Appendix

We searched for each of the seventeen initial candidates' known Twitter handles, with search criteria including tweets mentioning any of the other candidates' accounts or at least one name in a list (below). We counted a tweet referencing *n* candidates as *n* distinct tweets. In other words, if a tweet mentioned both Marco Rubio and Ted Cruz, we counted this tweet twice (once from the sender to Rubio, and once from the sender to Cruz). Not captured in our search process were tweets that did not mention a target by name in the allotted 140 characters; for example, if the sender tweeted an image of or "meme" referencing a target, but did not call him or her by name in the text of the tweet, our search process did not capture the tweet. In addition to searching by official Twitter handle, we used the "search for any of these words" component of Twitter's Advanced Search function to search for tweets referencing any of the targets by name. The list of search terms is; *Trump, Carly, Fiorina, Kasich, Christie, Carson, Rand, Paul, Jeb, Bush, Santorum, Cruz, Rubio, Huckabee, Gilmore, Pataki, Graham, Walker, Jindal, Perry*. We dropped any tweets found to be false positives (e.g. if "Paul" referred to Ron Paul or Paul Ryan, or Bush referred to another family member or a shrub).

After cleaning the data of tweets that didn't meet criteria for inclusion, we engaged in a coding of both tweet tone and type. Tweet tone was coded as positive (when the sender would praise or commend the target), negative (when the sender would criticize or insult the target), or neutral (when the sender's address was unclear or lacking affect). With respect to type, the tweet could be coded as policy (when the sender passed judgment on a target's policy plans or record), personal (when the sender simply referenced the target's characteristics, abilities, or other personal events pertaining to the target), or neither (which could include a sender referencing poll results about or a joint appearance with the target). When the content of a tweet was unclear (such as when a candidate posted a link to a photo, video, or news story), coders checked the content for clarification before assigning a code. The coding effort was checked and validated by a second coder more than once in the coding process The first round of coding was conducted on anonymized tweets, with each name replaced by an ID. This was meant to prevent coders from making excessive assumptions based on previous knowledge. Of course, in certain cases, it would be easy to figure out a particular candidate's identity. Furthermore, we corrected a small number of codes based on investigation of the original context; this could not remain anonymous..

We removed tweets from former candidates more than three days after dropping out of the race. Similarly, we removed tweets mentioning these former candidates from more than three days after the former candidate left the race. For our analysis of tweeting during the campaign, we also eliminated instances of simple "retweeting"—whereby a candidate simply re-circulated a tweet originating from another twitter handle (as opposed to creating original content)—unless commentary (e.g. "So true!") had been appended by the candidate. Finally, we dropped tweets with a neutral or ambiguous tone. The cleaning process left us with a total of 1523 tweets.

Table A1: 2016 Republican Presidential Candidate Twitter Handles

Candidate	Twitter Handle
Trump:	@realdonaldtrump
Cruz:	@tedcruz
Rubio:	@marcorubio
Kasich:	@johnkasich
Carson:	@realbencarson
Bush:	@jebbush
Christie:	@chrischristie, @govchristie
Paul:	@randpaul
Huckabee:	@govmikehuckabee
Fiorina:	@carlyfiorina
Santorum:	@ricksantorum
Gilmore:	@gov_gilmore
Pataki:	@governorpataki
Graham:	@lindseygrahamsc
Walker:	@scottwalker @govwalker
Jindal:	@bobbyjindal
Perry:	@governorperry

Note: We used the list of candidates' twitter accounts in two ways within Twitter's Advanced Search Function. We searched for tweets originating from any of the accounts (the "from these accounts" field within the search function), and tweets mentioning any of these accounts (the "mentioning these accounts" field).

Coverage Of Twitter On Major Broadcast News Networks

Table A2: Coverage of Twitter on Major Broadcast News Networks

Network	Stories Referencing Twitter
CNN	504
MSNBC	626
FOX	1158

Note: Search terms included "twitter OR tweet OR tweets OR tweeted," and the search was restricted to stories airing on June 1, 2015 through May 4, 2016. Lexis Nexis also provides a list of news story subjects with its searches. On each network, close to 3/4 of these stories focused on elections and politics, and many were specifically focused on US Presidential Candidates in 2016.

