



What Drives U.S. Congressional Members' Policy Attention on Twitter?

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Social media platforms like Twitter enable policymakers to communicate their policy preferences directly and provide a bird's-eye view of their diverse policy agendas. In this article, we leverage politicians' social media data to study political attention using a supervised machine-learning classifier that detects policy areas in individual tweets. We examine how individual diversity and institutional factors affect differential attention to public policy among members of the U.S. Congress. Our novel approach to measuring policy attention builds on work by the Comparative Agendas Project, in order to study members' political attention in near real-time and to uncover both intra-group and intergroup differences. Using this classifier, we labeled more than one million tweets and found statistically significant differences in both the level and distribution of attention between parties, chambers, and genders. However, these differences were small enough to suggest that other Congressional members' characteristics are also at play. We explored institutional factors (e.g., committee assignment, caucus), partisan issue preferences (e.g., issue ownership), and the political environment (e.g., partisan issues, confirmations, etc.) that may help explain the patterns of political attention that appear in Congress's tweets.

KEY WORDS: political attention, US congress, social media, machine learning, text analysis, agenda setting, Twitter

像推特这样的社交媒体平台让决策者能够直接传播其政策偏好并对其多样化的政策议程提供一个鸟瞰图。本文中我们通过使用一个能探测个人推文的政策领域的监督式机器学习分类器，利用政客们的社交媒体数据研究政治关注。我们检验了个人多样性与制度因素如何影响美国国会成员在公共政策上的差异性关注。我们对衡量政策关注所使用的新颖方法基于“比较议程项目”，以期接近实时地研究国会成员的政治关注，并揭开团体内与团体间存在的差异。通过使用该分类器，我们对超过一百万条推文进行标记，发现党派、议会、性别之间在政治关注的程度和分配方面都出现显著差异。然而，这些差异由于过小而无法排除国会成员的其他特征也在发挥影响的可能性。我们探究了制度因素(例如委员会分配、预选会议)、党派议题偏好(例如议题所有权)、以及政治环境(例如党派议题、确定过程)，这些可能有助于解释国会推文中出现的政治关注模式。

关键词： 政治关注, 美国国会, 社交媒体, 机器学习, 文本分析, 议程设置, 推特

Las plataformas de redes sociales como Twitter permiten a los encargados de formular políticas comunicar sus preferencias políticas directamente y proporcionar una vista panorámica de sus

diversas agendas políticas. En este artículo, aprovechamos los datos de las redes sociales de los políticos para estudiar la atención política mediante un clasificador supervisado de aprendizaje automático que detecta áreas de políticas en tweets individuales. Examinamos cómo la diversidad individual y los factores institucionales afectan la atención diferencial a las políticas públicas entre los miembros del Congreso de los Estados Unidos. Nuestro enfoque novedoso para medir la atención de las políticas se basa en el trabajo del Proyecto de Agendas Comparativas, con el fin de estudiar la atención política de los miembros en tiempo casi real y descubrir diferencias tanto intra como intergrupales. Usando este clasificador, etiquetamos más de un millón de tweets y encontramos diferencias estadísticamente significativas tanto en el nivel como en la distribución de la atención entre las partes, las cámaras y los géneros. Sin embargo, estas diferencias fueron lo suficientemente pequeñas como para sugerir que las características de otros miembros del Congreso también están en juego. Exploramos factores institucionales (p. Ej., Asignación de comités, caucus), preferencias de temas partidistas (p. Ej., Propiedad del tema) y el entorno político (p. Ej., Asuntos partidistas, confirmaciones) que pueden ayudar a explicar los patrones de atención política que aparecen en los tweets del Congreso.

PALABRAS CLAVE: atención política, congreso de EE. UU., redes sociales, aprendizaje automático, análisis de texto, configuración de agenda, Twitter

Introduction

Lawmakers' public statements often garner as much attention as their policy proposals in Congress, if not more. Members of Congress use press releases, newsletters, and now social media to communicate their policy priorities and preferences (Cormack, 2016a, 2016b; Grimmer, 2010; Russell, 2018). Scholars have traditionally understood lawmakers' behavior by their institutional actions (e.g., roll-call votes) but recent research is turning to non-legislative action, like political communication, to understand complex questions about representation (Carson, Engstrom, & Roberts, 2007; Rocca & Gordon, 2010; Shepsle & Weingast, 1987; Shepsle, 1979). Public statements like newsletters and press releases can signal a lawmaker's policy intentions even before legislative action takes place (Cormack, 2016a, 2016b; Grimmer, 2013), and increasingly, Twitter is a popular site for these statements to appear (Russell, 2018; Straus, Glassman, Shogan, & Smelcer, 2013).

Lawmakers use communication platforms to explain their legislative activities in Washington, and as a result, their policy agenda on Twitter is linked to congressional decision-making. Public statements on Twitter provide timely data to determine how individual characteristics (i.e., gender, party, and chamber) affect policy attention. For example, in 140 or 280 characters,¹ a member can support a policy, take credit for its success, and signal its advantages to his or her constituents. Here, we introduce a computational method to identify the topics mentioned in more than one million Congressional tweet messages, investigate what drives the attention that policy topics receive, and explain the patterns of policy attention among various groups of lawmakers. Politicians have indicated that they use social media, even when they don't expect it to impact voters (Bernhard, Dohle, & Vowe, 2015), and our study explains how individual and institutional characteristics, rather than strategic considerations, influence social media content.

Studying Twitter presents researchers with a methodological challenge of sorting through large volumes of tweets and deciphering policy attention amid partisan disagreements, birthday messages, and other types of non-policy-related tweets. We address this challenge by introducing a computational model to identify expressions of individual Member of Congress's policy agendas in their tweets. We trained a supervised machine-learning classifier to categorize lawmaker tweets according to the Comparative Agendas Project codebook (Baumgartner, 2019). Our approach allows us to study their policy attention in near real-time, and to uncover both intra- and inter-group differences that not only highlight how members use social media, but also reveal their public agenda-setting behavior. The model enables us to evaluate how individual and institutional characteristics affect how legislators explain their work to public audiences.

