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Abstract
In this paper we apply a computational text analysis technique used for measuring moral rhetoric in text to analyze the moral loadings of tweets. We focus our analysis on tweets regarding the 2013 federal government shutdown; a topic that was at the forefront of U.S. politics in late 2013. Our results demonstrate that the positions of the members of the two major political parties are mirrored by the positions taken by the Twitter communities that are aligned with them. We also analyze retweeting behavior by examining the differences in the moral loadings of intra-community and inter-community retweets. We find that retweets in our corpus favor rhetoric that enhances the cohesion of the community, and emphasize content over moral rhetoric. We argue that the method proposed in this paper contributes to the general study of moral cognition and social behavior.

Keywords: Twitter; Moral Reasoning; Social Networking; Political Science; Corpus Statistics.

Introduction
Social networks now play a major role in the dissemination of opinions and news in the U.S., and Twitter plays a prominent role in this domain. In this paper, we explore the moral rhetoric expressed by tweets. Our analysis focuses on two questions: (1) do different communities of users show different patterns of moral rhetoric, and (2) are tweets that users choose to repeat on their feed (“retweet”) characterized by specific aspects of moral rhetoric that separate them from other tweets. We focus our analysis on tweets relating to a topic that was at the forefront of the U.S. news during October 2013 – The federal government shutdown.

Almost since its founding, Twitter.com has been of interest to researchers from a variety of domains. Among others, researchers have investigated Twitter’s community structure (e.g., Java, Song, Finin, & Tseng, 2007), the platform’s potential for data mining (e.g., Sakaki, Okazaki, & Matsuo, 2010) and as a tool for collaboration (e.g., Honey & Herring, 2009). There has also been research on identifying the topics of tweets (e.g., Hong & Davison, 2010) and predicting which tweets will be retweeted (e.g., Hong, Dan, & Davison, 2011).

In the present paper, we are concerned with the identifying the moral content of tweets and how such moral rhetoric might relate to the community to which the user belongs and to the likelihood that it will be repeated by other users. We chose to analyze tweets regarding a political issue because prior research has demonstrated that moral rhetoric is prevalent in political debates (e.g., Marietta, 2009).

Our investigation contributes to the general study of moral cognition by providing an alternative method for measuring moral concerns in a more naturalistic setting compared to self-report survey method and artificial paradigms used in traditional judgment and decision-making experiments.

Following Sagi and Dehghani (2013), we define moral rhetoric as “the language used for advocating or taking a moral stance towards an issue by invoking or making salient various moral concerns”. Our analysis of moral rhetoric is grounded in Moral Foundations Theory (Graham et al., 2013; Haidt & Joseph, 2004), which distinguishes between five psychological systems, also thought of as moral intuitions or concerns, which account for various aspects of our moral cognition. Each moral concern is associated with both virtues and vices, as shown below:

1. Care/harm: Caring and protecting individuals from harm.
2. Fairness/cheating: Concerns regarding acts of cooperation, reciprocity and cheating.
3. Loyalty/betrayal: Characterized by expressions of patriotism, self-sacrifice, etc. as well as their vice counterparts such as betrayal, and unfaithfulness to the group.
4. Authority/subversion: Concerns regarding topics such as respect and insubordination.
5. Purity/degradation: Related to sanctity as a virtue and disgust, degradation, and pollution as vices.

These five concerns serve separate, but related, social functions. Moreover, it has been shown that the degree of sensitivity to various concerns varies across cultures (Graham, Haidt, & Nosek, 2009). Likewise, Moral Foundations Theory suggests that the sensitivity towards these concerns can change over time and across contexts.

Various lines of research have demonstrated differences between liberals and conservatives in the U.S. on the degree to which they attend to the various moral concerns (e.g., Graham et al., 2009; Koleva, Graham, Iyer, Ditto, & Haidt, 2012). Moreover, endorsement of the various foundations are strong predictors of support for political issues such as abortion, immigration, and same-sex marriage (Koleva et al., 2012). Koleva et al. (2012) show that moral foundations are better predictors of such support than more traditional predictors such as ideology and religiosity.
Since the topic of the analysis we chose is political, we expected that the majority of users will be politically active, which, due to the bipartisan nature of U.S. politics, means that they will likely identify with one of the two major parties – the Republican party or the Democratic party. Because the government shutdown was characterized by a struggle between these two parties we hypothesized that this will be reflected in the tweets on the subject. That is, the positions of the two parties in the political struggle will be mirrored by the positions taken by the Twitter communities that are aligned with them. We further hypothesized that this “culture war” is a reflection of the differences in the moral preferences between the two parties. Therefore, the moral rhetoric used by the two communities will be more similar following the crisis than during it. However, it is important to note that showing a similar moral concern does not necessarily mean that the particular topics underlying this concern are the same. For instance, while both parties might be concerned with loyalty, one party might show a concern regarding patriotism while the other might be more concerned with self-sacrifice. Nevertheless, focusing concerns on the same dimension indicates that qualitatively similar types of representations and reasoning are used. This, in turn, provides some common ground for the two sides, which is crucial for resolving differences. Consequently, it is more likely that the two communities would share concern regarding some moral dimensions after reaching an agreement than before.