Candidate Twitter Behavior, 2008 And 2012 Elections

Table A3: Presidential Candidate Twitter Presence, 2008 and 2012 Elections

Election	Candidate Party	Candidate	Handle	Withdrew	Joined Twitter
		Joe Biden	@JoeBiden	1/3/08	March 2007
		Hillary Clinton	@HillaryClinton	6/7/08	April 2013
		Chris Dodd	@SenChrisDodd	1/3/08	September 2008
2008	Democrat	John Edwards	.	1/30/08	.
		Mike Gravel	@MikeGravel	3/25/08	May 2008
		Dennis Kucinich	@Dennis_Kucinich	1/24/08	June 2008
		Barack Obama	@BarackObama	.	March 2007

		Bill Richardson	@GovRichardson	1/10/08	April 2009
		Sam Brownback	@govsambrownback	10/18/07	November 2009
		Rudy Giuliani	@RealRudyGiuliani	1/30/08	October 2011
		Mike Huckabee	@GovMikeHuckabee	3/4/08	July 2008
		Duncan Hunter	@Rep_Hunter	1/19/08	March 2013
		Alan Keyes	@loyaltoliberty	4/15/08	January 2009
	Republican	Ron Paul	@RonPaul	6/12/08	April 2011
		Mitt Romney	@MittRomney	2/7/08	June 2009
		Tom Tancredo	@ttancredo	12/20/07	August 2009
		Tommy Thompson	@TommyForHealth	1/12/07	September 2011
		Fred Thompson	@fredthompson	1/22/08	March 2007
		John McCain	@SenJohnMcCain	.	January 2009
		Sarah Palin	@SarahPalinUSA	.	August 2009
		Mitt Romney	@MittRomney	.	June 2009
		Ron Paul	@RonPaul	5/14/12	April 2011
		Fred Karger	@fredkarger	6/29/12	August 2008
		Newt Gingrich	@newtgingrich	5/2/12	February 2009
		Rick Santorum	@RickSantorum	4/10/12	July 2009
		Buddy Roemer	@BuddyRoemer	2/22/12	February 2011
2012	*Republican*	Rick Perry	@GovernorPerry	1/19/12	January 2009
		John Huntsman, Jr.	@JonHuntsman	1/16/12	May 2011
		Michele Bachmann	@MicheleBachmann	1/4/12	December 2008
		Gary Johnson	@GovGaryJohnson	12/28/11	December 2009
		Herman Cain	@THEHermanCain	12/3/11	April 2009
		Thaddeus McCotter	@ThadMcCotter	9/22/11	August 2007
		Tim Pawlenty	@TimPawlenty	8/14/11	March 2009

Note: A qualitative read of candidates' twitter feeds began from when they joined twitter to when they withdrew their candidacy. In general, candidates did not use their twitter handles in 2008 (save for Barack Obama). In 2012, when candidates did criticize opponents, they directed their ire at Obama and, infrequently, at Mitt Romney. Instead, they used their Twitter accounts to inform voters of their movements, encourage voting and donation, and highlight favorable news stories.

Candidate Groups and Expert Analysis
In order to consider dyad histories as entire trajectories (which span a period wherein relative status may shift), it is necessary to assess typical relative status. In an earlier version of this paper, we asked two experts to consider debate invitations, polls, and cumulative delegate counts and assign candidates status scores from 0 to 10. They received the following prompt:

"Thinking holistically about the overall campaign trajectories (from June 2015-May 2016) for the seventeen GOP candidates, and considering polls, debate exposure, and delegates for the handful who earned them, assign each candidate an overall status score from 0 (lowest status) to 10 (highest status). You may use decimals to distinguish between two similarly placed candidates. Someone who polls well, is invited to appear in most main debates, and earns a lot of delegates

would be relatively high status, while someone who polls consistently in low single digits, is invited to few debates, and receives no delegates would be toward the bottom. Loosely you can think of *status* as degree to which a candidate is perceived as potential threat by opponents, weighed by time spent perceived as a threat. These scores are, of course, subjective, but I would expect some degree of similarity in ordering. Attached are three spreadsheets for you to reference: cumulative scores based on debate invitations (2 points for main debate, 1 for lower-tier debate), polls, and cumulative approximate delegate counts over time."

