

Change in Twitter user's behavior, homophily and echo chamber effect regarding US politics after Elon Musk's acquisition

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Data Collection

- Tweets Dataset: query = "(#democrat OR #democrats OR #republican OR #republicans) -is:reply -is:retweet"
- Replies Dataset: query = "in_reply_to_status_id:"+str(tweet_id[0])+" -from:"+str(tweet_id[1])"

Measures on Tweets

- *Sentiment*, calculated using Vader on Tweets, then expanded to Hashtags and Words (average score of appearance).
- *Political*, calculated on Hashtags; starting vector with values 1 for #republican(s), -1 for #democrat(s), 0 for all others, applied PLMP with $\alpha=0.2$, then applied $\sqrt{p/p_{\max}}$ if $p \geq 0$, $-\sqrt{p/p_{\min}}$ if $p < 0$; expanded to Tweets as mean score of Hashtags in Tweet, then to Words as average score of appearance in Tweets.
- *Alignment*, by multiplying *Sentiment* and *Political*.

Measures on Replies

- *Sentiment*, scores with VADER as for Tweets.
- *Political*, mean score of Hashtags in the Reply, if it contained no Hashtags then as mean score of Words in the Reply
- *Alignment*, by multiplying *Sentiment* and *Political*.

Hashtags Analysis

- Negative *Sentiment*, especially in June.
- *#twitter*, *#twitterfiles* and *#elonmusk* in December.
- "Flatter" *Alignment* in December.