In addition to examining how communities differ from one another, our analysis of moral rhetoric also allows us to test whether tweets that users consider important enough to repeat show patterns of moral rhetoric that differentiate them from other tweets. Moreover, because the topic we chose involves two well-established communities, it is possible to also compare retweets that cross from one community to another with those that remain within a single community. Differences in the rhetoric between such inter- and intra- community retweets are important because inter-community retweets are one of the main channels through which information crosses from one community to the other. Likewise, intra-community retweets are important to the cohesiveness of the community – they let one community member show support for other members of their community. This latter hypothesis leads to a fairly direct prediction: That intra-community retweets, more than inter-community ones, should show rhetoric that is associated with loyalty dimension because that dimension is directly related to group cohesiveness – a sense of community is based on notions such as loyalty, and ‘us’.

Method

In this section, we will describe our data collection method and the techniques we used for community detection and for measuring moral rhetoric in text. We used a community detection method to find the most dominant communities in our corpus – a conservative community, associated with the Republican party, and a liberal community, associated with the Democratic party. We hypothesize that these two communities will show different moral concerns for the duration of the government shutdown (October 1st through 16th), but that this difference will be diminished after the crisis concludes. Finally, we hypothesize that retweets will show a pattern of moral rhetoric that is distinctive from that of general tweets. Specifically, we predict that intra-community retweets will show a higher than average loading on the loyalty moral concern.

Data Collection

We used the public Twitter stream, which provides random samples of the data flowing through the network, to collect tweets, and network information, about the government shutdown. The Tweepy API1 was used for this purpose. We started by collecting data on the first day of the shutdown (October 1st). Using the API described above, we searched the public stream for a list of hashtags and pages that were collected independently and agreed upon before we began collecting data (see Appendix A for the list of hashtags we used). We stopped data collection on October 24th, about a week after the end of the government shutdown. We collected the following information about every tweet: the date and time the tweet was published, the ID of the user who published the tweet, and the tweet itself. Following the period in which we collected the tweets, we gathered information about the network structure within the corpus using the Tweepy API. Specifically, we collected the list of followers and friends for every user in the corpus and used this information to map the network structure.

Language Detection

We used Chromium’s Compact Language Detector to detect the language of each tweet and limited our analysis to Tweets that were identified as English. Specifically, we used the R API made available through the Chromium browser via the Chromium Compact Language Detector library2.

Community Detection

One of our goals in this paper is to investigate whether there are differences in the use of moral rhetoric between different groups of users. Because of the political nature of the topic, we assumed that the majority of users were politically active. Given the bipartisan politics spectrum in the U.S., we expected that most of the users would identify as either Democrats or Republicans.

In order to identify the various communities in our data, we formed a network based on ‘follower’ information. That is, we connected two nodes (users) on the social graph if one node was the follower of the other. This resulted in 9,601,660 edges connecting the 167,041 nodes in the graph.

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1 https://github.com/tweepy/tweepy
2 https://code.google.com/p/chromium-compact-language-detector/
We then used a greedy community detection algorithm developed by Clauset, Newman, and Moore (2004). This algorithm works especially well for large graphs. It starts in an unclustered state by assuming that all the nodes in the graph form singleton communities. Then, it iteratively calculates likely improvements of modularity when two adjacent communities are merged. Two communities are then merged if this likelihood is higher than a threshold. This process is repeated until there are no more communities left to be merged. We used the implementation of this algorithm available in the R igraph package.