Our results confirm a pattern of skewed policy attention, similar to what other researchers found in studies of budgets, hearings, and bill introductions (e.g., Rocca & Gordon, 2010; Sheingate, 2006; Woon, 2008). Having established tweets as a reliable measure for policy attention based on their reflection of similar patterns in other Congressional materials, we conducted a multinomial logistic regression to identify factors that influence the attention patterns we detected. Our results suggest that party, gender, and chamber affect the policy areas that members tweet about. We also compared the diversity of political attention among lawmakers and our findings build and expand on research that suggests Democrats, Representatives, and women are generally more likely to post policy-related tweets (Cormack, 2016b; Evans, Ovalle, & Green, 2016; Straus, Williams, Shogan, & Glassman, 2014); Democrats and Senators exhibited significantly more diversity than Republicans and Representatives. The specific policies that lawmakers address, and the timing of their attention, likely depend on legislative debates and their committee and caucus memberships.

Policy Agenda Setting on Twitter

Policy agenda setting describes the process through which ideas and policy issues become salient for decision making by political institutions. Traditional agenda-setting studies among policy and media scholars typically assess institutions' policy agendas, including how the media or governing systems influence issue salience (Baumgartner & Jones, 1993; Kingdon, 1989; McCombs & Shaw, 1972). However, individual lawmakers also practice agenda setting through their public statements, seeking to frame salient policy debates according to their own preference intensities (Rocca, Sanchez, & Morin, 2011). Lawmakers perpetuate policy debates by reinforcing or introducing a new policy image, influencing how issues are portrayed or characterized. Policy agenda setting and the way issues are discussed is contingent on many factors—for example, political climate, political feasibility, and personal and constituent priorities (Dearing & Rogers, 1996).

Communication and political science scholars alike have analyzed lawmakers' use of speeches, newsletters, and direct mail to influence media and public agendas (Cormack, 2016a; Grimmer, 2013; Kingdon, 1989). Newsletters and direct mail are

tailored to a narrow audience with the expectation that the recipient is a constituent and an interested or likely voter. But, different media attract and target different audiences. Different media allow for different modes of information production and consumption (Jungherr, 2014). The constraints of the technology underlying broadcast news or e-newsletters are different than that of social media, for example. Politicians seem oriented toward their peers in their social media use (Bernhard et al., 2015), indicating that they use social media to raise their individual profiles, especially among other political elites (Scherpereel, Wohlgemuth, & Lievens, 2017). In newspapers or television broadcasts, politicians' priorities become integrated with the news organizations' priorities. Further, traditional media messages may be an index of elite opinions or deferential to politicians (Bennett, 1990). Traditional media offer a periodic, indirect measure of priorities, where social media offers a more frequent, direct measure where only the political actors and their staff contextualize content.

Twitter, unlike alternative media options, offers lawmakers outsized discretion over the information a networked, digital constituency receives on a daily basis. In a single day, a member of Congress can use Twitter to make multiple policy pronouncements that aim to garner media buzz. Twitter is a broadcasting device for politicians (Gainous & Wagner, 2014; Golbeck et al., 2018; Hemphill, Otterbacher, & Shapiro, 2013), experiencing a nearly 100 percent adoption rate in Congress (Evans, Habib, Litzen, Jose, & Ziegenbein, 2019; Golbeck et al., 2018; LaMarre & Suzuki-Lambrecht, 2013). This public communication domain offers policymakers a relatively unfiltered credit claiming opportunity (Mayhew, 1974) to highlight accomplishments and advertise a political brand. Particularly for those members with less political power or who are defined by their "outsider" status, lawmakers on Twitter have a venue to develop policy debates and connect with a digital audience (Borge Bravo & Esteve Del Valle, 2017; Evans et al., 2016). Combined with the publicity surrounding President Donald Trump's morning tweets, Twitter has become the social media platform of choice for most legislators (Evans et al., 2016; Golbeck et al., 2018). Twitter's open network—compared with Facebook's closed system, for example—facilitates a sharing of public information and openness among users that matches legislators' desire to connect with as many constituents as possible. Instagram and Snapchat have also been useful political communication tools, but the widespread adoption of Twitter and its use for policy-relevant information rather than photos or personal messages has made it an ideal platform for policy agenda setting. As such, being able to take advantage of Twitter's outreach capabilities is especially important to politicians and their staffers (Chi & Yang, 2011; Straus et al., 2013).

Further, Twitter enables direct communication with both elite and mass publics with minimal opportunity costs relative to the potential gains. Lawmakers must devote the time and effort to cultivating a political brand on Twitter that they can strategically use for policy statements. In return for this cost, they receive the benefit of increased control over their own communications strategies. A representative gets to decide the timing and tenor of a message that could be directly seen by a wide network of social media followers and indirectly seen by an even

greater audience via journalists' reporting. This relative cost balanced with the outsized potential is why lawmakers are publicly broadcasting their agenda and creating an accessible record of government action (Bruns & Highfield, 2012). In many ways Twitter's greatest utility, and what distinguishes it from alternative public relations platforms, is its ability to aggregate a lawmaker's policy agenda in a convenient and accessible public space.

Prior work has established that politicians do use Twitter to communicate their agendas and discuss policy issues (Barberá et al., 2019; Casas & Morar, 2019; Hemphill & Schöpke-Gonzalez, 2019). For Members of Congress, policy agenda setting on Twitter is a two-stage strategy that relies on (a) connections with the media and (b) direct connections with constituents. Entman's Cascading Activation Model describes how Representatives seek to influence public opinion by framing issues that are reported by the media (Entman, 2003). Twitter is one of many media opportunities that politicians regularly take advantage of, seeking to supply the dominant policy frame that influences public opinions and constituents' voter attitudes (Entman, 2003). Additionally, the information shared on Twitter can bypass journalists through a representative's digital constituency.

For these reasons, legislators' Twitter agendas are an ideal platform to address theoretically important questions about their agenda-setting behavior and representation (Russell, 2018). Because individuals develop unique styles of communication and legislative style (Bernhard & Sulkin, 2018; Grimmer, 2013), we expect their Twitter agendas and the issues they choose to prioritize for public messaging to reflect those individual patterns of communication.

We use politicians' *policy attention*, or the amount and type of attention they give to a particular policy issue, to understand their policy agendas and agenda-setting behaviors. Twitter's readily available data lets us study attention without having to wait for legislative sessions to complete or to aggregate other resources such as press releases. We demonstrate Twitter's utility for studying attention—that is, the factors that drive attention elsewhere also drive attention on Twitter.

Individual Characteristics Affecting Policy Agendas

Policy attention is often dependent on the political climate, issue emergence, and policy frames, but at the individual level, we look at how lawmaker-specific characteristics and institutional factors influence attention allocation to policy issues on Twitter. In the following sections, we outline our hypotheses about individual and institutional effects on legislators' policy attention patterns on Twitter.

