

Bots and Automation over Twitter during the Second U.S. Presidential Debate

[COMPROP](#) DATA MEMO 2016.2 / 19 OCT 2016

Bence Kollanyi
Corvinus University
kollanyi@gmail.com
@bencekollanyi

Philip N. Howard
Oxford University
philip.howard@oii.ox.ac.uk
@pnhoward

Samuel C. Woolley
University of Washington
samwooll@uw.edu
@samuelwoolley

ABSTRACT

Bots are social media accounts that automate interaction with other users, and political bots have been particularly active on public policy issues, political crises, and elections. We collected data on bot activity using the major hashtags related to the U.S. Presidential debate. In this brief analysis we find that (1) Twitter traffic on pro-Trump hashtags was roughly double that of the pro-Clinton hashtags, (2) about one third of the pro-Trump twitter traffic was driven by bots and highly automated accounts, compared to one quarter of the pro-Clinton twitter traffic, (3) the significant rise of Twitter traffic around debate time is mostly from real users who generate original tweets using the more neutral hashtags. In short, Twitter is much more actively pro-Trump than pro-Clinton and more of the pro-Trump twitter traffic is driven by bots, but a significant number of (human) users still use Twitter for relatively neutral political expression in critical moments.

WHAT ARE POLITICAL BOTS?

A growing number of political actors and governments worldwide are employing both people and bots to shape political conversation.[1], [2] Bots can perform legitimate tasks like delivering news and information, or undertake malicious activities like spamming, harassment and hate speech. Whatever their uses, bots are able to rapidly deploy messages, replicate themselves, and pass as human users.

Networks of such bots are called “botnets,” a term combining “robot” with “networks” and describing a collection of connected computers with programs that communicate across multiple devices to perform some task. There are legitimate botnets, like the Carna botnet, which gave us our first real census of device networks, and there are malicious botnets, like those that are created to launch spam and distributed denial-of-service (DDoS) attacks and to engineer theft of confidential information, click fraud, cyber-sabotage, and cyberwarfare.[3], [4]

Social bots are particularly prevalent on Twitter, but they are found on many different platforms that increasingly form part of the system of political communication in many countries.[5] They are computer-generated programs that post, tweet, or message of their own accord. Often bot profiles lack basic account information such as screen names or profile pictures. Such accounts have become known as “Twitter eggs” because the default profile picture on the social media site is of an egg. While social media users get access from front-end websites, bots get access to such websites directly through a code-to-code connection, mainly through the site’s wide-open application programming interface (API) that enables real-time posting and parsing of information.

Bots are versatile, cheap to produce, and ever evolving. Unscrupulous Internet users now deploy bots beyond mundane commercial tasks like spamming or scraping sites like eBay for bargains. Bots are the primary applications used in carrying out

DDoS and virus attacks, email harvesting, and content theft. A subset of social bots are given overtly political tasks and the use of political bots varies from country to country. Political actors and governments worldwide have begun using bots to manipulate public opinion, choke off debate, and muddy political issues. Political bots tend to be developed and deployed in sensitive political moments when public opinion is polarized. How were bots used during the second Presidential debate in the United States?

SAMPLING AND METHOD

This data set contains approximately 11.5 million tweets collected October 9-12 2016, using a combination of hashtags associated with the Presidential candidates or the @realDonaldTrump and @HillaryClinton account names. Since our purpose is to discern how bots are being used to amplify political communications, so we did specific analysis of hashtag use in this dataset.

Twitter provides free access to a sample of the public tweets posted on the platform. Twitter’s precise sampling method is not known, but according to Twitter, the data available through the Streaming API is at most one percent of the overall global public communication on the platform at any given time.[6] In order to get the most complete and relevant data set, the tweets were collected by following particular hashtags identified by the team as being actively used during the debate. A few additional tags were added, during the debate, as they rose to prominence. The programming of the data collection and most of the analysis were done by using the statistics package R.