Measuring Moral Rhetoric

We based our measure of moral rhetoric on the method described in Sagi and Dehghani (2013). At the core of this measure is the notion of word co-occurrence patterns as used by methods such as Latent Semantic Analysis (LSA; Deerwester, Dumais, Furnas, Landauer, & Harshman, 1990; Landauer & Dumais, 1997). Specifically, we constructed a semantic vector space by applying singular value decomposition to a matrix of word co-occurrence frequencies. The distance between two words in this space is inversely related to the probability that they will co-occur in the text. A common measure used for the distance is the cosine of the angle between the vectors representing the words, where, for normalized vectors, the cosine of the angle is equivalent to the correlation between the vectors. Furthermore, these patterns of co-occurrence are not random and words that relate to similar topics tend to occur together more frequently than unrelated words (e.g., moon and earth tend to occur with each other more frequently than either tends to occur with gun).

By calculating the distance in this space between a tweet and a set of terms associated with a particular moral concern, we can estimate the likelihood that the tweet expresses the moral concern. This results in a set of moral concern loadings that are suitable for statistical analysis.

Results

In our analysis we were interested in two separate questions. Firstly, we were interested in analyzing the moral rhetoric used by conservative and liberal Twitter users over the course of the government shutdown. Secondly, we wanted to explore the relationship between tweets and retweets.

The corpus of tweets we used was comprised of 421,778 English language tweets (approx. 9.5 million words) from 167,041 users. We used Infomap (Schütze, 1997, 1998) to construct a semantic space based on the corpus. Next we computed the moral loading on the 5 moral concerns for each tweet by calculating the mean correlation between the vector representing the tweet and the vectors representing relevant terms derived from the Moral Foundations Dictionary (Graham et al., 2009). This results in loading scores between 1 and -1 which can be interpreted in a fashion analogous to correlations. However, it is important to note that the sparsity of morally loaded terms limits the actual range of loadings. In our corpus, the highest measured moral loading of any tweet is 0.20, and 75% of tweets have an overall loading below .03.

Additionally, we computed the network structure of the corpus and used the community detection algorithm described above to identify the various communities in the network. The two biggest communities that emerge from the connectivity structure of the graph cover 85.6% (143,023) of the nodes in the graph. Therefore, we focus our analysis on these two communities. A manual analysis of the 20 most central nodes in each community (closeness centrality is a measure of how many steps it takes to reach every other node in the cluster from a given node) revealed that, as we had predicted, members of the main two clusters in the network identify with either the Republican or Democratic parties. This is a further indication of the bipartisan nature

3 http://igraph.sourceforge.net/

4 http://infomap-nlp.sourceforge.net/

5 To generate the list of terms we identified all of terms in the corpus with a frequency greater than 20 that matched entries in the Moral Foundations Dictionary. This included both regular words and hashtags.
of the political spectrum in U.S. politics. We labeled these communities as conservatives and liberals, respectively.

In order to further validate the nature of these clusters we examined the proportion of hashtags and references that are associated with conservatives and liberals. In particular we looked at the hashtags #obamacare and #aca, and reference beginning with @fox and @cnn (standing for sources related to Fox News and CNN, respectively). In all cases we found that expected results – Mentions of obamacare and Fox News were more than twice as common in the community we labeled as conservative, whereas uses of aca and CNN where twice as common in the liberal community than the conservative one (p < .001 in all cases).

We grouped the tweets based on their community of origin and whether they were posted during the shutdown or after it had concluded. The mean loadings on the various moral concerns for the conservative community are given in Figure 1. The mean loadings for the liberal community are given in Figure 2. Appendix B provides a sample of tweets with relatively high moral loadings from both communities.

**Conservative and Liberal Tweets**

A multivariate analysis of variance with the community of origin and the week as the independent variables and the loadings on the five moral concerns as the dependent variables revealed several key results:

1. Conservative tweeters showed a higher overall moral loading that liberal tweeters, $F(5, 182857) = 53.77, p < .0001$.
2. The moral rhetoric used in tweets increased over time. However, while tweets by conservatives showed a week-to-week increase, tweets by liberals only showed an increase in moral loading in the week following the resolution of the shutdown, $F(5, 182857) = 692.89, p < .0001$.
3. Over the course of the shutdown, conservatives used rhetoric that was most closely associated with fairness, authority, and loyalty whereas liberal rhetoric was more concerned with harm and purity. In the week following the shutdown tweets from both communities showed increased concern with fairness (All results, p < .0001).

These results suggest that liberals and conservatives initially viewed the shutdown differently, liberals focused on the possible harm the shutdown might cause, whereas conservatives stressed the ideals of freedom and rights (fairness). However, as the crisis resolved, both sides appear to agree that the issue of fairness is an important concern.