Gender. Work by Evans and Clark (2016) suggests that gender will directly affect political candidates' social media messages. They found that women running for Congress mention policy issues on Twitter at a higher rate, and those issues are often "women's issues" (e.g., health care, education, and poverty). In a later study, Evans further clarified that women mention all policy issues, not just "women's issues," more frequently than men (Evans, 2016). Stereotypes of female lawmakers as compassionate relationship-builders rather than policy experts may incentivize

some women to be more active in policy communication on Twitter (Evans & Clark, 2016; Huddy & Terkildsen, 1993). Wagner, Gainous, and Holman (2017) find that during campaign periods, female Congressional candidates are more likely than males to integrate Twitter into their campaign strategies. Once in office, they may also adopt styles of communication that highlight policy preferences more often. Women may also combat stereotypes by adopting more diverse agendas that allow them to develop reputations as experts in many policy areas and deter possible challengers (Atkinson & Windett, 2018). Having an alternative agenda space on Twitter may enable female lawmakers to counter these stereotypes and compensate for perceptions that they are less policy capable. On the basis of this earlier work, we expect that women will mention policy more often than their male counterparts, and that they will exhibit greater attention diversity.

H1: Women will mention policy more often than men.

H2: Women will exhibit more diverse policy agendas than men.

Party. Political parties are a mechanism to serve and facilitate electoral goals (Mayhew, 1974) and to maintain majority status (Aldrich, 1995). Prior work on Congressional tweets established that Republican and Democratic parties use Twitter for different communication activities (Golbeck et al., 2018; Hemphill et al., 2013; Russell, 2018), and we expect to see similar differentiation here. Another study of Twitter use in the U.K. Parliament found that the Labour Party members generated fragmented communication networks rather than a cohesive party (Adi, Erickson, & Lilleker, 2014). The precise impact of party affiliation on a politician's expressed agenda and communication preferences remains unknown.

Our research expands on the work by Gainous and Wagner (2014) and Evans et al. (2014), who found partisan patterns in campaign tweets. Our expectation is that Republicans will more frequently turn to Twitter to outline their policy priorities, given their early adoption of Twitter and distrust of traditional media for agenda setting. Studies by Lassen and Brown (2011) and Peterson (2012) suggest patterns of early Twitter adoption by Republican lawmakers, and we extend that leading behavior to their policy promotion as well. Democrats, as the minority party or "out party" in Congress in 2017 and 2018, may be more focused on party politics and future electoral concerns rather than policy agendas. Lawmakers have increased discretion on Twitter and that discretion is essential for those who believe alternative media platforms, like newspapers or television coverage, are biased. Research suggests an overall decline in public trust of the media (Gronke & Cook, 2007), but that cynicism is most prevalent among conservatives and Republicans (Lee, 2005). Conservative politicians signal the public and copartisans to believe that the media is biased and favors Democrats (Domke, Watts, Shah, & Fan, 1999; Watts, Domke, Shah, & Fan, 1999). Republicans may view Twitter as a more viable outlet for their policy messaging strategies if they believe other options are untrustworthy, and therefore use it more.

A party's collective effort constrains a lawmaker's strategic action. Parties have increased influence over the institutional agenda (Aldrich, 1995; Cox & McCubbins, 1993; Rohde, 1991), but the extent to which leaders and parties influence the issues that individual lawmakers choose to address in their public agendas on Twitter has implications for both representation and the policy process. Research on issue ownership—the idea that the public associates particular issues with one party or the other (Arbour, 2014; Egan, 2013)—suggests that Republicans and Democrats will mention different policy issues. Not only do we assume different preferences, but even before those opinions get expressed, the issues up for debate should be different by party. For instance, Republicans are often associated with security and military issues, while Democrats own issues around education and health care (Egan, 2013). Theory argues that voters will consider one party or the other more qualified to handle issues in an area (Petrocik, 1996), and that parties reinforce and leverage these expectations by addressing mainly those issues they own.

Together, research about parties and the media suggest that we will observe two patterns:

H3: Republicans will mention policy on Twitter more often than Democrats.

H4: Republicans and Democrats will tweet about different policy issues; specifically, they will attend to issues their party owns.

Chamber. Research that examines chamber differences in Twitter behavior, explicitly, found that senators were, on average, less frequent tweeters than Representatives (Hemphill et al., 2013). However, to our knowledge, research to date has not yet explored how Senate and House members differ in their policy agendas on Twitter. Senators and Representatives represent different constituencies—states and districts within states—and those constituencies likely require different political strategies. Prior research shows that the differing constituencies produce distinct patterns in federal spending policy and credit-claiming between the two chambers (Lee, 2004). This prior literature on chamber differences suggests that senators employ more resources and must address more diverse constituencies (Druckman, Hennessy, Kifer, & Parkin, 2009; Gulati & Williams, 2007). The smaller size of the Senate also means that individual senators enjoy more opportunity for influence than do individual House members (Sheingate, 2006). Therefore, we predict that the Senate will use Twitter more often to mention policy and that they will exhibit more diversity in their attention.

H5: Senators will mention policy more often than Representatives.

H6: Senators will exhibit more diverse policy agendas than Representatives.

We address open questions about whether and how lawmakers use Twitter to communicate their policy agendas and how that communication differs among parties, chambers, and genders. We first describe the construction of our classifier, report and discuss the patterns of political attention we found after labeling the

115th U.S. Congress's tweets, and conclude by assessing our hypotheses on the influence of individual characteristics on members' attention patterns.

Methods

The fact that social media can both bypass traditional media and facilitate connections between policymakers and journalists requires that we differentiate how we study social and traditional media sources (Barberá et al., 2019; Jungherr, 2014; Shapiro & Hemphill, 2017). The current media landscape requires research that takes advantage of social media's platforms—particularly Twitter—to aggregate attention and participate in dialogue unmediated by mass media.

Existing methods for studying lawmakers' policy agendas often employ manual topic labeling, which depends on human effort and can be restrictive in terms of scope and scale (Quinn, Monroe, Colaresi, Crespin, & Radev, 2010). As members of Congress have expanded their use of social media for daily communications about policy problems, so too must the research methods that we use to understand how lawmakers engage various constituencies. To understand what influences those patterns of attention and how they differ among lawmakers, we seek alternative methods of policy agenda analysis.

To address the need for a comprehensive and consistent mechanism for measuring policy agendas through attention on Twitter and at scale, we developed a computational model for estimating political attention. We leveraged a sample of human-labeled congressional tweets to train a supervised machine-learning classifier to label the policy topics in lawmakers' tweets. We tested that classifier to evaluate the performance of our models against experts' labels, and found that the trained classifier serves as a viable alternative to manual coding techniques.