Selecting tweets on the basis of hashtags has the advantage of capturing the content most likely to be about this important political event. The streaming API yields (1) tweets which contain the keyword or the hashtag; (2) tweets with a link to a web source, such as a news article, where the URL or the title of the web source includes the keyword or hashtag; (3)

retweets where the text contains the original text, and the keyword or hashtag is used either in the retweet part or in the original tweet; and (4) quote tweets where the original text is not included but Twitter uses a URL to refer to the original tweet.

Our method counted tweets with selected hashtags in a simple manner. Each tweet was coded and counted if it contained one of 66 specific hashtags that were being followed. If the same hashtag was used multiple times in a tweet, this method still counted that tweet only once. If a tweet contained more than one selected hashtag, it was credited to all the relevant hashtag categories.

Unfortunately, not enough users geotag their profiles to allow analysis of the distribution of this support around the world or within the United States. In addition, analyzing sentiment on social media such as Twitter is difficult.[7], [8] Contributions using none of these hashtags are not captured in this data set, and it is possible that users who used one of these hashtags and were not discussing the debate had their tweet captured. Moreover, if people tweeted about the debate, but did not use one of these hashtags or identify a candidate account, their contributions are not analyzed here. Any comparison with the sample taken around the first debate should consider that this sample was taken on different days of the week and taken with a larger number of relevant hashtags.

FINDINGS AND ANALYSIS

With this sample we can draw some conclusions about the character and process of political conversation over Twitter during the second debate. Specifically, we can parse out the amount of social media content related to the two major candidates, and we can investigate how much of this content is driven by highly automated accounts. We can parse out the volume of tweets by perspective, assess the level of automation behind the different perspectives, and evaluate the particular contribution of bots to traffic on this issue.

Comparing the Candidates on Twitter.

Table 1 reveals that 6.0 million tweets used some combinations of these hashtags. This table reveals that the overall volume of pro-Trump traffic (40.3 percent), and the overall volume of neutral debate-related traffic (37.9 percent), was much greater than the volume of pro-Clinton traffic (12.1 percent). Much smaller proportions of the tweets were categorized for different mixes of hashtags. The fact that so much of the Twitter content about the debates used exclusive clusters of hashtags from each camp (52.4 percent) is evidence of how polarized and bounded the different communities of social media users are.

Figure 1 displays the rhythm of this traffic over the sample period. Interestingly, Figure 1 also reveals that the significant peak of Twitter content about the debate comes from users who do not tweet exclusively with pro-Clinton and pro-Trump

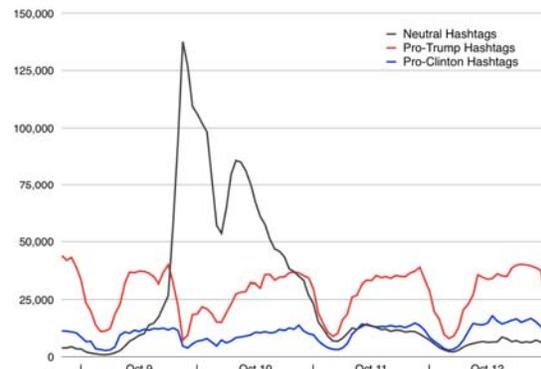
Table 1: Twitter Activity during the Second U.S. Presidential Debate

	All Tweets in Sample	
	N	%
Pro-Trump	2,409,300	40.3
Pro-Clinton	723,412	12.1
Neutral	2,262,569	37.9
Trump-Neutral	250,146	4.2
Clinton-Neutral	74,974	1.3
Trump-Clinton	185,636	3.1
Trump-Clinton-Neutral	68,930	1.2
Total	5,974,967	100.0

Source: Authors' calculations from data sampled 09-12/10/16.