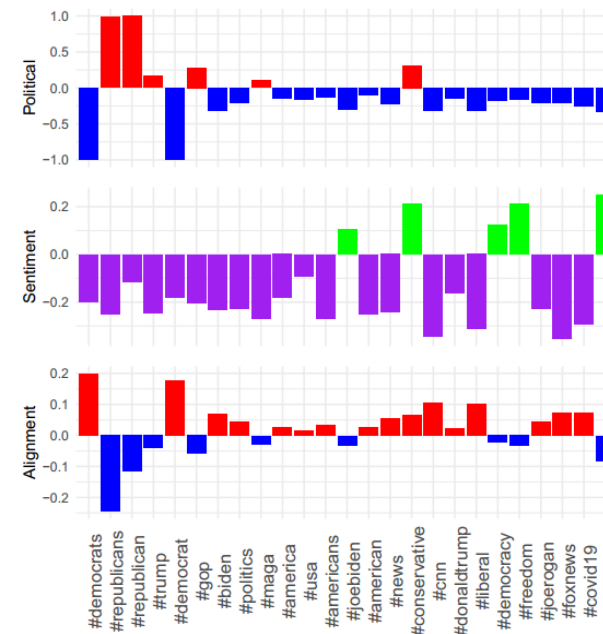


Figure 1: Hashtags scores in February

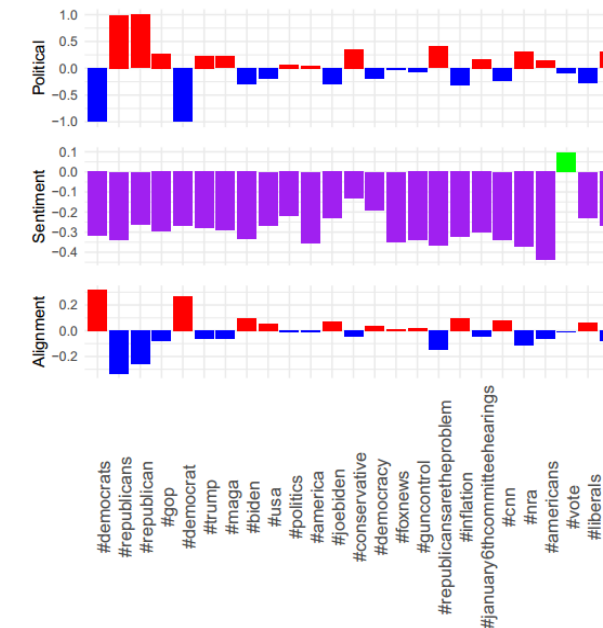


Figure 2: Hashtags scores in June

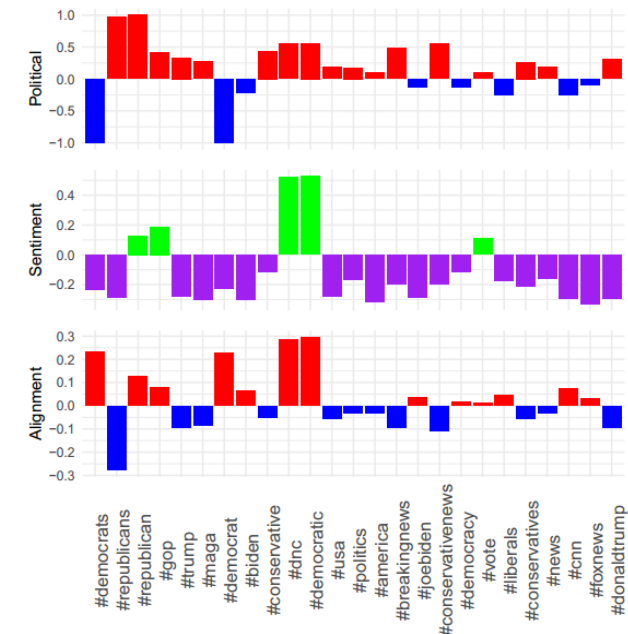


Figure 3: Hashtags scores in September

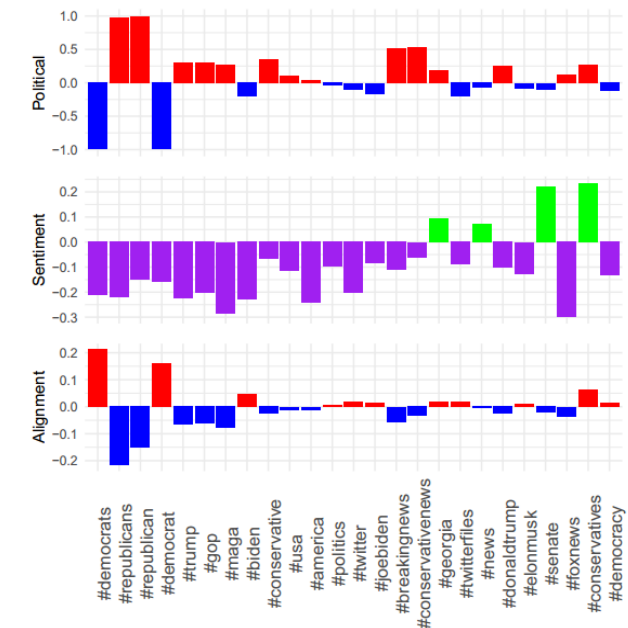
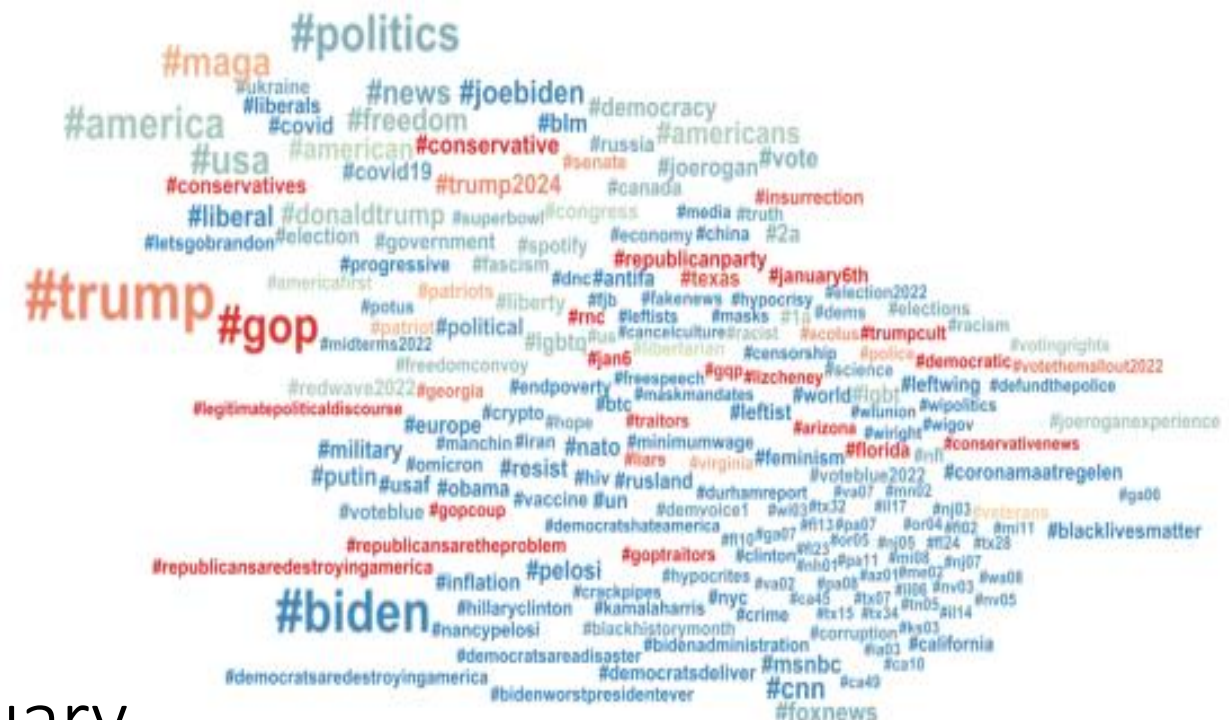
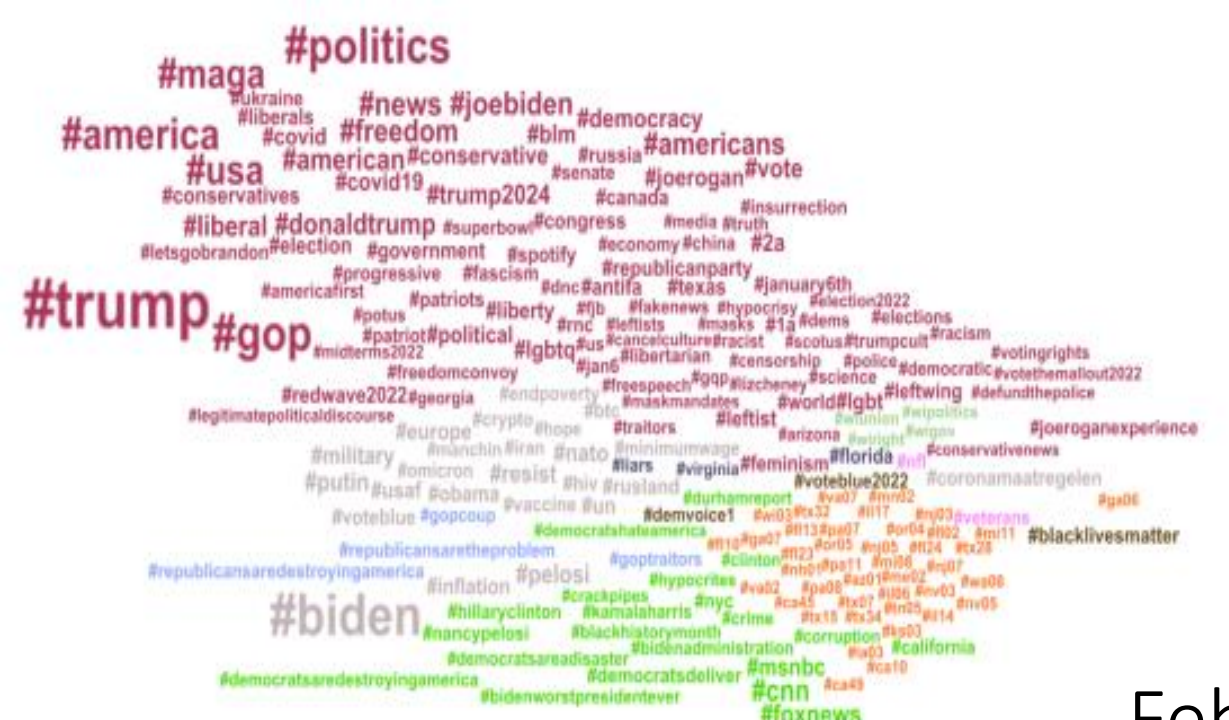
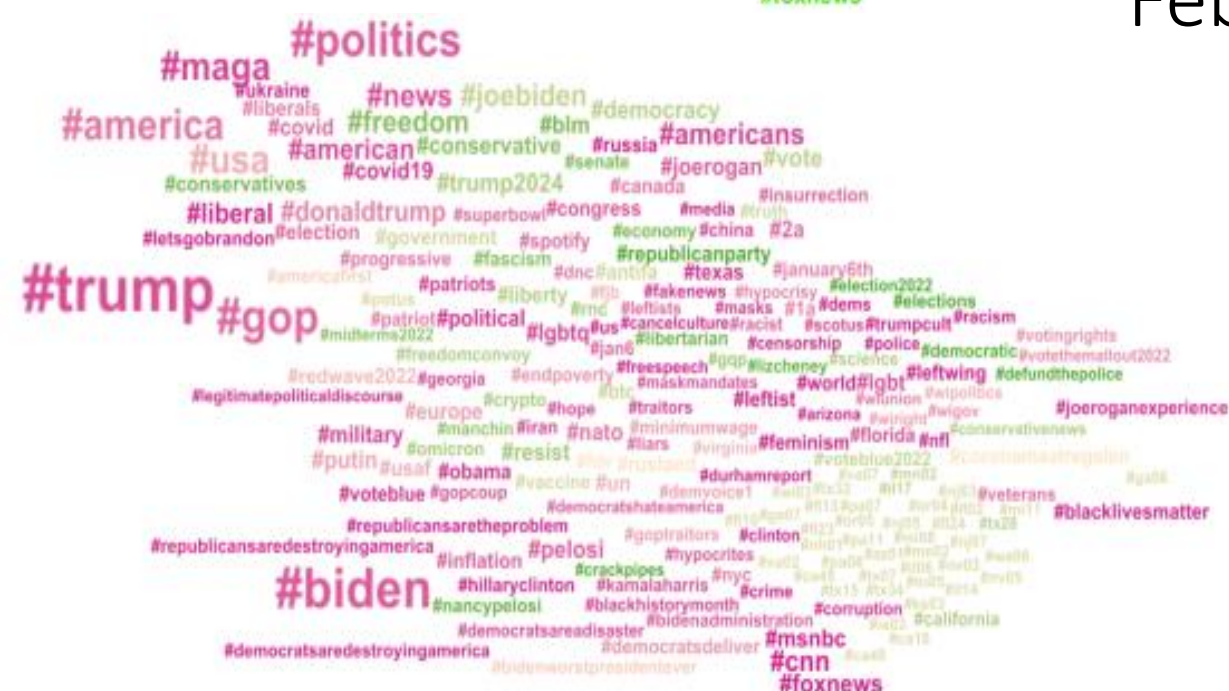
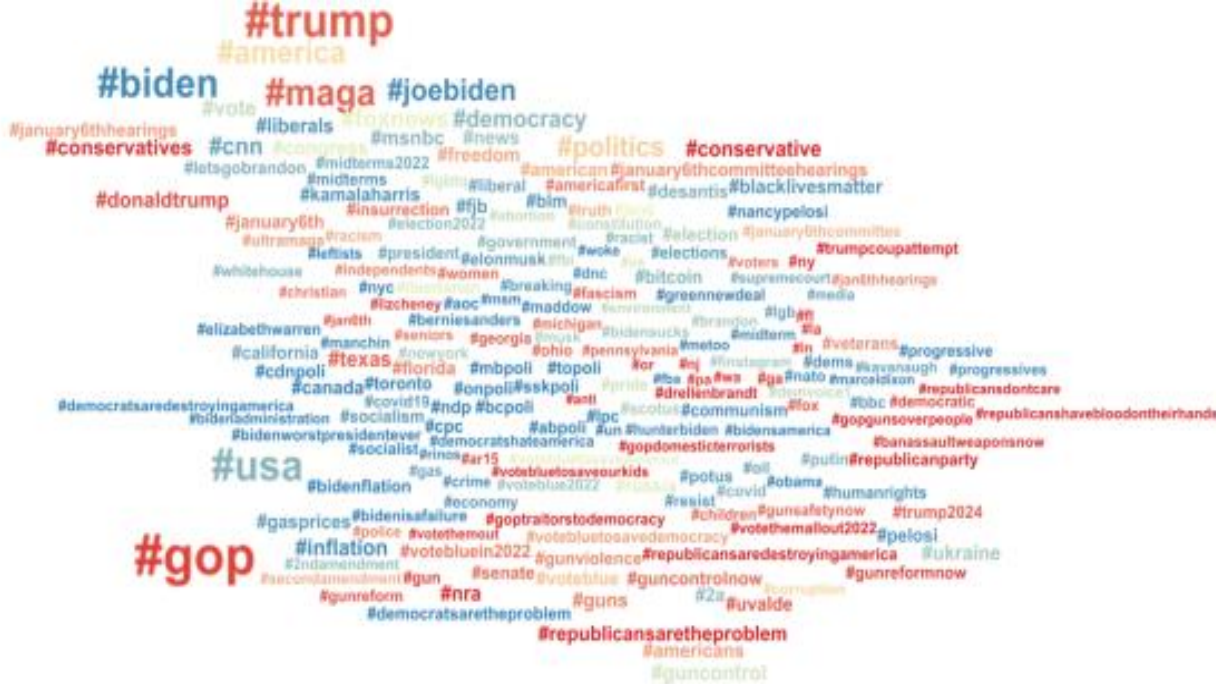
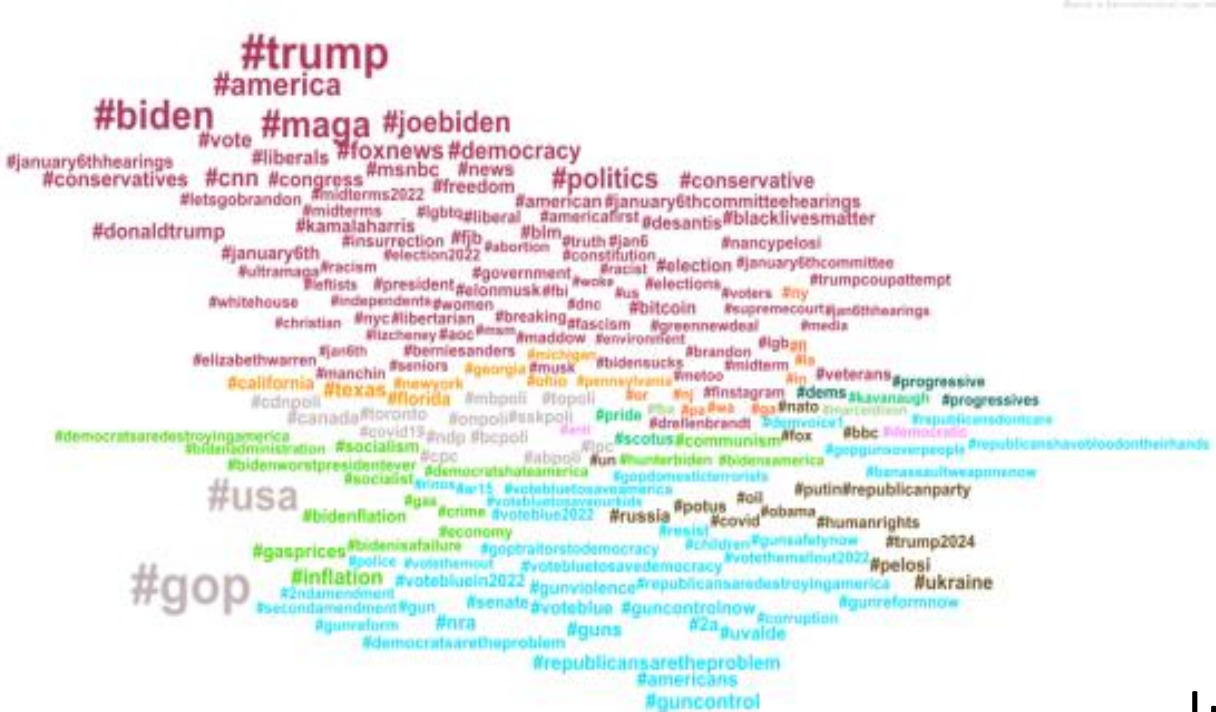