With a high-performing classifier, we can analyze what drives lawmakers' patterns of attention among a consistent set of policy topics on a much larger scale than is possible by current content coding techniques. Our machine-learning classifier enables analysis across the set of topics from the Comparative Agendas Project that have been used over time to study policy attention. By using all the tweets of lawmakers in Congress, the data allows us to use this coding scheme to test our hypotheses.

Data

115th Congress Data. Using the Twitter Search API, we collected all tweets posted by official accounts linked to voting members of Congress during the 115th Congress, which ran from January 3, 2017 to January 3, 2019. We identified Twitter user names by combining lists of members' social media accounts from the UnitedStates project,² George Washington Libraries,³ and the Sunlight Foundation.⁴ Throughout 2017 and 2018, we periodically used the Twitter API to search for the user names in this composite list and retrieved the accounts' most recent tweets. We conducted our final search on January 3, 2019, shortly after the 115th Congress ended. In all, we collected 1,485,834 original tweets from 524 accounts. Table 1 shows tweet frequencies for gender, chamber, and party. We included data from while they

Table 1. Total Tweets Posted by Party, Chamber, and Gender

	House	Senate
Man		
Republican	441,890	171,083
Democrat	356,870	143,522
Woman		
Republican	65,240	19,867
Democrat	212,457	74,905

were in office for members who resigned (e.g., Ryan Zinke) and those who joined after special elections (e.g., Rep. Conor Lamb).

Metadata. We used UnitedStates project and Sunlight Foundation datasets to retrieve members' metadata information, including details about which state they represent, chamber, party, and gender. For the six members (gianforte, lindsey-grahamsc, replblumenauer, repryanzinke, amashoffice, and senbillcassidy) who did not have state metadata available via UnitedStates project or Sunlight Foundation, we used data from their official websites to manually collect metadata.

Manually Labeled Training Data. The original set of labeled tweet data from Russell (2018, 2017) comprised 68,398 tweets. Of these tweets, the model labeled 45,402 tweets as "policy" and 22,996 as "not-policy" tweets. We removed retweets from this set to limit our classification to original tweets, resulting in a final dataset of 59,826 labeled tweets (39,704 policy tweets, and 20,122 not-policy tweets). By restricting our analysis to original tweets, we provide conservative estimates of attention.

Model Specification. We used the manually labeled data to train a logistic regression classifier and achieved an F1 score of 0.79. We experimented with alternative preprocessing steps, different classification algorithms, and feature selection approaches such as word2vec (Mikolov, Chen, Corrado, & Dean, 2013), and found that simple bag-of-words vectorization and logistic regression achieved the best performance.⁵

Statistical Analyses

Our goal is to understand and explain how a member's party, chamber, and gender affect their political attention. A tweet's policy area class indicates attention to that topic. Since the Comparative Agendas Project (CAP) codebook includes 20 policy areas, we used multinomial logistic regression to approach this question. We chose policy area number 5, *labor*, as our reference category and used the *nnet* package in R (Venables & Ripley, 2002) to conduct these analyses. We selected *labor* as the base category, given its moderate level of salience and inter-party appeal that spans from issues around workforce development to questions about fair pay and benefits.

Results

General Policy Attention Patterns

We performed snapshot and time series frequency analyses of policy attention in order to understand general patterns. We see that most policy topic areas receive little attention (see Figure 1), and those low levels of attention vary little over time (Figure 2).

Figure 2 shows that *health*, *macroeconomics*, *law and crime*, *defense*, and *immigration* receive more attention sporadically. *Health* (topic 3) received a peak in attention during the first half of 2017 and then leveled off over the remainder of the 115th Congress. *Macroeconomics* (topic 1) peaked in the Fall of 2017. *Law and crime* (topic 12) received increased attention during the first half of 2018, which then decreased for the rest of the year while remaining higher overall than 2017 rates of attention. *Defense* (topic 16) featured a generally higher baseline than most topics, demonstrating some periodicity toward the end of 2017 and early 2018. For *immigration*, we observed three noticeable peaks—the last quarter of 2017 and the first and second quarters of 2018.

Figure 3 shows the percentage of tweets represented by each policy area over time during the 115th Congress. Figures 3 and 4 display the same data, but the stacking in Figure 3 reveals different trends and anomalies. We see that during the first three quarters of 2018, *housing* (topic 14) and *foreign trade* (topic 18) increased slightly in their proportion of tweet attention relative to other topics. During the third quarter of 2018, we see *social welfare* (topic 13) exhibit a jump in tweet attention. Finally, during the final quarter of 2018, we see *agriculture* (topic 4) also exhibit a jump in tweet attention.

Individual Characteristics' and Policy Attention Patterns

To identify explanatory patterns in the specific policies mentioned, we fit six different multinomial logistic regression (MLR) models to determine the relationships

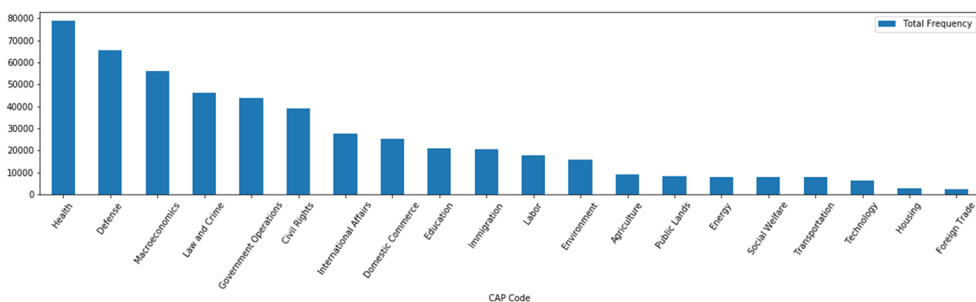


Figure 1. Overall distribution of attention (frequency of tweets) across policy areas for the 115th Congress. Topic 3 (*health*) receives the most attention overall.