Note: Pro-Trump hashtags include #50points, #AltRight, #AmericaFirst, #benghazi, #ClintonFoundation, #clintonscandals, #CrookedHillary, #DebateSideEffects, #deplorable, #hillaryshealth, #ImWithYou, #LatinosForTrump, #LawAndOrder, #lockherup, #MAGA, #MakeAmericaGreatAgain, #MSM, #NeverHillary, #pepe, #realDonaldTrump, #RNC, #tcot, #TeamTrump, #Trump, #TrumpPence16, #TrumpPence2016, #TrumpTrain, #TrumpWon, #VoteTrump, #WakeUpAmerica. Pro-Clinton hashtags include #Clinton, #ClintonKaine, #ClintonKaine16, #ClintonKaine2016, #CountryBeforeParty, #ctl, #dems, #DirtyDonald, #DNC, #Factcheck, #failedtaxaudit, #HillaryClinton, #HillarysArmy, #hillarywon, #ImWithHer, #lasttimetrumpaidtaxes, #LoveTrumpsHate, #NeverTrump, #OHHillYes, #p2, #p2b, #shareblue, #StrongerTogether, #TNTweeters, #TrumpedUpTrickleDown, #UniteBlue, #VoteDems, #WhyIWantHillary. Neutral hashtags include #Debates2016, #Debates, #Debate, #Election2016, #POTUS.

Figure 1: Hourly Twitter Traffic, by Candidate Camp



Source: Authors' calculations from data sampled 09-12/10/16.

Note: This figure is made without candidate @ mentions because of the difficulty of interpreting the valence of their use.

hashtags. Large dips in traffic coincide with night time in the United States. Figure 1 includes a total of 11.5m tweets from 2.0m users who tweeted with one of our sampled hashtags, but not the candidate's user names because the @ mentions reveal little about the political affinity of the user. During the debate itself, the amount of neutrally-tagged traffic outstripped the volume of traffic using candidate-specific hashtags

Automated Political Traffic. A fairly consistent proportion of the traffic on these hashtags was generated by highly automated accounts. These accounts are often bots that see occasional human curation, or they are actively maintained by people who employ scheduling algorithms and other applications for automating social media communication. We define a high level of automation as accounts that post at least 50 times a day, meaning

200 or more tweets on at least one of these hashtags during the data collection period.

Extremely active human users might achieve this pace of social activity, especially if they are simply retweeting the content they find in their social media feed. And some bots may be relatively dormant, waiting to be activated and tweeting only occasionally. But this metric captures accounts generating large traffic with high levels of automation. Finally, self-disclosed bots were identified by searching for the term “bot” in either the tag or account description. While this is a small proportion of the overall accounts, we expect the actual number of bots to be higher—many bots, after all, would not disclose their activities. Future research will involve a more detailed analysis of the disclosed and hidden bots and searching for a wider range of terms referring to bots in the account name and description data.

Table 2 reveals the different levels of automation behind the traffic associated with clusters of hashtags. To track the activity of political bots during the Presidential debates we clustered the hashtags by their candidate associations. To evaluate the role of automation in this debate, we organize clusters of opinion based on hashtag use. Then we created a subcategory of accounts that use high levels of automation. Table 2 indicates the level of traffic, by political camp and associated hashtags. This table distinguishes between the messages that exclusively used a hashtag known to be associated with a perspective and then the combinations of mixed tagging that are possible.

Table 2 also reveals that automation is used at several different levels by accounts taking different perspectives in the debate. The accounts using exclusively neutral hashtags are rarely automated (only 13.6 percent use high level of automation) while one-third of all the tweets using a mixture of all hashtags are generated by accounts that use high level of automation. The exclusively neutral hashtags seem to be relatively free of highly automated traffic. Figure 2 reveals the relative flow of traffic overall, and from accounts with high levels of automation. As in many political conversations over Twitter, the most active accounts are either obvious bots or users with such high levels of automation that they are essentially bot-driven accounts.

Additional Observations on Automation.

