Assessing the effectiveness of e-petitioning through Twitter conversations

MOLLY ASHER
Data Science Intern, University of Leeds, UK

CRISTINA LESTON BANDEIRA
Professor of Politics, University of Leeds, UK

VIKTORIA SPAISER
University Academic Fellow, University of Leeds, UK

Abstract. Recent trends of decline in political support have led political institutions to develop new democratic innovations to promote linkages with the public, beyond the representative democracy model. It is in this context that the UK Parliament introduced a new e-petitions system in 2015, aiming to significantly enhance its relationship with the public, namely by opening up the institution to a wider public and to develop deeper engagement. This paper explores whether this aim is being met, through specifically using Twitter data from conversations on e-petitions. Through the use of natural language processing (computational text mining), machine learning and social network analysis of Twitter data we explore (a) what Twitter data can teach us about the extent of people's engagement with e-petitions beyond signing them, (b) the nature of Twitter e-petition conversations and the extent to which they reveal how people perceive the e-petition procedure and (c) who is taking part in these conversations and how they interact. Focusing mainly on a case study, we find the public reacts differently to an oral evidence session and a parliamentary debate: whilst the former stays factual and discursive, the latter becomes more emotive and critical. We also show clear patterns of polarization. Our results show that more care needs to be given to how petition debates unfold and the extent to which they're inclusive of the original petition's aims.

Introduction

Recent years have witnessed an expansion of democratic innovations (Cain et al, 2003; Smith, 2009) to help address trends of public dissatisfaction with political institutions. E-petitions are amongst these innovations, with increasing popularity, to the extent that a number of parliaments have been developing their own e-petitions systems. In July 2015 the UK Parliament and Government launched their collaborative e-petitions system, which allows members of the public to lodge petitions online. Although a government e-petitions site had existed for several years, this was a markedly new system, crucially integrating Parliament. The new system hoped to redress flaws identified with previous versions, whilst expanding the scope of traditional petitioning to parliament, a practice in place for centuries. A key change was the introduction of a specific House of Commons

Petitions Committee to oversee the process and to liaise with petitioners. This was in response to assertions that the previous, government-led, system was failing to deliver on its promises, and was risking "reputational damage to the House of Commons in particular, and an exacerbation of public disillusionment with the political system in the long-term" (Hansard 2012, 5). When the House finally came to report on a new agreed e-petitions system, there was much hope that it had "the potential to bring about a significant enhancement of the relationship between petitioning public and their elected representatives" (Procedure Committee, 2014, 31). Since then, the e-petitions system has mediated very significant activity, with over 18,000 e-petitions submitted in its first year alone. Besides this, the Petitions Committee has also developed a plethora of public engagement activities utilizing a wide range of tools such Twitter, the focus of this paper. However, there has been little attempt made to study whether those interacting with the system have felt politically empowered by it and whether it is indeed acting to enhance the relationship between public and representatives.

In this paper we utilise Twitter data to assess this issue. While we acknowledge that Twitter data is not representative of the view of the general public (Duggan & Brenner 2013; Ruths & Pfeffer 2014), it can nevertheless serve as a first, quick, indicative measure of people's opinions and sentiments particularly when no other, more representative, data is available. In fact social media are increasingly used by media, campaigners, companies and governments to get an idea of what is on peoples' minds (Ceron et al. 2014; Fast et al. 2015; Smith & Derville Gallicano 2015). We explore what Twitter conversations can tell us about the UK Parliament's[1] e-petitions system's effectiveness in engaging the public. We focus on Twitter data for two reasons: first of all, the Petitions Committee explicitly uses Twitter to engage the wider public in the parliamentary debates of petitions that reach over 100,000 signatures; secondly, Twitter data are per default public and thus more easily accessible than for instance data from Facebook, which hosts much more private, closed groups debates.