Figure 4: Hashtags scores in December

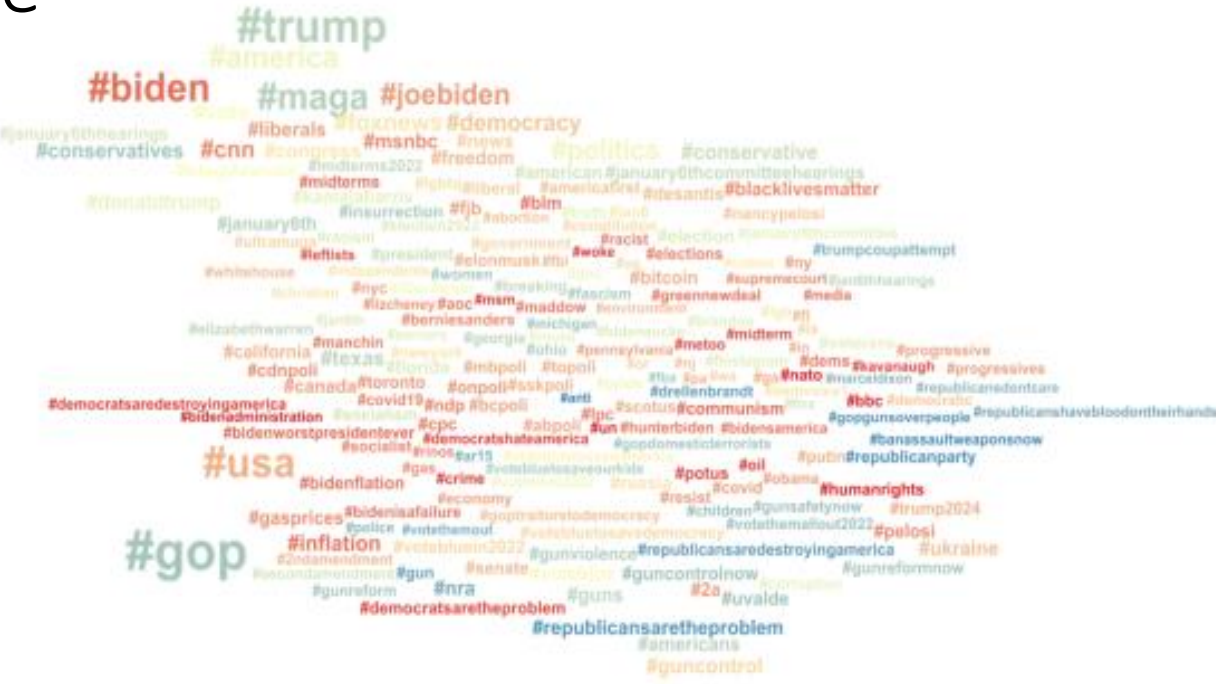
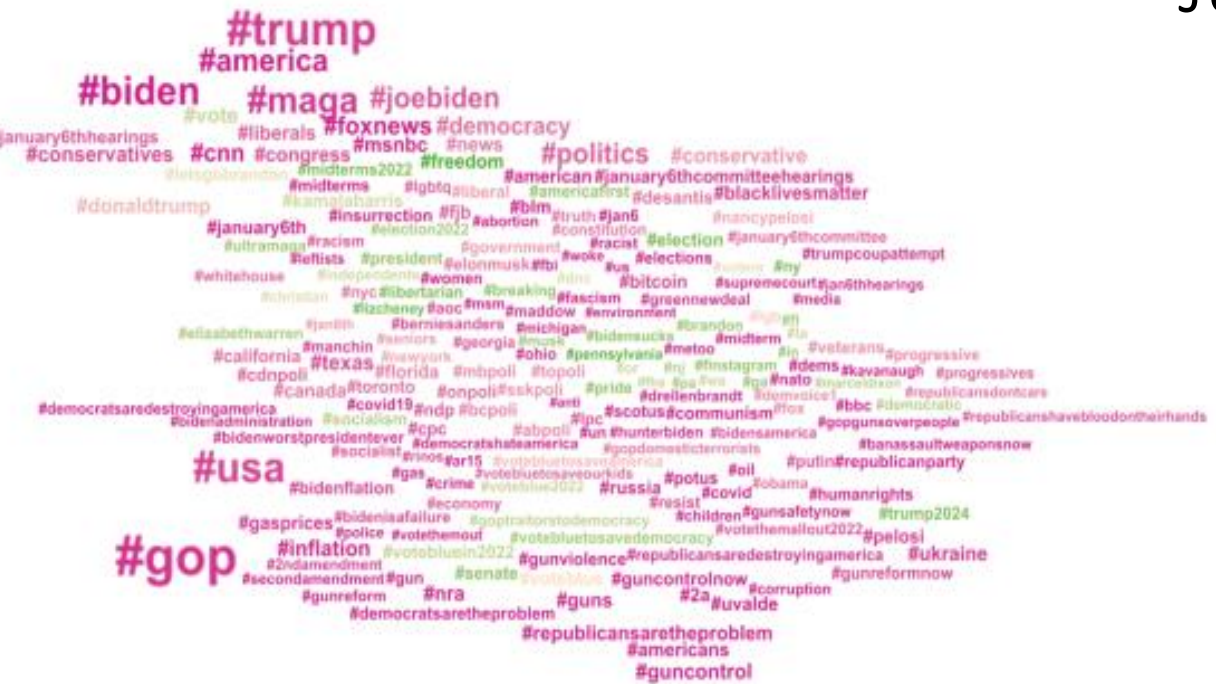