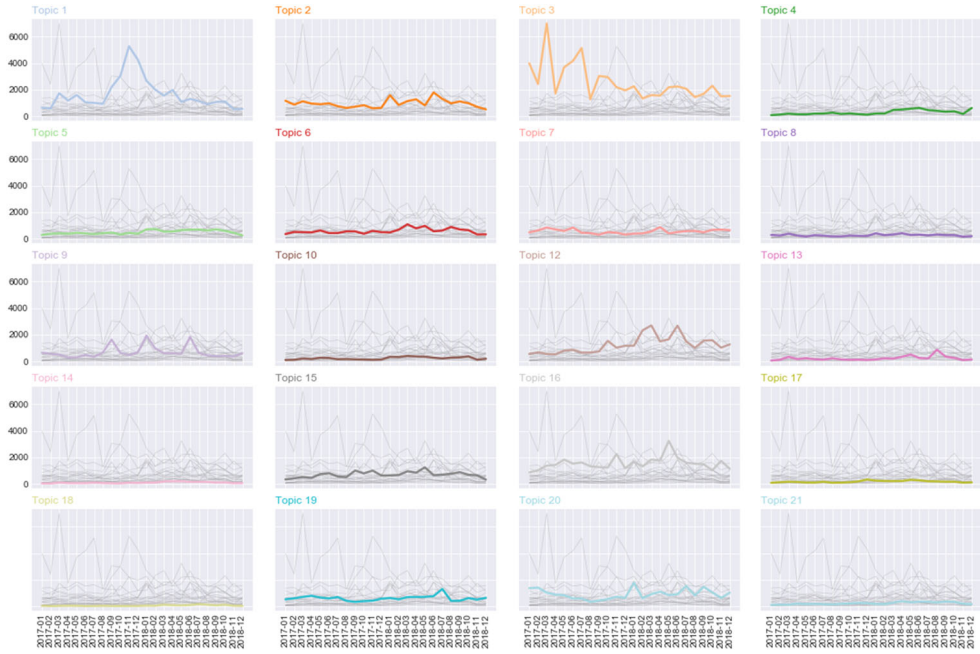


Figure 2. Frequency over time for each topic in CAP codebook. Results are presented with monthly frequencies.

between party, chamber, gender, and policy area. We fit each of the independent variables alone, then all three together, interacting party and chamber, and interacting all three terms. Using Akaike information criterion (AIC) comparisons and analysis of variance (ANOVA), we found that the model of best fit included all three independent variables and no interaction terms. Table 2 shows the results of the best MLR;⁶ it contains odds ratios and standard errors for each topic. The results of the MLR show that there are significant differences between genders, parties, and chambers for nearly all topics in the CAP codebook.

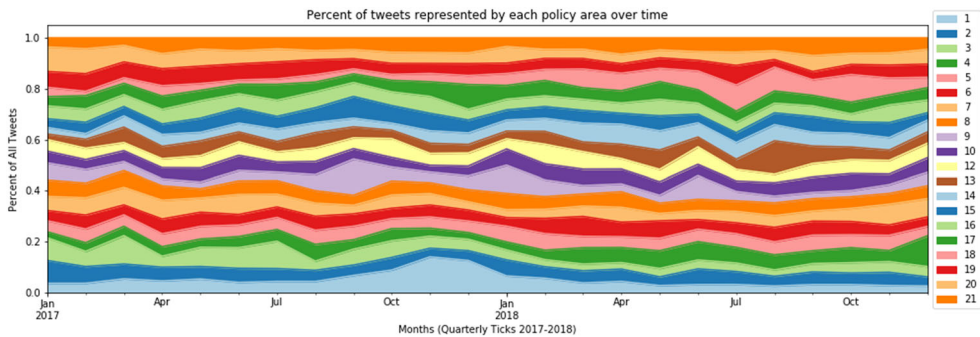


Figure 3. Percent of tweets in each policy area over time.

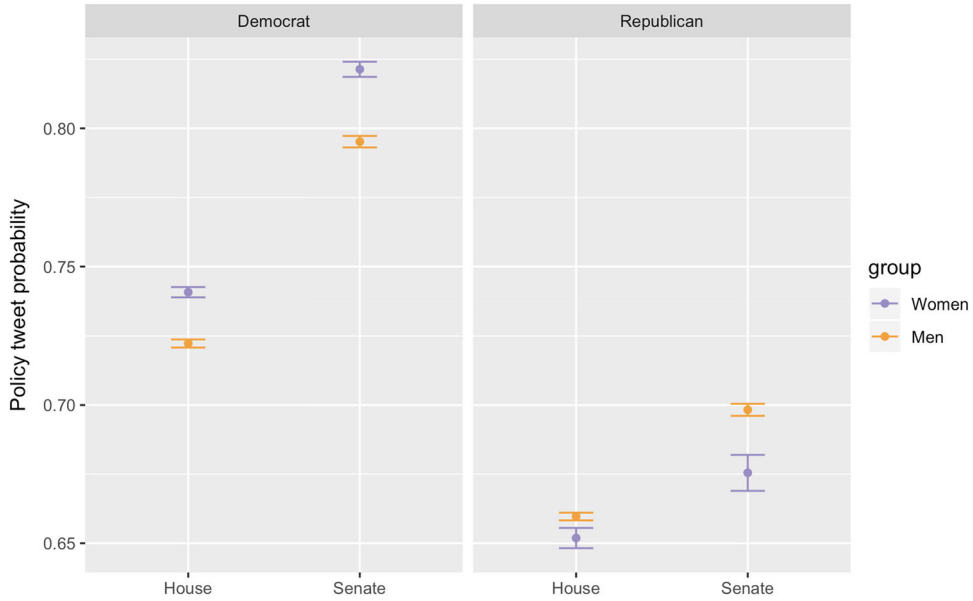


Figure 4. Marginal effects plot comparing policy tweet frequencies by party, chamber, and gender.