To understand the distribution of content production across these users, we then look at segments of the total population of contributors to these hashtags. There is a noticeable difference between the usage patterns of typical human users and accounts that are bots or highly automated. For example, the top 20 accounts, which were mostly bots and highly automated accounts, averaged over 1,000 tweets a day and they generated close to 90,000 tweets. The top 100 accounts, which still used high levels of automation, generated around 200,000 tweets at an

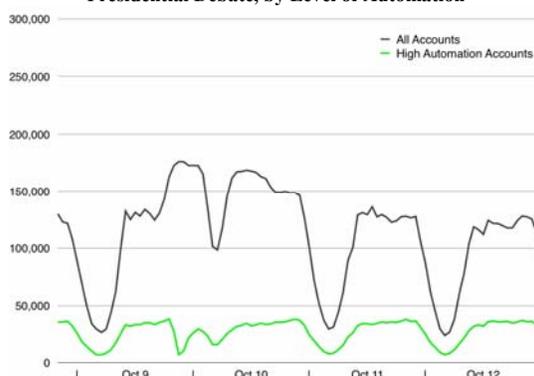
Table 2: Twitter Content, By Hashtag and Level of Automation

	Low %	High %	All N	%
Exclusive Hashtag Clusters				
Pro-Trump	64.1	35.9	2,409,300	100
Pro-Clinton	73.1	26.9	723,412	100
Neutral	86.4	13.6	2,262,569	100
Mixed Hashtag Clusters				
Trump-Neutral	66.6	33.4	250,146	100
Clinton-Neutral	74.7	25.3	74,974	100
Trump-Clinton	65.5	34.5	185,636	100
Trump-Clinton-Neutral	63.0	37.0	68,930	100
Sum	73.9	26.1	5,974,967	100

Source: Authors' calculations from data sampled 09-12/10/16.

Note: Low volume users are average human users, high volume accounts post more than 50 times per day using these hashtags.

Figure 2: Total Hourly Twitter Traffic on the Second Presidential Debate, by Level of Automation



Source: Authors' calculations from data sampled 09-12/10/16..

Note: This data includes @ mentions of particular candidates. We define heavily automated accounts as tweeting 50 times or more per day.

average rate of 500 tweets per day. In contrast, the average account in the whole sample generated one tweet per day. While heavily automated accounts are usually the most active, there is a long tail of human users with only occasional Twitter activity.

The accounts using a high level of automation—the accounts that tweeted 200 or more times with a related hashtag and user mention during the data collection period—generated close to 25 percent of all Twitter traffic about the Presidential debate. That volume is significant, considering that this number of posts was generated by 7,260 users in a sample of more than 2 million users. In other words, less than half a percent of the accounts generate almost a fourth of all the content. It is difficult for human users to maintain this rapid pace of social media activity without some level of account automation, though certainly not all of these are bot accounts

CONCLUSIONS

Across the first two debates (See Data Memo 2016.1) we find that there were roughly the same levels of highly automated twitter activity. Highly automated pro-Trump bots generated four tweets for every one

that highly automated pro-Clinton accounts generated.

In the first debate we scooped 9.0m tweets from 2.0m users who contributed to using 52 hashtags. For the second we scooped 11.5m tweets from 2.0m users who contributed to 66 hashtags. We distinguish between relatively low activity users who tweet occasionally from the accounts with relatively high levels of automation that generate anywhere from 50 to over a thousand tweets a day.

Comparing across the first two debates, we find that the amount of election traffic from highly automated accounts increased from the first debate to the second, from 23% to 26% of relevant traffic. Pro-Clinton highly automated accounts increased their activities from the first to second debate but still never reached the level of automation behind pro-Trump Twitter traffic. Highly automated pro-Trump accounts still out-tweeted the automated pro-Clinton accounts 4:1. The debates themselves do inspire a lot of relatively neutral political discussion among humans, especially around broadcast. And overall, discussion of the second debate went longer than the first after broadcast, with daytime traffic from the second debate lasting over 100,000 tweets/hour for an extended period.