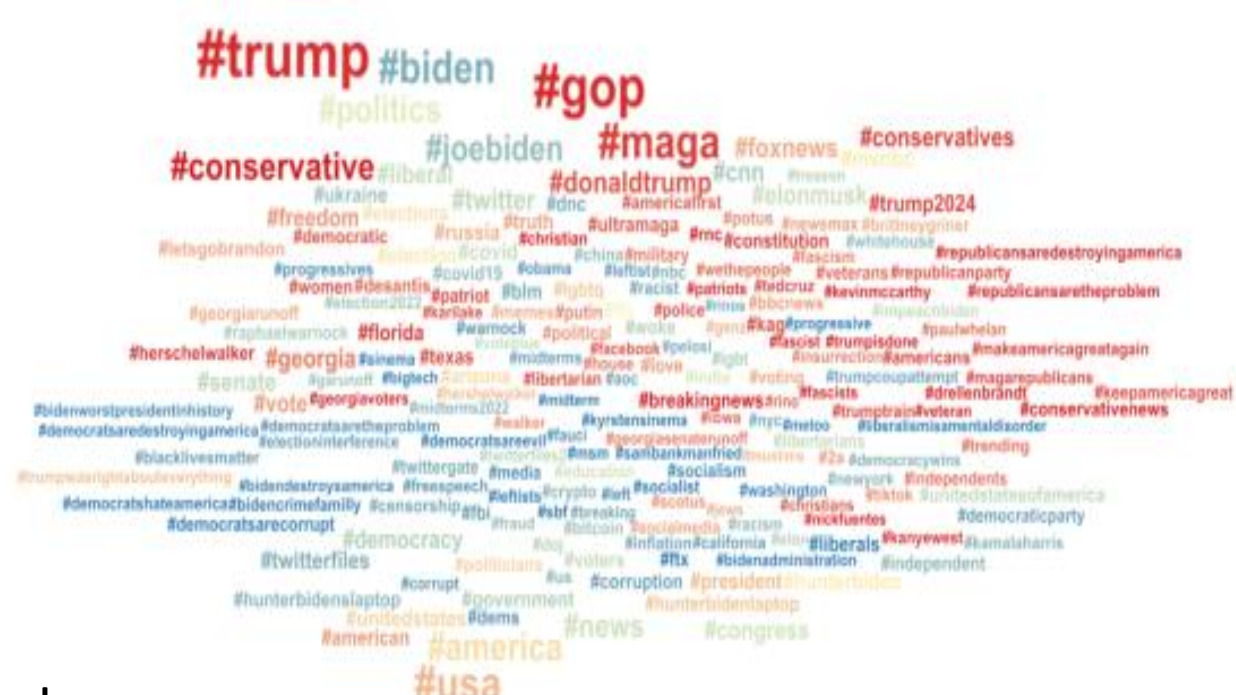
February





June



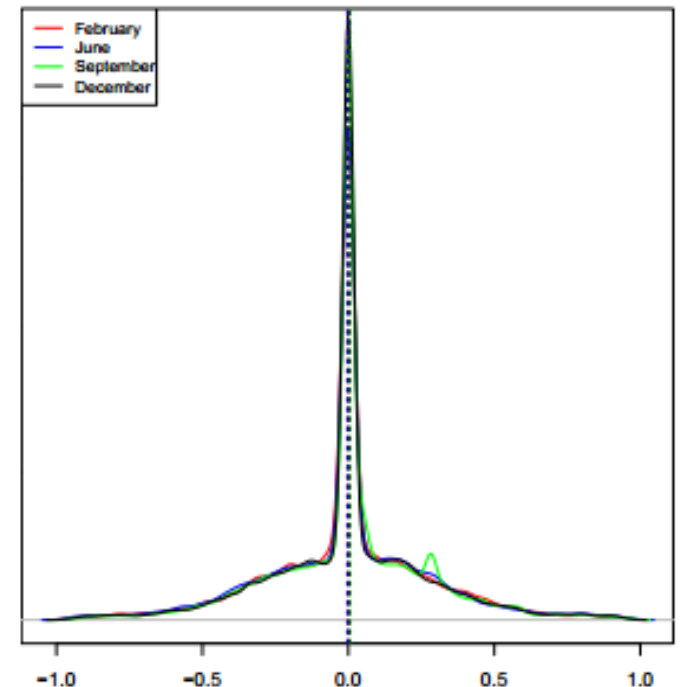
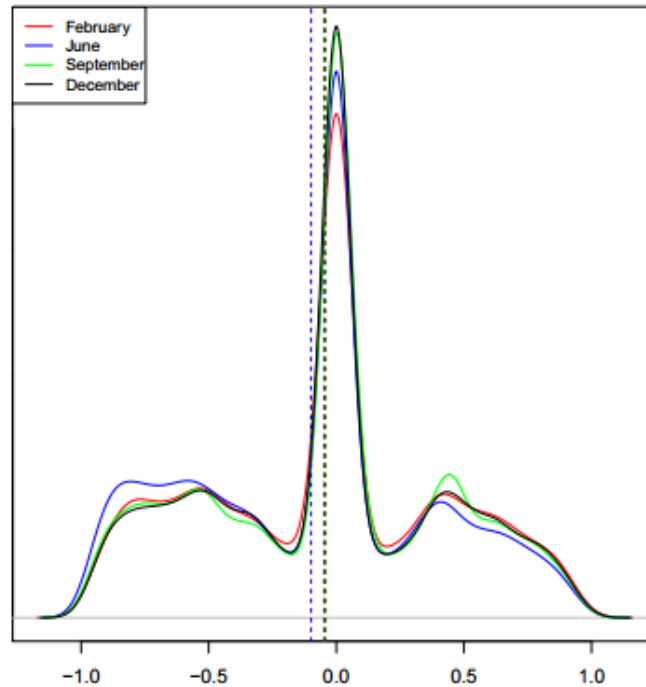
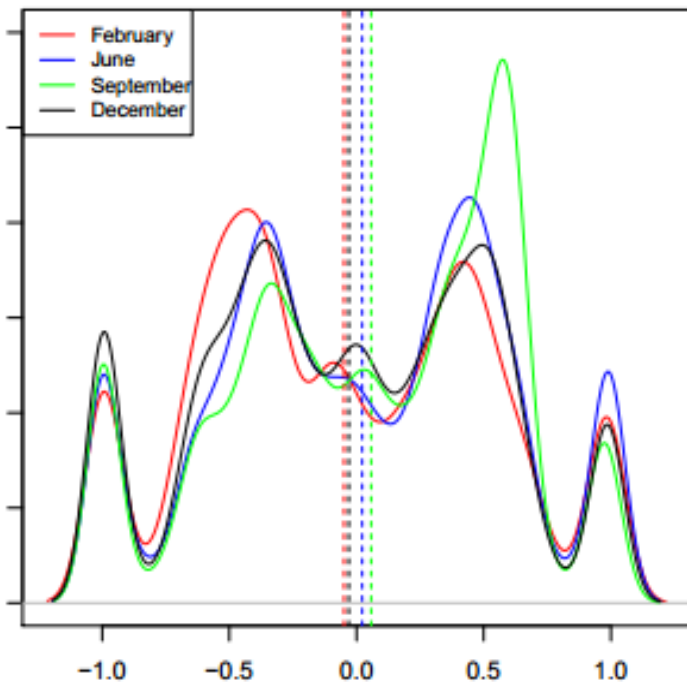