### Table 1 - The distribution of tweets and retweets.

<table>
<thead>
<tr>
<th>Source</th>
<th>Original Tweets</th>
<th>Conservative Source</th>
<th>Liberal Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative</td>
<td>71,767</td>
<td>9,797</td>
<td>1,025</td>
</tr>
<tr>
<td>Liberal</td>
<td>132,647</td>
<td>1,140</td>
<td>18,920</td>
</tr>
</tbody>
</table>

**Figure 3 - Mean difference in moral concern loadings between retweets and normal tweets.** Positive numbers indicate an increase in moral loading for retweets compared to normal tweets. Negative numbers indicate a decrease in the moral loading of retweets compared to normal tweets. Error bars represent standard error of the mean.

#### Comparing Tweets and Retweets

We now turn to examining the relationship between tweets and retweets. To conduct this analysis we first identified retweets, following the conventions of Twitter, as tweets that begin with the term ‘RT’. Next we attempted to identify the source tweet for each retweet by matching the retweet (without the ‘RT’ term and the attribution) with its source. Within our corpus we were able to find the source for approximately a third of the retweets. In the following analysis we only used retweets whose source was identified as being a user in either the conservative or liberal communities. Table 1 summarizes the distribution of the tweets and retweets among the communities. Overall, 93% (28,717) of the retweets were published by users from the same community as the original tweet. This is expected because of the way we identified the communities. The ‘follower’ relation that we used to construct our social network graph also identifies users who are likely to retweet a particular user’s tweet.

To analyze these results we labeled a retweet as “intra-community” if its source community was the same as the community of the retweeting user (e.g., a conservative retweeting a tweet by another conservative). Retweets whose source community was different from the community of the retweeting user were labeled “inter-community”. Since we are interested in examining the properties of retweets as they compare to tweets in general, we subtracted the average loading for original tweets from the source community from each retweet. The resulting number is an index of how a particular retweet differs from the average of its source community. Figure 3 shows the means of these difference index for each moral concern based on whether it is intra- or inter-community.

We conducted a multivariate analysis of variance with the retweet type (intra- or inter- community) as an independent variable and the moral difference index on the five moral concerns as the dependent variables. This analysis revealed
that retweets are generally less morally loaded than the average original tweet ($F(5, 235290) = 1649.1, p < .0001$) and that this difference is greater for inter-community tweets than intra-community ones ($F(5, 30876) = 8.73, p < .0001$). In stark contrast with this overall pattern, intra-community tweets tended to show a higher than average loading on the loyalty moral concern ($p < .001$). These results suggest that users are more likely to retweet messages that focus on content rather than rhetoric. At the same time, users also tend to retweet messages that employ rhetoric that appeals to their sense of community belonging.

The result that tweets that users choose to repeat are less morally loaded than the average tweet is somewhat counterintuitive. It might be expected that users will choose to repeat tweets that they connect with emotionally and that represent their opinions. Consequently, we might expect users to repeat tweets that show a high degree of emotional and moral content. In contrast, the observed result is in the opposite direction. To further explore this result we manually examined tweets that showed a high moral loading, as well as retweets. This analysis revealed two separate explanations for the observed effect. Firstly, many of the highly morally loaded tweets involved language that can be considered inappropriate and inflammatory, using terms such as “racist”, “stupid”, “gays”. Furthermore, these tweets show frequent use of religious terms, such as “Christians” and “Muslims”, in derogatory contexts. This effect can also be observed by examining the tweets that were retweeted from those available in Appendix B, although tweets that are overly inflammatory were intentionally excluded from the Appendix. Secondly, many of the least morally loaded tweets come from major media and news organizations such as NBC, CNN, and Fox News. These tweets are worded in fairly objective and non-morally loaded terms and are frequently retweeted, therefore reducing the overall moral loading of retweets. Both of these explanations suggest that retweets are chosen based on the information they convey rather than their emotional content. Regardless, it is important to note that these explanations do not explain the difference in moral loading between intra- and inter-community retweets, only the general trend that finds that retweets are less morally loaded than the average tweet.

**Discussion**

In this paper we explored the moral rhetoric used by Twitter users during the U.S. Federal Government Shutdown in October 2013. In accordance with our hypothesis, we found that conservative and liberal tweets expressed different moral concerns during the shutdown. Tweets by conservatives focused on the concerns of fairness, authority, and loyalty, while liberal tweets showed more concern for harm and purity. In addition, conservatives showed a higher overall level of moral rhetoric in their tweets, suggesting a higher degree of emotional involvement in the debate.