Table 2. Results of Multinomial Logistic Regressions

CAP #	CAP Major Code	Issue Owner	GOP	SE	Sen.	SE	Man	SE	Const.	SE
1	Macroeconomics	Dem	1.46***	0.012	0.87***	0.013	1.28***	0.014	2.03***	0.012
2	Civil Rights	Dem	0.63***	0.013	0.82***	0.014	0.86***	0.014	2.73***	0.012
3	Health	Dem	1.02	0.012	1.03**	0.012	0.99	0.013	3.75***	0.011
4	Agriculture	Dem	1.83***	0.019	1.34***	0.019	0.86***	0.021	0.34***	0.019
6	Education	Dem	0.88***	0.015	0.94***	0.015	0.89***	0.016	1.23***	0.014
7	Environment	Dem	0.49***	0.017	1.28***	0.016	1.51***	0.018	0.66***	0.016
8	Energy	Dem	1.97***	0.018	1.45***	0.018	1.26***	0.021	0.29***	0.019
9	Immigration	GOP	0.70***	0.016	0.71***	0.017	1.23***	0.017	0.93***	0.015
10	Transportation		0.98	0.019	1.12***	0.019	1.15***	0.021	0.38***	0.019
12	Law and Crime	GOP	0.75***	0.013	0.996	0.013	0.95***	0.014	2.48***	0.012
13	Social Welfare	Dem	0.54***	0.021	0.59***	0.023	0.83***	0.02	0.62***	0.017
14	Housing	Dem	0.64***	0.032	1.16***	0.031	1.03	0.032	0.15***	0.028
15	Domestic Commerce	GOP	1.27***	0.014	0.96***	0.015	1.11***	0.016	1.08***	0.014
16	Defense	GOP	1.70***	0.012	0.96***	0.012	1.18***	0.013	2.51***	0.012
17	Technology		1.15***	0.022	1.36***	0.022	1.05*	0.025	0.24***	0.022
18	Foreign Trade	GOP	1.34***	0.035	1.51***	0.034	1.15***	0.041	0.07***	0.037
19	International Affairs	GOP	1.39***	0.014	1.10***	0.014	1.36***	0.016	0.94***	0.014
20	Government Operations		1.22***	0.012	1.17***	0.013	1.25***	0.014	1.67***	0.012
21	Public Lands	Dem	1.15***	0.019	1.44***	0.019	1.00	0.021	0.36***	0.019

Note: Odds ratios (columns 4, 6, 8, and 10) and standard errors (columns 5, 7, 9, and 11) are provided. "Labor" (CAP #5) is the reference category. The CAP codebook has no #11.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 3. Results of Logistic Regression Predicting Policy Tweets

Term	Odds ratio	SE
Republican	0.656***	0.006
Senate	1.610***	0.017
Man	0.910***	0.006
Senate:Republican	0.691***	0.014
Republican:man	1.137***	0.012
Senate:man	0.927***	0.012
Republican:Senate:man	1.158***	0.026
(Intercept)	2.857***	0.014

SE, standard error.

*** $p < 0.01$.

This significance indicates that the Members of Congress with different characteristics exhibit different patterns of political attention. However, the odds ratios noted in Table 3 are all less than two, indicating weak to moderate associations between gender, party, chamber, and policy attention.

Concerning the effects of gender, we found that *environment* exhibited the highest odds ratio for men compared to women and that *social welfare* receives the lowest odds ratio. These odds ratios suggest that men are more likely to focus attention on *environment* than women, and women are more likely to focus attention on *social welfare* than men.

When examining party effects, we found that the highest odds ratio exists for Republicans compared to Democrats with *energy*. The lowest odds ratio exists for Republicans compared to Democrats for *environment*. These odds ratios suggest that the Republican Members of Congress are more likely to focus attention on *energy* than are Democrats, and Democrat members are more likely to focus attention on *environment* issues than are Republicans.⁷

Finally, concerning the effects of chamber, we found the highest odds ratio exists for Senators compared to House Representatives with *foreign trade* and the lowest odds ratio for *social welfare*. These odds ratios suggest that Senators are more likely to focus attention on *foreign trade* than are House Representatives, and House Representatives are more likely to focus attention on *social welfare* than are Senators.

To understand whether there are differences among genders, parties, and chambers related to tweeting about policy generally, we first used logistic regression to predict the frequency of policy tweets on any topic. We have two dependent variables: *policy_tweet*, a binary variable that indicates whether a tweet is about policy; and *policy_area*: a categorical variable that corresponds to the tweet’s major code from the Comparative Agendas Project codebook. We use binary predictor variables Republican, Senate, and Man to indicate party, chamber, and gender. We fit models of the predictors independently, in combination, and with interaction terms. Using AIC comparisons and ANOVA, we found that the exhaustive model that included all three independent variables and interactions among them was the model of best fit when predicting the frequency of

policy-related tweets (see Table 3). We plotted residuals using the binned plot function of the *arm* package (Gelman & Su, 2018) and found no significant outliers.

Policy Attention Volume Hypotheses

Overall we observed more policy discussion on Twitter in 2018 than in 2017, peaking in April and May of 2018, increasing after the 2018 primaries, and decreasing after Congressional elections in November 2018. Generally, we found that Democrats, Senators, and women tended to post policy tweets more frequently than Republicans, Representatives, and men. Senators were the most frequent policy tweeters, indicating support for H5 (Senators more frequently mentioned policy than did Representatives). Among both Senators and House members, Democrats tweet more frequently than Republicans, leading us to reject H3 (Republicans discuss policy less often than Democrats). While Republicans were initially more likely to adopt Twitter (Lassen & Brown, 2011), we find that Democrats are the more vocal policy messengers on Twitter. Finally, among Democrats, women mention policy more often than men, and among Republicans, men mention policy more often than women (see Figure 4). This echoes research by Cormack (2016a, 2016b) that women will communicate more vote revelations than men in their constituent communications. Additionally, this finding supports work by Russell (2018) that finds female senators, primarily Democrats, are likely to send position-taking messages compared to their male counterparts, and research by Evans and Clark (2016) that finds a higher rate of policy messages among women in the House. These results indicate mixed results for H1; whether women mention policy more often than men depends on the party and chamber.

Issue Ownership Hypothesis

H4 suggests that Democrats and Republicans will attend to different issues, specifically those that they own. The results of our multinomial logistic regression (Table 2) indicate mixed support for this hypothesis. For some issues, such as Civil Rights, the issue-owning party (Democrats) showed more attention. However, for others, such as Immigration, the issue-owning party (Republicans) showed less attention.

Policy Attention Diversity Hypotheses

We calculated attention diversity for each Member of Congress using Shannon's H as recommended by Boydston, Bevan, and Thomas (2014), and calculated linear regression to predict H using party, chamber, and gender.⁸ Table 4 shows the results of that regression, indicating that Democrats and Senators exhibited significantly more diversity than Republicans and Representatives. These findings support H6 (Senators exhibit more diverse policy agendas than Representatives). We find that the difference between genders was not significant, rejecting H2; that is, women exhibit neither more nor less diverse policy agendas than men.

Table 4. Predicting Agenda Diversity (Shannon's H) by Party, Chamber, and Gender

	Shannon's H (S.E.)
Republican	-0.184*** (0.017)
Senate	0.104*** (0.021)
Man	0.003 (0.021)
Constant	2.419*** (0.019)

* $p < 0.1$.
 ** $p < 0.05$.
 *** $p < 0.01$.

We summarize our hypotheses, and whether our statistical analyses support or reject them, in Table 5.