Hashtags Analysis Gephi

- Neutral biggest component.
- Nodes referring to geographic locations mainly neutral.
- Other components are generally sided.
- Nodes that are consistently the most sided are explicitly sided and convey negative message.
- Overall lower *Sentiment* in June, *Political* and slightly *Alignment* towards the right in September.
- *Alignment* shrinks towards neutrality overtime.

Tweets Analysis

- *Political* towards Right Wing in September, with also small bump in *Alignment*.
- Lower amount of positive and higher of negative *Sentiment* in June.
- No overall *Alignment* change overtime, except consistently higher density of completely neutrally *aligned* tweets.



Political vs Sentiment

- No great difference, except more positive correlation between Right Wing *Political* and Positive *Sentiment*.

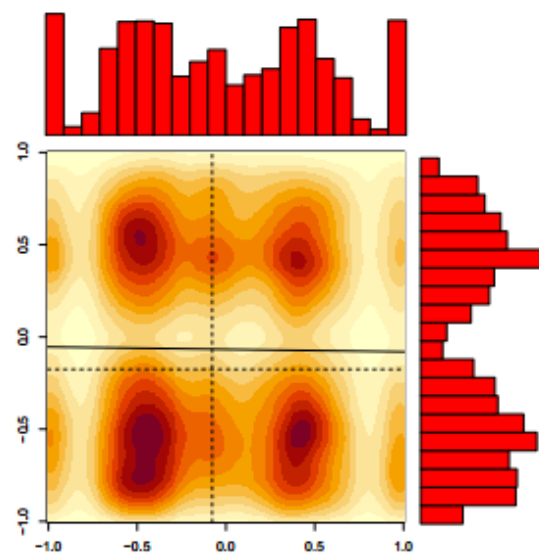


Figure 16: x : Political, y : Sentiment, February

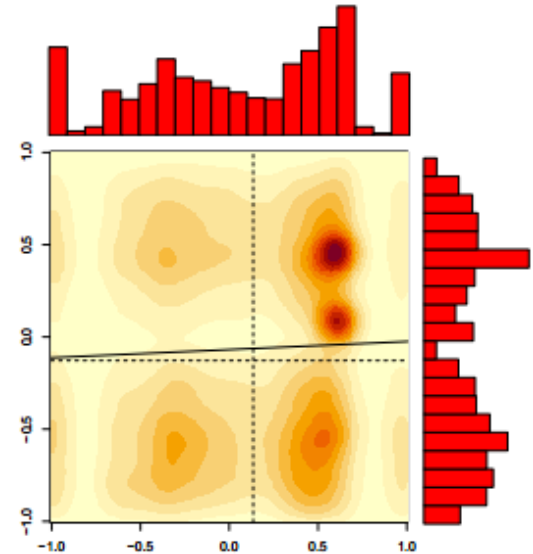


Figure 18: x : Political, y : Sentiment, September

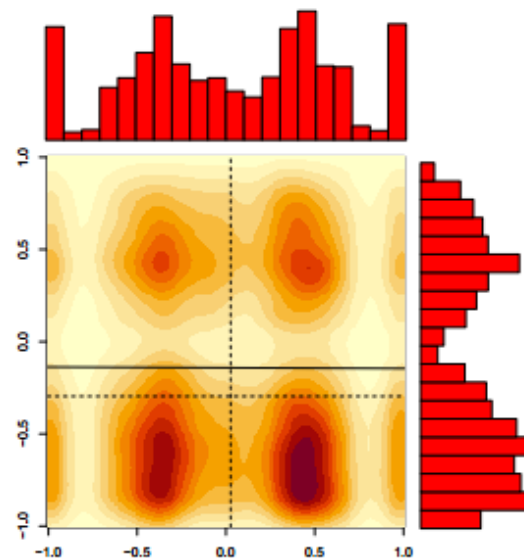


Figure 17: x : Political, y : Sentiment, June

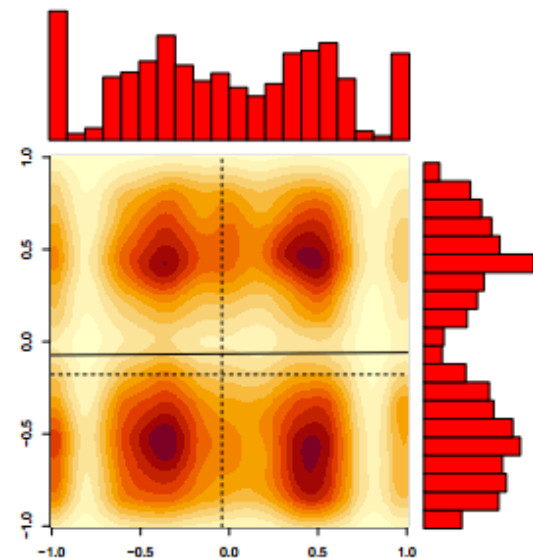


Figure 19: x : Political, y : Sentiment, December

Political vs Alignment

- Only slightly steeper linear regression curve in June.
- X shape of the heatmap is due to the construction of *Alignment*.