Our Twitter data relates to conversations on 16 e-petitions that were granted a parliamentary debate between March and November 2016 and it covers 21 parliamentary sessions, mostly debates but including also five oral evidence sessions. We collated data of tweets using the hashtags determined by the Petitions Committee for each instance. However, our analysis in this paper focuses primarily on one petition calling for a ban to driven grouse shooting. This makes an interesting case study for two key reasons. Firstly, as the practice is fiercely protected by some and strongly opposed, mostly on environmental and animal rights grounds, by others, it refers to something a specific public feels very strongly about, being more likely therefore to engage in discussions. This petition did generate very active discussions on Twitter providing for rich data which can usefully be explored to gain deeper insights into how people react to a parliamentary session addressing a petition they feel strongly about. Secondly, besides a debate, this petition also led to an oral evidence session, which allows the creator of the petition and other experts to provide evidence. This enables us to compare public reactions to how e-petitions are dealt with in parliament between two very different types of parliamentary

sessions. Despite the focus on this case study, we will also refer to other petition debates on Twitter where applicable. In particular, we will examine the following three questions:

1. What can Twitter conversations tell us about the extent to which individuals engage in the petitioning process beyond the signing stage?

2. How are individuals engaging through Twitter with e-petitions and to what extent do their discussions inform us about their reactions to the e-petitions process?

3. Who gets involved in Twitter conversations about e-petitions and how do they interact?

We will proceed by first outlining the theoretical questions that have informed our Twitter data analyses. We will then explain our data and methodological approach. Following this we will present and discuss our results, answering the aforementioned three questions and then finish the paper with a conclusion.

Trust, Public Engagement and the new E-Petitions System

As clearly established by a wide range of studies and scholars, the last few decades have witnessed a general trend of decline of political support in traditional representative democracy institutions, in Britain and elsewhere (Dalton, 2004; Franklin, 2004; Stoker, 2006; Hay, 2007, Norris, 2011; Whiteley, 2012; Mair, 2013). This is reflected in low levels of voter turnout and of public trust in political institutions. Simultaneously we have seen a rise in popularity of different forms of democracy, namely of participatory democracy initiatives, and a deepening of public expectations towards more regular involvement in politics between elections. If participation in traditional political institutions has declined, engagement through other forms of participation has actually expanded (Cain et al, 2003; Norris, 2011). In particular, Dalton et al (2003) show that faced with perceived rising levels of disenchantment, political institutions across advanced industrial democracies have expanded new mechanisms of linkage with the public, leading to a rise in direct democracy initiatives such as referendums, but also of advocacy democracy initiatives.

Advocacy democracy refers to initiatives whereby "citizens directly participate in the process of policy formation or administration, although the final decisions are still made by elites" (Dalton et al, 2003, 11). Petitions fall into this type of initiatives. And, as with other democratic innovations (Smith, 2009), we have seen a particular rise in the popularity of e-petitions since the early 2000s, thanks in great part to the opportunities brought by the internet in terms of easiness of dissemination and collation of signatures (Hale et al. 2014). The World Values Survey have shown for some time that petitions are one of the most used tools of political activism (WVS, 2017), a phenomenon confirmed in the UK by the Hansard Society's Audits of Political Engagement (Hansard Society, 2016). This expansion happened first mainly through informal e-petitions platforms, such as PetitionOnline and Change.org, but formal political institutions have also started tapping into this as a way to strengthen linkages with the public. It is within this context that a number of governments and parliaments have introduced e-petitions systems, such as the 2015 UK Parliament and Government collaborative e-petitions system.

Petitions have existed for centuries, in many ways pre-dating representative institutions. They are the simplest form for a citizen to present a concern and/or a request to political authorities. They went into disuse over the last century, as focus shifted to representative institutions such as political parties and legislatures. But they were a highly used tool in past centuries, namely in the UK from the 17th century to the beginning of 19th century, when thousands of petitions were presented annually with the back-up of millions of signatures to Parliament (Leys, 1955; Judge, 1978). Their online form, however, has led to their resurgence. After the Scottish Parliament launched its own e-petitions system in 2004, other parliaments followed such as the German Bundestag in 2005 and most recently, in 2016, the Irish Parliament. There is great variance between these systems but they all hope to provide citizens a channel to present their grievances and suggestions directly to parliament, rather than through mediators such as MPs or parties. They aim to open the institution to the public and ultimately to promote trust in the institution.