Interestingly, while we hypothesized that the moral rhetoric of the two communities will become more similar after the resolution of the crisis, we only observed a trend in that direction – Both communities converged on fairness as the most important moral concern, but the remaining four concerns did not differ much from their levels during the shutdown.

We also investigated the moral rhetoric exhibited by retweets. Here we found that, as predicted, retweets showed an increase in rhetoric involving loyalty when repeating tweets from their own community, but not when repeated tweets from other communities. Our analysis also revealed that retweets tend to exhibit a diminished level of moral rhetoric overall, suggesting that, with the exception of rhetoric supporting group cohesiveness, users select tweets to repeat based on their content rather than emotional and moral associations.

The research we presented here demonstrates the feasibility of quantitative moral rhetoric analysis on large corpora. This type of analysis can provide interesting insights on the moral reasoning that guides users of Twitter and other social networks when posting and repeating information. Moreover, it is likely that the moral reasoning employed when interacting in social networks is the same as used elsewhere. Consequently, the wide availability of this type of data, combined with an efficient, quantitative, analysis, can be used to study general processes of moral reasoning.

**Acknowledgments**

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**References**


Appendix A

Hashtags used to identify relevant tweets

#boehner #congress #medicaldevicetaxrepeal #conservatives #dearcongress #furloughs #gop #governmentclosed #governmentshutdown #harryreid #house @MarkLevineTalk @delong

#congress #conservatives #gop #furloughs #dearcongress #obama #shUTDOWN #shutdown #shutdown #shutdown #schutt #harryreid #tedcruz

#house #congress #boehner #congress #conservatives #gop #furloughs #dearcongress #obama #shUTDOWN #shutdown #shutdown #shutdown #shutdown #shutdown

Appendix B

Sample Tweets with High Moral Loading

<table>
<thead>
<tr>
<th>Conservative Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 8th #Teaparty has the same rights as every other group of Americans in this country no matter what Obama says or tries to do to us with the #IRS</td>
</tr>
<tr>
<td>Oct 13th Why r you fricking #liberals so stupid? Don't let your blind hatred of the #TeaParty movement take the message of freedom away. Please think</td>
</tr>
<tr>
<td>Oct 15th Retweeted So #Liberals, its okay when you protest but when others do it, it's terrorism, radical or fringe?!</td>
</tr>
<tr>
<td>Oct 16th Retweeted Everyday the danger of #Obama becomes bigger. He is a tyrannical dictator the media is complicit in the destruction of America</td>
</tr>
<tr>
<td>Oct 17th #Obama hates the Constitution because it prevents him from doing what he wants. The same Constitution that guarantees Civil Rights.</td>
</tr>
<tr>
<td>Oct 18th We must shift the focus away from #Obama to Progressives. Make #media defend the movement NOT the man. #tcot #libertarian #teaparty</td>
</tr>
<tr>
<td>Oct 24th Retweeted Democrat control at it's finest - #2A #NRA #tcot #liberty #teaparty #Obamacare #patriots #DNC #GOP #military</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liberal Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 8th #teaparty -smaller government when it comes to helping others but enough gov to conserve hating gays, woman's rights and foreigners</td>
</tr>
<tr>
<td>Oct 9th @delong Looking at US from outside, one could think it's full of gun toting Christian extremists who don't understand macroeconomics. #GOP</td>
</tr>
<tr>
<td>Oct 12th #TeaParty agenda: protect interests of hardworking ordinary people by privileging exploitative rich (ie counter own interests) #zizek #tcot</td>
</tr>
<tr>
<td>Oct 15th #POTUS tryin so hard to maintain integrity of US but #teaparty #gop blinded by hatred racism Wil b demise of country #msnbc</td>
</tr>
<tr>
<td>Oct 17th Retweeted 'Death of an American party'; to be published on 11 2016... 'A morally bankrupt ideology' #GOP #teaparty</td>
</tr>
<tr>
<td>Oct 16th Retweeted Why are #TedCruz and his #TeaParty brethren still proud of what havoc they wreaked?? w @MarkLevineTalk -- 888-6-LESLIE</td>
</tr>
<tr>
<td>Oct 20th Ironic: Regular old white people being upset at realizing the US Constitution isn't about protecting their rights anymore. #teaparty #GOP</td>
</tr>
</tbody>
</table>