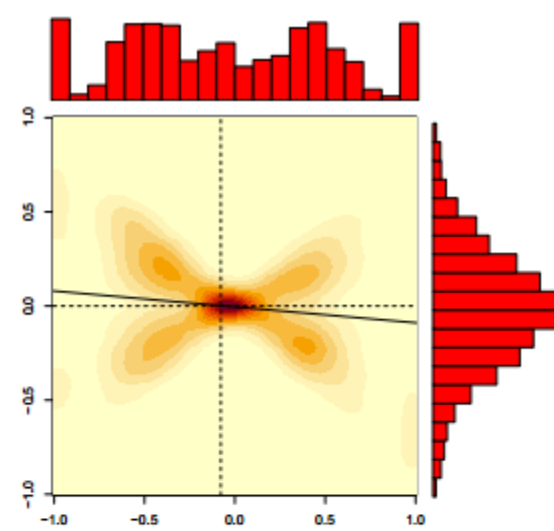


Figure 20: x : Political, y : Alignment, February

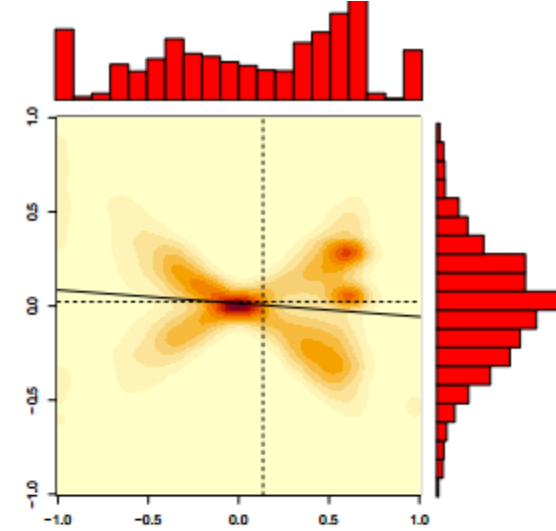


Figure 22: x : Political, y : Alignment, September

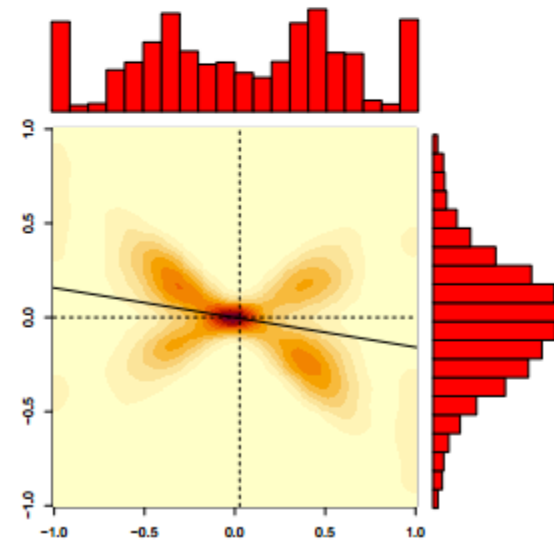


Figure 21: x : Political, y : Alignment, June

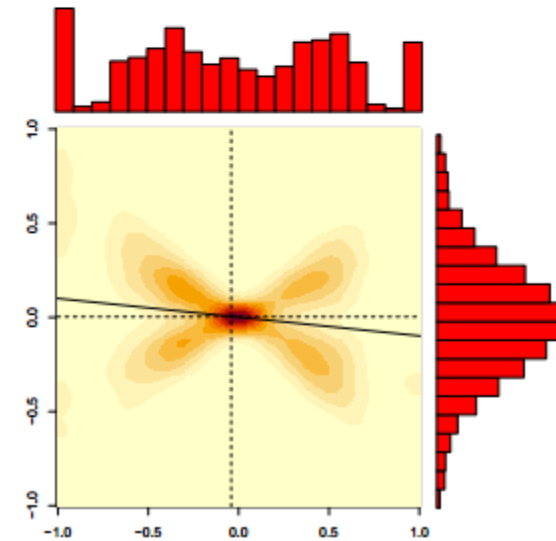


Figure 23: x : Political, y : Alignment, December

Alignment vs Sentiment

- Interpretation: "how positive or negative are the messages conveyed by user that tend to the Right or Left Wing"
- Negative relation in Feb and Dec, positive in Jun and Sep.

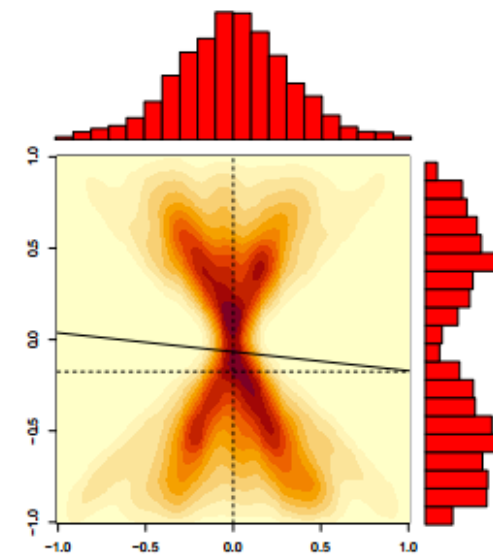


Figure 24: x : Alignment, y : Sentiment, February

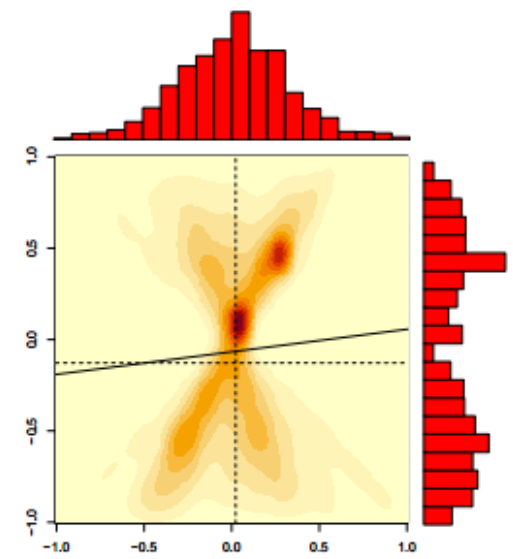


Figure 26: x : Alignment, y : Sentiment, September

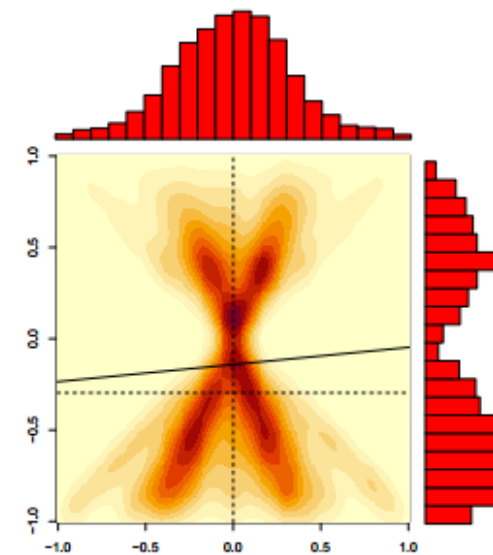


Figure 25: x : Alignment, y : Sentiment, June

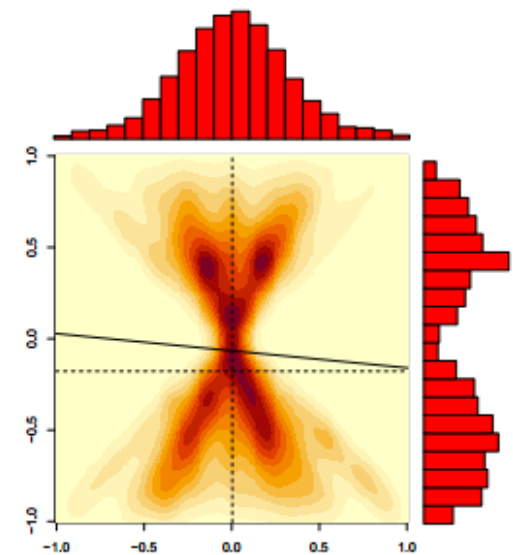


Figure 27: x : Alignment, y : Sentiment, December

Political vs Sentiment

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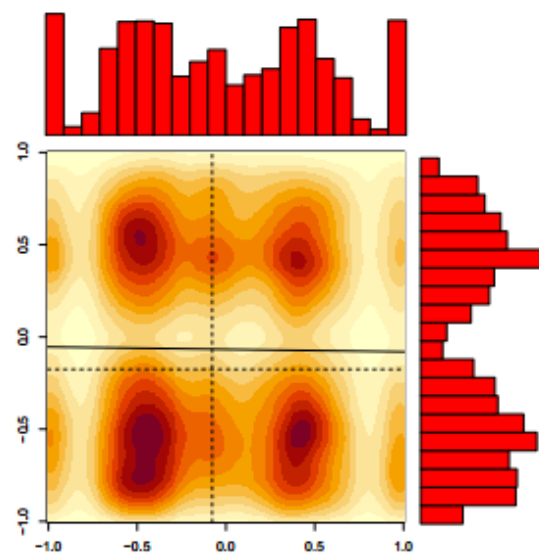