The scholars ranked the candidates in a manner that may be characterized based on their mean assigned scores as follows:
1. Trump
2. Cruz
3. Rubio
4. Kasich, Carson, Bush
7. Fiorina, Paul, Christie
10. Walker, Huckabee, Santorum
13. Graham, Jindal, Perry
16. Pataki, Gilmore

In the revised paper, as published, we use a less subjective ordering, based entirely on mean of poll numbers provided by http://elections.huffingtonpost.com/pollster/2016-national-gop-primary.csv, taken until each candidate withdrew. Substantive results were similar to those based on the expert ordering.

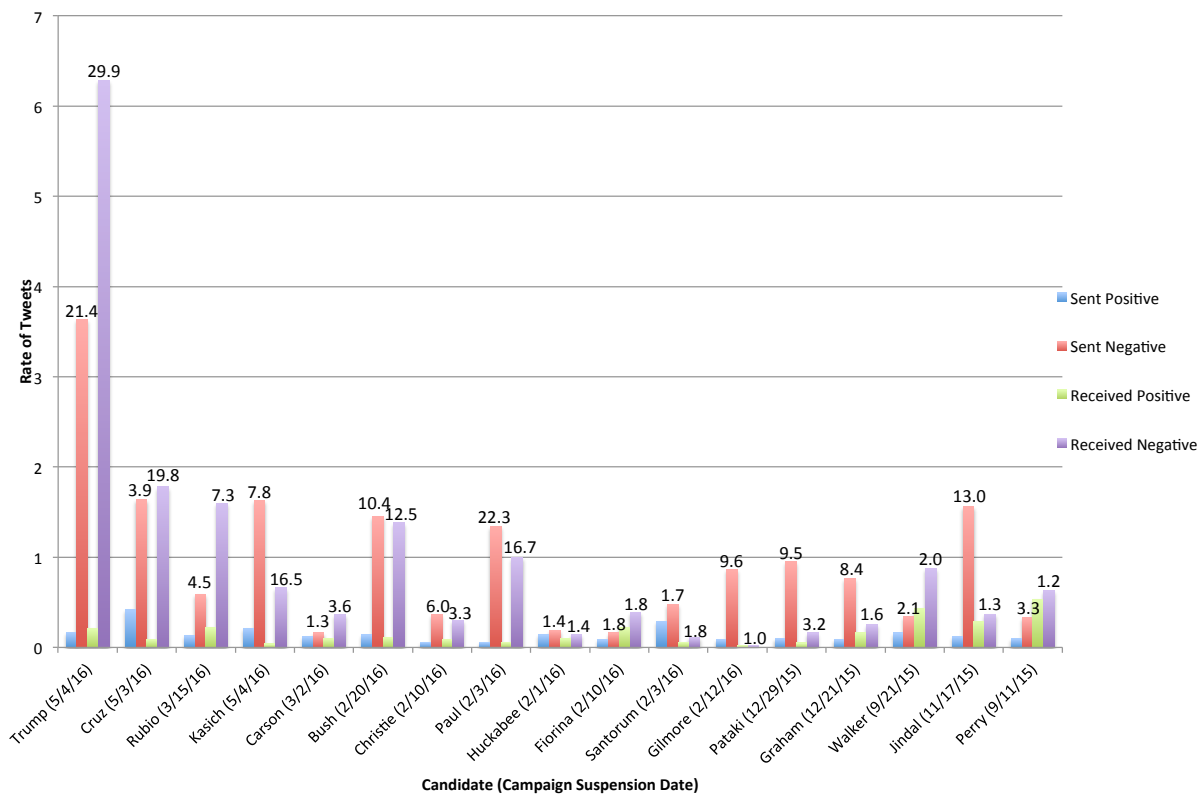*Mean Poll Ratings Until Campaign Suspension* (Pollster.com)
1. Trump (31.3%)
2. Cruz (14.9%)
3. Carson (12.8%)
4. Rubio (10.8%), Walker (10.7%), Bush (9.9%)
7. Kasich (5.6%), Huckabee (5.0%), Paul (4.8%)
10. Christie (3.9%), Fiorina (3.7%)
12. Perry (2.6%)
13. Santorum (1.1%), Jindal (1.0%), Graham (0.8%)
16. Pataki (0.3%), Gilmore (0.1%)