However, many questions still arise from the practice of parliamentary e-petitions. Broadly speaking, do they make a difference? Do they actually lead to citizen-led policy and, more importantly for the purposes of this paper, do they lead to deeper engagement with parliament? In his seminal study of the Scottish Parliament, Carman (2010) showed that evaluations of procedural fairness are crucial in shaping the extent to which petitions can enhance trust in parliament. Regardless of the outcome of their petitions, if petitioners felt that their petition had been considered through a fair process, their trust on parliament rose. Bochel (2016) argues also that procedural fairness is key for the effectiveness of petitions' systems. A petitions system can therefore contribute towards improved perceptions of parliament, if procedurally sound. It is also hoped that it deepens engagement, in that it encourages citizens to engage with Parliament through the issues that matter to them.

These were very much the hopes when the UK Parliament's new e-petitions system was established in 2015. A key difference of the new system lies in the creation of a Petitions Committee, which would lead on the moderation, processing and engagement with petitions. As the then Leader of the House stated, this was "a major change and should be the catalyst for a fundamental change in the relationship between parliament and petitioner" (Hague, HC Debates 24 February: col.256). After the much criticised government e-petitions sites, there was a clear intent that the new system would encompass fair and transparent processes, as well as plenty of opportunities for engagement with Parliament. As the Chair of the Procedure Committee, which reported on the details of the new system, stated "The Petitions Committee will seek to improve engagement with petitioners. Often, those submitting and supporting a petition will not get the exact outcome they want, but they will hopefully feel that their concerns have been appreciated and heard through constructive engagement with the Committee" (Walker, HC Debates 24 February: col.250). Clarity of process and engagement are therefore key in the new system.

Once accepted, e-petitions submitted to petition.parliament.uk are accessible online where supporters can sign the petition. Once it gets 10,000 signatures, the government is obliged to respond within 21 days. Once it gets to 100,000 signatures, the Petitions

Committee considers whether to debate it; most are debated, unless their topic has been recently debated in Parliament. When petitions are rejected or when the Committee decides against doing a petition debate, the reasons are outlined on the petition's webpage. All signatories of petitions receive updates from the Committee for every new action taken, such as a response from government. On occasions the Committee leads inquiries and hosts oral evidence sessions, web forums etc. Each petition's webpage lists all the actions taken and the respective links to transcripts and web streaming of relevant parliamentary sessions. The process is therefore clearly set out and transparent.

The new e-petitions system went live in July 2015. On its first day nine petitions were submitted and 60,580 signatures were added, and since then the site has continued to attract significant interest. By the end of March 2017, over 10,000 petitions had been successfully submitted and over 10 million unique email addresses had been used to sign them, with several petitions gaining over one million signatures. The first 18 months of the system's life have been largely deemed a success. The latest Audit of Political Engagement reported that e-petitions were the "new front door of parliament" and the "single most important route to engage the public that Parliament currently has at its disposal, apart from direct contact with a representative" (Hansard Society 2016, 1, 28). Besides the very high volumes of e-petitions and signatures, the committee has also developed six enquiries and a wide range of public engagement initiatives (Leston-Bandeira, 2016).There has been therefore considerable activity; what we know little of though is whether it has also led to effective engagement and how the public is reacting to key elements of the process such as the petition debates.

However, it is important to distinguish between activity and effectiveness, as Wilson established back in 1999 "more participation is not the same thing as more democracy" (Wilson 1999, 258). Quantifying whether e-petitions are achieving their aims of increasing political engagement and trust of parliament and leading to "more democracy" is a complex problem, but their existence on a digital platform opens up new possibilities for study. E-petitions leave a strong online imprint from their creation, to their presentation, to their dissemination and to their eventual debate (Hale et al. 2013a). Our analysis focuses on data from conversations on Twitter, collected using a series of hashtags defined by the Petitions Committee to promote conversations on petitions. Harvesting this data allows the creation of a 'big data' set containing a traceable log of every individual who used the hashtag to interact with the petitions on Twitter and a record of what they actually said (Hale et al. 2013a). This is a shift from conventional social science methods, which rely on surveys of a representative sample of a population and contain information only on how individuals reported to have behaved (Hale et al. 2013a). Crucially, this data enables us to listen in real-time to what the public is saying whilst a petition parliamentary debate is taking place. In short, it gives us an insight to first-hand reactions from a public particularly interested in specific petitions. Considering how important procedural fairness is for petitions' evaluation (Carman, 2010), these Twitter conversations allow us to determine what the public thinks about the unfolding petition debate, and/or oral evidence session.