Figure 16: x : Political, y : Sentiment, February

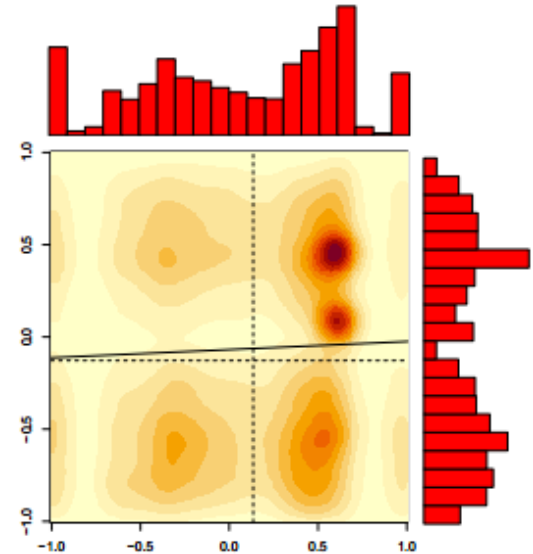


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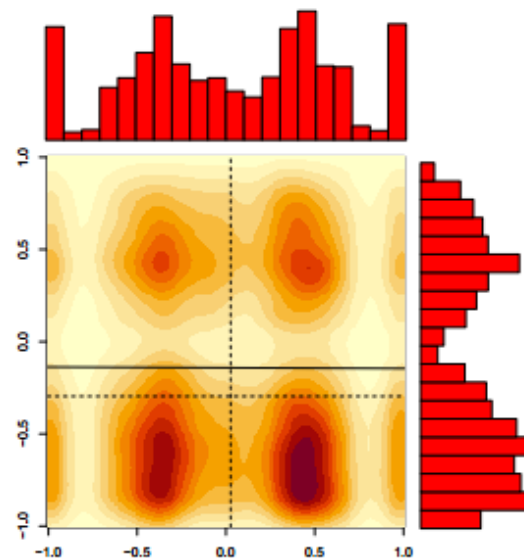


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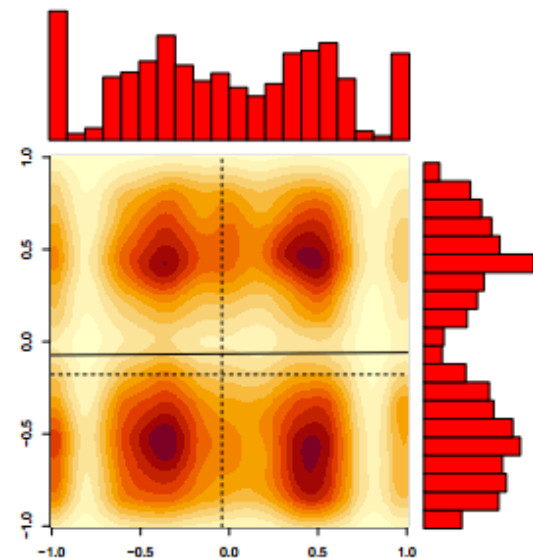


Figure 19: x : Political, y : Sentiment, December

Replies Political

- In Feb and Dec the discussion is more about Left Wing, Jun and Sep more about Right Wing, for both Tweets and Replies.
- Consistent positive relation, which means the discussion tends to stay on the same Wing mentioned in the Tweet.
- Flatter heatmap overtime: while the relation stays the same Variance in Replies lower over time.

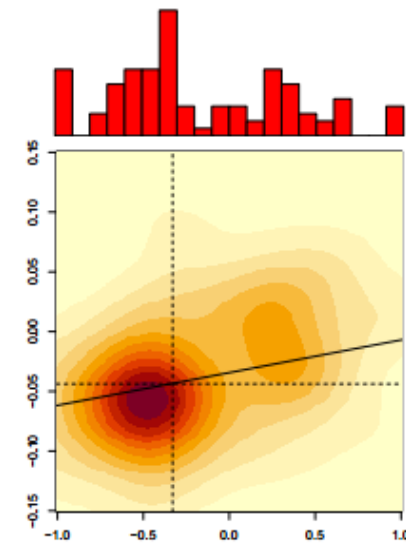


Figure 28: Political in x: tweet, y: replies, February

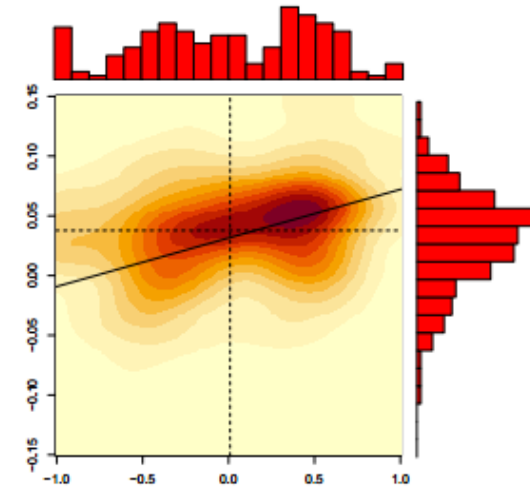


Figure 30: Political in x: tweet, y: replies, September

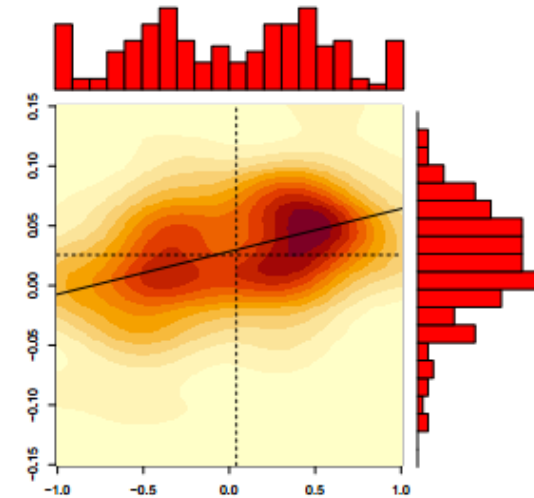


Figure 29: Political in x: tweet, y: replies, June

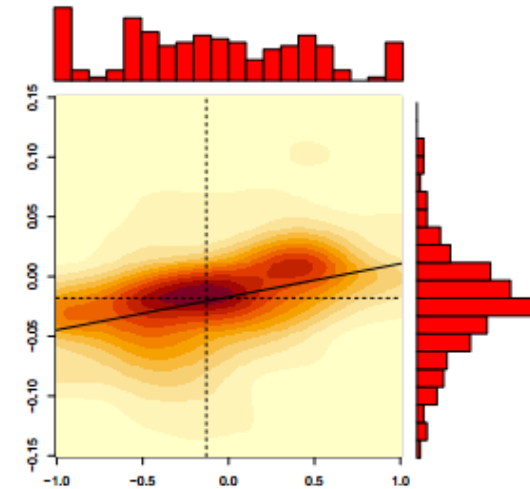


Figure 31: Political in x: tweet, y: replies, December

Replies Sentiment

- Positive relation: positive Tweets attract positive Replies and negative attract negative.
- Relation gets weaker overtime.
- *Sentiment* shrinks towards 0 for both Tweets and Replies.