Discussion

We presented a supervised machine-learning model that detects political topics in tweets and assigns them to categories in a widely used codebook for measuring political attention. This model enabled us to (a) observe patterns in Congress's political attention through the 115th Congress, and (b) identify differences in policy agendas through political attention patterns among lawmakers’ parties, chambers, and genders. We found that the proportion of lawmakers’ tweets that address policy issues stayed relatively stable throughout the congress, ranging from 41 to 57 percent of tweets, but that the parties, genders, and chambers produced different patterns of attention to issues within those policy tweets. These differences were quite small in effect, the importance of which we discuss in greater detail in the sections that follow.

Table 5. Summary of Hypotheses and Results

Hypothesis	Result
H1: Women will mention policy more often than men.	Among Democrats: Supported Among Republicans: Not supported
H2: Women will exhibit more diverse policy agendas than men.	Not supported
H3: Republicans will mention policy more often than Democrats do.	Not supported
H4: Republicans and Democrats will attend to different policy issues.	Mixed
H5: Senators will mention policy more often than Representatives do.	Supported
H6: Senators will exhibit more diverse policy agendas than Representatives.	Supported

Party, Gender, and Chamber Effects

Our results show that Democrats, Representatives, and women are generally more likely to post policy-related tweets. However, the significance of the interaction terms in our regression indicate that these general patterns do not always hold. Rather, the effects of party, chamber, and gender depend on one another.

Specifically, party moderates the effect of gender. We found that Democratic women attend to policy more often than Democratic men, and Republican women attend to policy less than Republican men. Evans et al. (2016) also found that women were more likely to attend to policy issues during campaigns. However, they found that, once elected, women in the 112th Congress did not exhibit behavior that differed significantly from men. They do not indicate whether women in both parties exhibit the same pattern, but we found that Republican women were less likely than their male counterparts to post policy tweets. The interaction here between party and gender potentially explains why our results differ—women and men exhibited similar patterns, but party mediated those effects. In a related vein, Pearson and Dancey (2011) found that “Republican congresswomen have particularly strong incentives to highlight their partisan credentials to both party leaders and attentive constituents,” which may explain why Republican women were less policy attentive in their tweets than Democratic women. Republican women spend more of their time tweeting about constituent relations (i.e., district affairs, emergency response, district awards, holidays, etc.) or partisan debate.

In regard to the diversity of issues, we find no difference between men and women in terms of the range of issues that are discussed on Twitter. Women are not sticking to a narrow set of “women’s issues” nor are they trying to address more issues than their male colleagues. This finding runs counter to work by Atkinson and Windett (2018) that shows women offer a more diverse number of policy proposals than their male colleagues in their legislative activity. On Twitter, these differences by gender do not appear and suggest the need for further inquiry into the different audiences and motivations of agenda setting on Twitter versus in Congress.

Democrats in both chambers attend to policy more often than Republicans, and Senators of both parties do so more than Representatives. Parties did not stick to the issues they “own” but did distribute their attention differently. One explanation for this finding may be that on Twitter, Member of Congress have latitude to choose topics that diverge from their legislative policy agendas, allowing them to explore a more diverse range of topics. Also, our model does not investigate policy preferences or whether a member is speaking in favor of or against a particular policy area. Future work should more thoroughly investigate policy preference as an additional dimension of issue-ownership expression in members’ tweets; it may help explain the mixed results we find here for H4. The higher frequency of policy tweets among Senators contradicted earlier findings where Republicans and Representatives tweeted more often (Hemphill et al., 2013).

We then examined policy tweets alone and found that party, chamber, and gender impact the relative attention topics receive. However, in evaluating each of

these demographic groups’ different tweet frequencies, we found that the low odds ratios (indicating weak associations) meant these differences among demographic groups were not meaningful in practice. For instance, Figure 5 shows the proportion of tweets in each category by gender. Though the regression showed a significant statistical difference between the genders for nearly all topics, the figure shows how small those differences are. As in Hayes and Lawless (2016), the “file drawer” problem may mean that published research about gender differences may overrepresent those differences. The small effects of the differences we identified are likely more interesting than the effects themselves.

Future Work

Our main contributions in this article are a model for labeling tweets according to their political topics, and explanation of the motivations for specific patterns of policy attention online by Members of Congress. We suggest future work should make advances in four areas (a) modeling, (b) institutional effects that impact attention, (c) relationships between agendas expressed online and elsewhere, and (d) strategic motivations for communication activities.

Model Improvements. To improve the modeling, future research may consider including topic vectors or hashtag co-occurrence features. We experimented with different approaches to improve the performance of the model but recommend that future work explore additional designs. For instance, more experiments with different word-embedding models may identify a better approach, such as topic2vec (Niu, Dai, Zhang, & Chen, 2015) that can learn both words and topics. It may also be useful to include individual characteristics in the models themselves. Party, chamber, and gender have small influence on the topics discussed and so may be more analytically useful as model features—they may help the model assign topics when two categories have similar probabilities; such as immigration and agriculture, or energy and environment in the U.S. context. Researchers should also experiment with unsupervised approaches to detecting political topics. Our

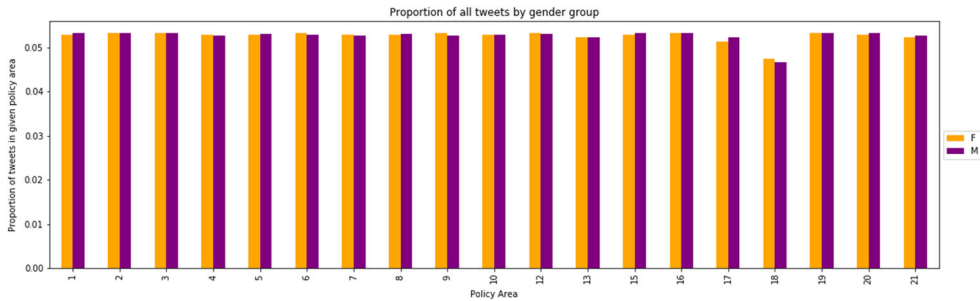


Figure 5. Male and Female Policy Area Attention Distributions. Orange Bars Indicate the Proportion of Attention Females Paid to a Given Policy Area Relative to Others, and Purple Bars Indicate Male Attention.

approach leverages manually labeled data to effectively classify documents, but an unsupervised approach, where the model identifies latent relationships, may generate results that are useful for different approaches to understanding political topics. Denny and Spirling (2018) and Hemphill and Schöpke-Gonzalez (2019) provide interesting comparisons of the two approaches and how they may be useful for different political research agendas.