Dyad History Types (Asymmetric Negative Family of Types in Boldface)
1. **Snipe** – A single negative tweet from one candidate to the other, possibly with positive tweets in either direction
2. **Sticks and Stones** (S&S) – Two or more negative tweets from sender to receiver without any negative reciprocation from the receiver; the candidate under attack may or may not send positive messages to the attacker
3. **Asymmetric Warfare** (AW) – Negative tweets in both directions, with at least three times as many tweets from one member of the dyad
4. Mutual Enmity (ME) – At least one negative tweet in each direction, with neither issuing three or more times the negative tweets of the other

5. <u>Mutual Respect (MR)</u> – At least one positive tweet from an initial sender and positive reciprocation from an initial receiver, with no negative tweets in either direction
6. <u>Unrequited Love (UR)</u> – Two or more positive tweets from a sender to a receiver with no reciprocation (positive or negative) from the receiver (asymmetric positive)
7. <u>Broken Friendship (BF)</u> – A secondary classification for dyads exhibiting negativity beyond an isolated snipe; positive tweets in *both* directions issued prior to the first negative tweet
8. Negligible (n) – The dyad pair either did not engage each other at all on Twitter, or one member of the pair sent just one positive, unreciprocated message.

**Figure A1: Tone of Rate of Sent and Received Tweets, by Candidate
(Nov 20, 2014 – Campaign Suspended)**

Note: Statistics reported here cover tweets made during the campaign season (November 20, 2014 through May 4, 2016). The two numbers appearing above the Sent Negative and Received Negative bars are ratios of negative to positive tweets sent and received, respectively. Thus Trump's weekly rate of negative tweeting at opponents is 21.4 times his rate of positive tweeting, while he receives negative tweets at a rate thirty times as great as positive tweets. Rate is average weekly rate of each type until three days after campaign suspension or May 4, 2016, whichever came first.

Donald Trump's Tweets About Carly Fiorina
CNN devoted two news stories to Donald Trump's tweets about Carly Fiorina. These stories were released on August 9, 2015 and November 13, 2015; Trump sent out the tweets on the same days as the news stories. Links to these stories are below:
1. http://www.cnn.com/2015/08/09/politics/donald-trump-attacks-carly-fiorina-on-twitter-2016/
2. http://www.cnn.com/2015/11/13/politics/donald-trump-carly-fiorina-ben-carson-pathological/

Non-Trump-Related Tweets Issued by Leader In Polls

Table A4: Non-Trump Tweets Issued by Candidate With Higher Average Polling

Attacker	Target	Average Difference in Previous 5 Polls	Tweet
Paul	Christie	2.0%	@ChrisChristie's disregard for the Constitution sets a dangerous precedent & ignores wisdom of our Founding Fathers. http://theatln.tc/1OV0Vcz
Paul	Christie	2.0%	.@ChrisChristie will fear monger and violate your Constitutional rights. And for what?
Rubio	Bush	4.6%	@jebbush was a "HUGE Marco fan" before getting ready to spend $20M on phony attacks.
Cruz	**Rubio**	2.5%	In the Senate, I led the fight against @marcorubio's amnesty bill. #GOPDebate
Cruz	**Rubio**	5.3%	Trump SUPPORTS amnesty. Read his 2013 tweet--while I was leading the fight to defeat Rubio Gang of 8 amnesty. #Truth
Rubio	Bush	5.3%	Jeb Bush, Ted Cruz and Hillary Clinton have one thing in common: https://youtu.be/OaC-N4PCuC0
Cruz	**Rubio**	7.0%	I was proud to lead the fight against @MarcoRubio's amnesty. When I say I'll secure the border, you can trust me!
Cruz	**Rubio**	7.0%	I was proud to keep my commitment to the voters of Texas & lead the fight to stop @MarcoRubio's amnesty #GOPDebate
Cruz	**Rubio**	4.0%	The lines are clear. @MarcoRubio right now supports citizenship for 11 million people here illegally. I oppose it. #GOPDebate
Cruz	**Rubio**	4.0%	I stood with Jeff Sessions, Steve King & the American people to stop @MarcoRubio's Gang of Eight amnesty. #GOPDebate