets
   - As a reflection of the tweet’s aboutness
   - Relative location in the tweet (in situ or as extra-grammatical tags).

3. the number of RTs in posts from all the locations was also assessed
Results

Frequencies of @ mentions by location

<table>
<thead>
<tr>
<th>Location</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>&gt;5</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVESTED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>844</td>
<td>392</td>
<td>46</td>
<td>10</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>NY Metro</td>
<td>545</td>
<td>663</td>
<td>68</td>
<td>22</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Indy</td>
<td>669</td>
<td>433</td>
<td>115</td>
<td>32</td>
<td>23</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>NON-INVESTED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dallas</td>
<td>880</td>
<td>308</td>
<td>75</td>
<td>13</td>
<td>12</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Miami</td>
<td>842</td>
<td>360</td>
<td>73</td>
<td>17</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Seattle</td>
<td>789</td>
<td>429</td>
<td>58</td>
<td>12</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>
# Results

## Frequencies of #hashtags by location

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>&gt;5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INVESTED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>684</td>
<td>391</td>
<td>116</td>
<td>90</td>
<td>14</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>NY Metro</td>
<td>742</td>
<td>299</td>
<td>223</td>
<td>20</td>
<td>11</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Indy</td>
<td>661</td>
<td>349</td>
<td>175</td>
<td>72</td>
<td>32</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>NON-INVESTED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dallas</td>
<td>824</td>
<td>312</td>
<td>104</td>
<td>28</td>
<td>26</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Miami</td>
<td>845</td>
<td>313</td>
<td>103</td>
<td>25</td>
<td>7</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Seattle</td>
<td>878</td>
<td>279</td>
<td>94</td>
<td>39</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
## Results

Kendall's Rank Correlation tau Matrix, #hashtags to @mentions

<table>
<thead>
<tr>
<th></th>
<th>Boston @</th>
<th>NY Metro @</th>
<th>Indy @</th>
<th>Dallas @</th>
<th>Miami @</th>
<th>Seattle @</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boston #</strong></td>
<td>.1133***</td>
<td>-.0030</td>
<td>-.0054</td>
<td>.0349</td>
<td>.0234</td>
<td>-.0337</td>
</tr>
<tr>
<td><strong>NY Metro #</strong></td>
<td>.0400</td>
<td>.0917***</td>
<td>-.0444^</td>
<td>-.0185</td>
<td>.0189</td>
<td>.0306</td>
</tr>
<tr>
<td><strong>Indy #</strong></td>
<td>.0180</td>
<td>.0266</td>
<td>.0492*</td>
<td>.0490*</td>
<td>-.0138</td>
<td>.0039</td>
</tr>
<tr>
<td><strong>Dallas #</strong></td>
<td>.0319</td>
<td>-.0094</td>
<td>-.0147</td>
<td>.0478^</td>
<td>-.0262</td>
<td>-.0476^</td>
</tr>
<tr>
<td><strong>Miami #</strong></td>
<td>.0237</td>
<td>-.0573</td>
<td>.0014</td>
<td>-.0085</td>
<td>.0799**</td>
<td>-.0193</td>
</tr>
<tr>
<td><strong>Seattle #</strong></td>
<td>.0124</td>
<td>.0104</td>
<td>.0057</td>
<td>.0273</td>
<td>.0004</td>
<td>.0344</td>
</tr>
</tbody>
</table>

*** p < 0.001, ** p < 0.01, * p < 0.05, ^ p < 0.10

First, we rule out multicollinearity and examine the relationships between hashtag and mentioning by location.
Results

- Are the invested interest groups the same, as far as use of @mentions?
- $H_0$: Boston = NY Metro = Indianapolis
- Kruskal-Wallis rank sum test
  - @mentions: $H = 130.0359$, $df = 2$, $p < 0.001$
  - Reject the null hypothesis
- Post hoc pairwise Wilcoxon rank sum test
  - Boston $\neq$ NY Metro ($p < 0.001$) ## Reject the null
  - Boston $\neq$ Indianapolis ($p < 0.001$) ## Reject the null
  - NY Metro = Indianapolis ($p = 0.058$) ## Fail to reject
Results

- Are the invested interest groups the same, as far as use of #hashtags?
- $H_0$: Boston = NY Metro = Indianapolis
- Kruskal-Wallis rank sum test
  - #hashtags: $H = 12.1263$, $df = 2$, $p < 0.0023$
  - Reject the null hypothesis
- Post hoc pairwise Wilcoxon rank sum test
  - Boston = NY Metro ($p = 0.2400$) ## Fail to reject
  - Boston = Indianapolis ($p = 0.2366$) ## Fail to reject
  - NY Metro $\neq$ Indianapolis ($p = 0.0015$) ## Reject
Results

- Are the non-invested interest groups the same, as far as use of @mentions?
- $H_0$: Dallas = Miami = Seattle
- Kruskal-Wallis rank sum test
  - #hashtags: $H = 8.7802$, $df = 2$, $p < 0.0124$
  - Reject the null hypothesis
- Post hoc pairwise Wilcoxon rank sum test
  - Dallas = Miami ($p = 0.6952$) ## Fail to reject
  - Dallas $\neq$ Seattle ($p = 0.0098$) ## Reject
  - Miami = Seattle ($p = 0.2440$) ## Fail to reject
Results