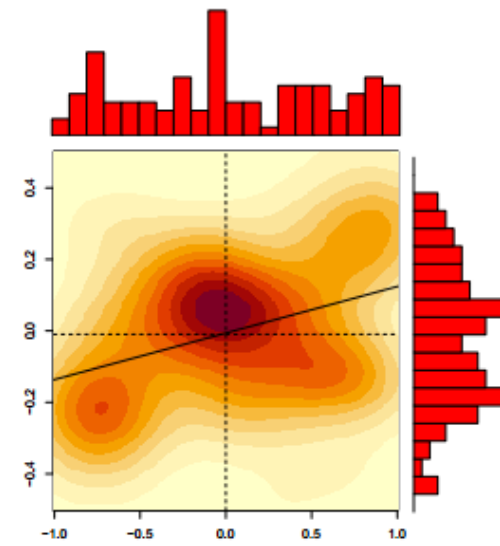


Figure 32: Sentiment in x: tweet, y: replies, February

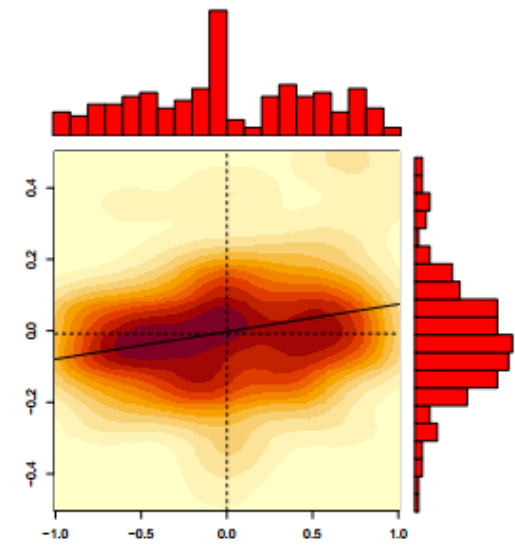


Figure 34: Sentiment in x: tweet, y: replies, September

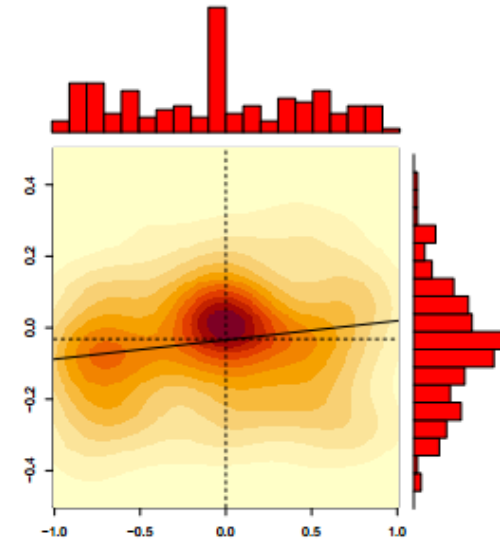


Figure 33: Sentiment in x: tweet, y: replies, June

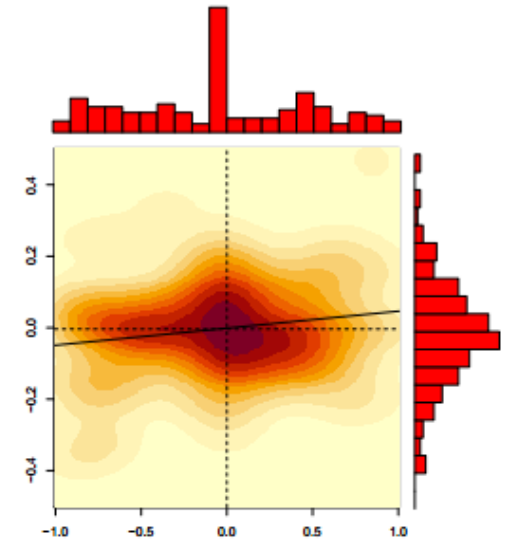


Figure 35: Sentiment in x: tweet, y: replies, December

Replies Alignment

- Similar to *Sentiment* relation between Tweets and Replies get lower over time, with particular drop after announcement.
- Overall score for both shrinks towards 0.

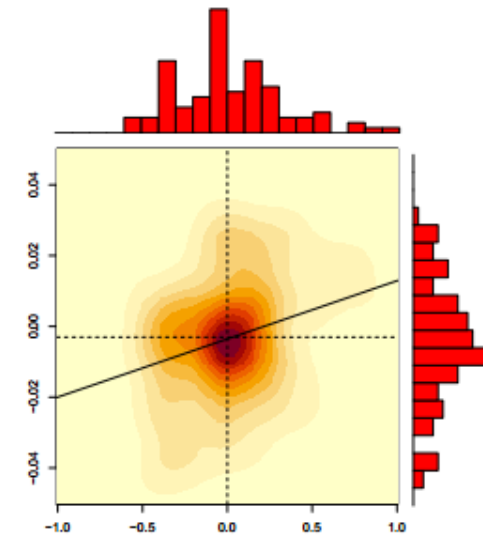


Figure 36: Alignment in x: tweet, y: replies, February

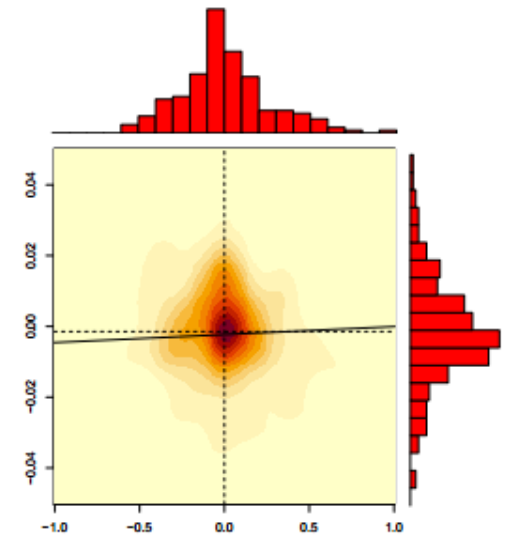


Figure 38: Alignment in x: tweet, y: replies, September

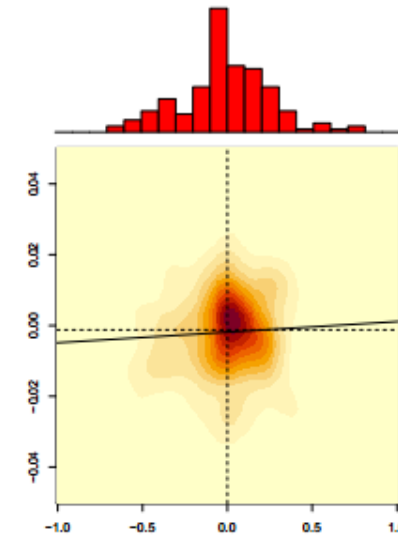


Figure 37: Alignment in x: tweet, y: replies, June

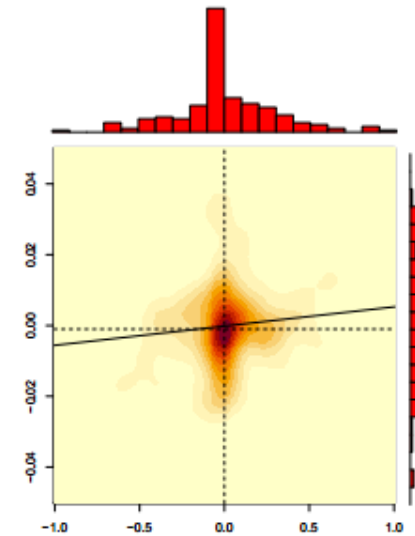


Figure 39: Alignment in x: tweet, y: replies, December

Conclusion

- Seemed like overall change was starting to take place after the announcement, however there is a return after acquisition to previous situation.
- Overall consistent slight shift towards neutrality in *Sentiment* and *Alignment*.
- Replies Analysis also shows a decrease in homophily / echo chamber, which is however more noticeable between February and June.
- Future improvements: usage of words for data collection and measurements, better *Sentiment* through trained ML techniques with also possibly scoring medias different than text, introducing scoring users based on tweet history or profile bio, expand Sentiment Analysis to also include Emotion Detection.