We find that political bots have a modest but strategic role in the U.S. Presidential debates. In this brief analysis we find that (1) Twitter traffic on pro-Trump hashtags was more than twice that of the pro-Clinton hashtags, (2) about one third of the pro-Trump twitter traffic was driven by bots and highly automated accounts, compared to one quarter of the pro-Clinton twitter traffic, (3) the significant rise of Twitter traffic around debate time is mostly from real users who generate original tweets using the more neutral hashtags.

ABOUT THE PROJECT

The Project on Computational Propaganda (www.politicalbots.org) involves international, interdisciplinary researchers investigating the impact of automated scripts—computational propaganda—on public life. *Data Memos* are designed to present quick snapshots of analysis on current events in a short format. They reflect methodological experience and considered analysis, but have not been peer-reviewed. *Working Papers* present deeper analysis and extended arguments that have been collegially reviewed and that engage with public issues. The Project's articles, book chapters and books are significant manuscripts that have been through peer review and formally published.

ACKNOWLEDGMENTS AND DISCLOSURES

The authors gratefully acknowledge the support of the National Science Foundation, "EAGER CNS: Computational Propaganda and the Production / Detection of Bots," BIGDATA-1450193, 2014-16, Philip N. Howard, Principle Investigator and the

European Research Council, "Computational Propaganda: Investigating the Impact of Algorithms and Bots on Political Discourse in Europe," Proposal 648311, 2015-2020, Philip N. Howard, Principal Investigator. Project activities were approved by the University of Washington Human Subjects Committee, approval #48103-EG and the University of Oxford's Research Ethics Committee. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the European Research Council.

REFERENCES

- [1] M. C. Forelle, P. N. Howard, A. Monroy-Hernandez, and S. Savage, "Political Bots and the Manipulation of Public Opinion in Venezuela," Project on Computational Propaganda, Oxford, UK, Working Paper 2015.1, Jul. 2015.
- [2] P. N. Howard and B. Kollanyi, "Bots, #StrongerIn, and #Brexit: Computational Propaganda during the UK-EU Referendum," *arXiv:1606.06356 [physics]*, Jun. 2016.
- [3] "Carna botnet," *Wikipedia*. 24-Nov-2015.
- [4] "Denial-of-service attack," *Wikipedia*. 15-Oct-2016.
- [5] A. Samuel, "How Bots Took Over Twitter," *Harvard Business Review*, 19-Jun-2015. [Online]. Available: <https://hbr.org/2015/06/how-bots-took-over-twitter>. [Accessed: 23-Jun-2016].
- [6] F. Morstatter, J. Pfeffer, H. Liu, and K. M. Carley, "Is the Sample Good Enough? Comparing Data from Twitter's Streaming API with Twitter's Firehose," *arXiv:1306.5204 [physics]*, Jun. 2013.
- [7] Z. Chu, S. Gianvecchio, H. Wang, and S. Jajodia, "Who is tweeting on Twitter: human, bot, or cyborg?," in *Proceedings of the 26th annual computer security applications conference*, 2010, pp. 21–30.
- [8] Cook, David, Waugh, Benjamin, Abdinpanah, Maldini, Hashimi, Omid, and Rahman, Shaquille Abdul, "Twitter Deception and Influence: Issues of Identity, Slacktivism, and Puppetry," *Journal of Information Warfare*, vol. 13, no. 1.
- [9] P. N. Howard, *Pax Technica: How the Internet of Things May Set Us Free*. New Haven, CT: Yale University Press, 2015.
- [10] D. W. Butrymowicz, "Loophole.com: How the Fec's Failure to Fully Regulate the Internet Undermines Campaign Finance Law," *Columbia Law Review*, pp. 1708–1751, 2009.
- [11] P. N. Howard, *New Media Campaigns and the Managed Citizen*. New York, NY: Cambridge University Press, 2006.