- Are the non-invested interest groups the same, as far as use of @hashtags?
- $H_0$: Dallas = Miami = Seattle
- Kruskal-Wallis rank sum test
  - #hashtags: $H = 5.1268, df = 2, p < 0.07704$
  - Fail to reject the null hypothesis.
- Post hoc pairwise Wilcoxon rank sum test
  - Dallas = Miami ($p = 0.776$) ## Fail to reject
  - Dallas = Seattle ($p = 0.072$) ## Fail to reject
  - Miami = Seattle ($p = 0.754$) ## Fail to reject
Results

- Is the invested interest group the same as the non-invested interest group, with regards to use of @mentions?
- $H_0$: Invested Interest Group = Non-invested Interest Group
- Wilcoxon rank sum test
  - $Z = 9.9411, p < 0.001, 95\%$ CIs $[0.0005, 0.00011]$
  - Reject the null hypothesis
Results

- Is the invested interest group the same as the non-invested interest group, with regards to use of #hashtags?
- $H_0$: Invested Interest Group = Non-invested Interest Group
- Wilcoxon rank sum test
  - $Z = 11.5831, p < 0.001, 95\% \text{ CIs } [0.00004, 0.00009]$
  - Reject the null hypothesis
Results

<table>
<thead>
<tr>
<th>Content of tweets</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Announce/advertise; Info for others</td>
<td>22</td>
<td>24%</td>
</tr>
<tr>
<td>Express opinion (general likes, dislikes)</td>
<td>26</td>
<td>28%</td>
</tr>
<tr>
<td>Commercials (explicit mention of content)</td>
<td>13</td>
<td>14%</td>
</tr>
<tr>
<td>Game events (explicit mention of content)</td>
<td>32</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>93</td>
<td>100</td>
</tr>
</tbody>
</table>

Content of random sample of #superbowl tweets independent of location.
# Results

<table>
<thead>
<tr>
<th>Aboutness of non-#superbowl #hashtags (n=46)</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly concerning the contents of the tweet</td>
<td>23</td>
<td>50%</td>
</tr>
<tr>
<td>Teams (e.g. #Patriots)</td>
<td>8</td>
<td>17%</td>
</tr>
<tr>
<td>Affective or conversational (e.g. #lmfao, #JustSaying)</td>
<td>6</td>
<td>13%</td>
</tr>
<tr>
<td>Venue other than #superbowl (e.g. #SB46)</td>
<td>3</td>
<td>7%</td>
</tr>
<tr>
<td>Network (e.g. #NBC)</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Other (e.g. #IndianapolisChildrensChior)</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Complete sentences (e.g. #DaddysDrinkinCabernet)</td>
<td>2</td>
<td>4%</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Placement of #hashtags</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning of tweet</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>End of tweet</td>
<td>94</td>
<td>68</td>
</tr>
<tr>
<td>Between sentences or complete thoughts</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Within tweets as words or sentences</td>
<td>36</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>100</td>
</tr>
</tbody>
</table>
Discussion

- We view #hashtags on Twitter as first-order organizational acts rather than first-order communicative acts.
  - Library and information science has much to offer to the study of #hashtag use.
  - We concede that there is a facilitation of conversation through the use of #hashtags
- In a real-time environment like a nationally televised event, #hashtags use promotes organization.
  - #Hashtags function in a way similar to social tags in traditional social tagging sites like CiteULike, Flickr, and Delicious due to their spontaneous use and creation and their grouping function for aboutness and affective topics.
- When deciding on a theoretical framework for analyzing and studying #hashtagged tweets in Twitter, it is necessary to distinguish between the field of organization and communication for choosing a theory.
  - Results in this study imply that the greater the number of Twitter conventions used, the more the tweet should be considered conversation.
Limitations

- The Super Bowl is a popular event and therefore the locational, organizational, and conversational aspects of chatterboxing during this event may be more pronounced than in other Twitter studies where certain groups have a non-invested interest in a much less dramatic event and its outcome.

- There is a difference between users’ symbolic conventions to organize and communicate on Twitter, and the relationship between these conventions becomes statistically dependent for invested-interest locations in our chatterboxing context.

- We, however, make no generalizable, qualitative claims about the use of these two conventions. More understanding about the qualitative differences and uses is needed.
Conclusion

- Based on the quantitative results of the study, we rejected the notion that #hashtags are identical to @mentions.
- Based on the qualitative results, we reject the notion that #hashtags do not provide for the description of tweet aboutness in a way that may be similar to social tagging.
- Accordingly, we feel that it is appropriate for researchers to use organization of information theory when analyzing #hashtags in tweets.
References


De Bellis, N. (2009). Bibliometrics and citation analysis: From the Science Citation Index to cybermetrics. Lanham, MD: Scarecrow Press.