Institutional Effects. Our predictions and analysis focused on properties of individual Members of Congress that may influence how they divide their political attention. Future work should examine whether institutional effects such as legislative debates or committee and caucus membership influence their behavior. To illustrate directions for this avenue of future work, we examined *health*, the most frequent policy topic, in more detail to explore what else may be driving attention on Twitter. *Health* topics fall under multiple jurisdictions (Sheingate, 2006) and so provide an opportunity to examine the potential influences of institutional factors on Twitter policy attention. To explore what motivates *health* policy area tweet patterns, we examined which Members of Congress contributed to these posts and what they are posting about. We sampled users from two groups: “prolific” and “attentive” users. Prolific users are those who posted most often (raw count) about *health*, and included Sen. Patty Murray (D-WA, F), Sen. Rob Portman (R-OH, M), Sen. Richard J. Durbin (D-IL, M), and Rep. Frank Pallone, Jr. (D-NJ, M). Among attentive users, *health* was the topic they talked about most (proportionally), and included Rep. Brett Guthrie (R-KY, M), Rep. Michael C. Burgess (R-TX, M), Rep. Grace F. Napolitano (D-TX, F), and Rep. Diane Black (R-TN, F). Interestingly, these two groups of members do not overlap—those who tweet the most about *health* are not the people who spend most of their attention on *health*. We used tweets from these users to explore the potential influences of institutional factors on Twitter policy attention, including committee membership, caucus membership, and legislative debates. Results from these samples of prolific and attentive tweeters indicate that members’ Twitter content may be driven by four factors that future work should examine:

1. partisan position-taking in legislative debates (e.g., ACA debate),
2. advocacy for sponsored legislation (e.g., Sen. Portman’s push for his sponsored STOP Act, and reauthorization and expansion of the CARA Act),
3. position-taking in nomination confirmation debates (e.g., Tom Price to U.S. Secretary of Health and Human Services), and
4. committee and caucus membership (e.g., Napolitano’s mental health narrative, or Murray and Black’s focus on the ACA debates).

Twitter and the Media Landscape. In addition to model improvements, we suggest that future work should test correlations between political attention on Twitter and elsewhere. For instance, Cormack (2016a) found that in email, Members of Congress communicate an ideology that matches their voters’ preferences better than it matches their actual voting history. One interesting question for future work

is whether this holds true on Twitter as well as email. This type of work can contribute important revelations about how legislators' communication motivations and goals differ across media platforms.

The relationships between topics on Twitter and in the press also deserve continued attention. Recent work has explained that Twitter is a popular source for political journalists, and confirmed the connection between Congress's Twitter posts and issues covered in *The New York Times* (Shapiro & Hemphill, 2017). In a study of Congress's responsiveness (Shoemaker & Reese, 1991), Barberá et al. (2019) found that media outlets influenced political attention among politicians, which suggests that future work should include media attention as a factor in modeling Congress's attention.

Social Media and Legislation. Future work should evaluate explicit relationships between Twitter communication and legislative action in the U.S. Congress. Purpura and Hillard's (2006) legislation classification models, which also use CAP codebook codes, make it possible to compare topic distributions across tweets and legislation. By combining behavioral data from members' votes and topic data from both members' votes and tweets, future work could explain the relationships between legislative actions and communicative activities. Russell and Wen's (2019) work examining the relationship between bill introductions and tweets falls in this vein, finding an association between policy rhetoric and policy activity in Congress. Each of these avenues can leverage time series analyses to understand how attention patterns and their influences change over time and across media platforms.

Researchers could also explain why politicians adopt either "prolific" or "attentive" strategies in their communications, and whether those strategies impact electoral or career outcomes. Existing research suggests that an individual's leadership aspirations have a greater influence over their behavior than their legislative institution (Scherpereel et al., 2017) or their party (Bernhard et al., 2015). Adopting a prolific strategy online may help an individual garner a reputation for general leadership, for instance, while attentive strategies may signal expertise in particular issues. Our findings around gender and party differences, and earlier work on gender and campaigning (Evans & Clark, 2016; Hayes & Lawless, 2016; Hayes, Lawless, & Baitinger, 2014) indicate that men and women will have different success with these strategies.

An important line of future inquiry should also consider the relationship between the president and a congressional party and whether that shapes the social media strategies of lawmakers. Members from the minority party, relative to the White House, may be incentivized to routinely promote a policy agenda that criticizes the president or his agenda (Green, 2015; Morris, 2001). That criticism is common in press statements (Groeling, 2010), and that behavior may influence the volume and nature of policy fights members take up on Twitter. Members who need to voice their opposition to the president may do so by turning to Twitter to offer an alternative policy agenda that is critical of the White House. The normalization of social media as a universal tool for policy debates lends itself to the needs of those minority voices, vis-à-vis their relationship with the White House.

Conclusion

Understanding how Members of Congress distribute their political attention is key to many areas of political science research including agenda setting, framing, and issue evolution. We demonstrated that it is possible to exploit members' Twitter behavior to study their political attention and found statistically significant differences in attention between parties, chambers, and genders. However, these differences were small enough to suggest that other member characteristics are also at play. Our computational modeling approach is an important first step to future analyses that examine institutional factors (e.g., committee assignment, caucus), partisan issue preferences (e.g., issue ownership), and political environment (e.g., partisan issues, confirmations, etc.). Our findings indicate that these factors likely explain the patterns of political attention we observed. Our study examines a critical aspect of the dataset and method we developed—that is, what differences in attention appear—and facilitates future efforts to understand political attention, social media, and legislative action.

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Notes

1. Twitter announced the move from 140 to 280 characters in the Fall of 2017 (<https://twitter.com/jack/status/912784057863245824>), and therefore some of the tweets in our sample were limited to 140 characters and others to 280.
2. <https://github.com/unitedstates/congress-legislators>
3. <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/UIVHQR>
4. <https://sunlightlabs.github.io/congress/index.html\#legislator-spreadsheet>
5. Additional details about the development of the model and our experiments, and frequencies and associated terms for each category, are available in the supplementary materials.
6. Complete results for all models are available in the supplementary materials.
7. The CAP codebook's *energy* topic discusses issues generally related to energy policy and appropriations, including: nuclear, electric, natural gas and oil, coal, alternative, and renewable energy sources; energy conservation; and energy research and development. Its *environment* topic discusses issues generally related to environmental policy and appropriations, including: drinking water; waste disposal; hazardous waste; air pollution; recycling; indoor hazards; species and forest protection; conservation; and environmental research and development not including alternative energy.
8. We also calculated models including interaction terms, and the full list of models and their results are available in supplementary materials. We again report only the model of best fit here.

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