Signing an e-petition is a small political participation act, intended to be just the beginning of a process of raising the importance of an issue with Government and Parliament. However, there are concerns that the process of signing an e-petition may actually be too easy to provide a real hook for engagement (Jungherr & Jurgens 2010). This is reflected in the description of e-petitions as 'clicktivism' or 'slacktivism' and "a trivial form of advocacy that doesn't accomplish anything" (Beato 2014, 23). There is a worry that e-petitions may even result in fewer individuals taking part in other political or civic activities as they have satisfied their internal moral obligation for action (Lee & Hsieh 2013). Engaging in Twitter conversations around a petition debate and raising awareness it is taking place is one way engagement can be maintained. Analysis of these Twitter conversations can therefore inform understanding of the extent to which engagement is maintained beyond signing.

Finally, the availability of e-petitions through the Internet is hoped to help broaden engagement to disengaged groups and to provide an ideal platform for political discussion (Dahlgren 2005); this would lead to "more democracy". Conversely, it could in fact accentuate political fractures in the population (Galston 2003). The concern is that the Internet allows individuals to selectively interact with those who are similar to them (without geographic constraints), therefore providing an echo chamber, which reinforces prior political views (Colleoni et al. 2014). As Norris established back in 2001, web-based participation may in fact widen the digital democratic divide rather than promote more engagement. The tendency of individuals to seek out interaction with others who they perceive as similar to them is known as homophily and can result into fractionalisation of citizens into politically polarised, homogenous groups (Hoffman 2012). Homophily has been shown to be found in political conversations on Twitter (Himelboim et al. 2014), it is therefore particularly relevant to explore in the context of conversations about e-petitions. Are these Twitter conversations promoting a wider engagement with e-petitions, or do they reflect closed discussions between those who were already engaged with the specific petition?

Methodological Approach

Data

We collected Twitter data between March and November 2016 using the Twitter Streaming API, which allowed us to scrape in real time all Tweets made to a hashtag defined by the House of Commons Petitions Committee to coordinate specific petitions discussions on Twitter.

For each petition, and unique hashtag, the data was collected the day before the debate or oral evidence session in Parliament, the day of the debate or oral evidence session and the day after. Overall, Tweets were collected for 21 parliamentary sessions, including 16 debates, four oral evidence sessions and one digital debate. In the digital debate in the context of the UK Aid e-petition, people were invited to provide input to the

parliamentary debate via Twitter two days prior to the parliamentary debate. Although the Twitter Streaming API has a 1% of all public tweets rate limit, this did not prohibit the collection of all tweets tagged with a specific hashtag, as these tweets make up only a small amount of overall Twitter activity. The data collected includes all of the following: tweet text, author of the tweet, when it was tweeted and whether it was a retweet or not, the original author of the tweet, plus further information on Twitter users, including profile description, location specification, number of followers etc.

Although Twitter data can be seen as a rich data source that provides insights into peoples' genuine opinions in fine-grained geographical and temporal contexts, the data has its limitation (Ruths & Pfeffer 2014). Most importantly, Twitter data is not representative, it is based on self-selection on several levels, in our case data is only collected from people who have Internet access, who have a Twitter account[2] and who decided to contribute to the respective hashtag thread. Nevertheless, the data is useful to assess how people, who have a Twitter account and who are sufficiently interested in a specific petition to participate, engage with the parliamentary debate; particularly bearing in mind this is a tool the Petitions Committee actively uses to promote public engagement with parliamentary processing of petitions. Using social media we are thus likely to capture in particular opinions of people who feel strong about a certain issue. On the other hand their opinions are important to understand how well the e-petitions system works in establishing links between people and the Parliament. They can be liked to large focus groups. If the system alienates those willing to engage then it is probably even less likely to encourage the disengaged to getting involved.

Twitter data can be also problematic for another reason – social bots. Social bots can further distort the data, for instance by simulating support for an issue by retweeting every tweet tagged with a specific hashtag or by generating a random opinion through a syntactically correct combination of words (Murphy et al. 2016). It is not a trivial task to detect bots in large amounts of data and bot detection is an ongoing and very active area of research (Davis et al. 2016; Morstatter et al. 2016). We have some evidence in our data (see Supporting Information S2.1) that social bots were used in particular in the #FireworkDebate (e-petition demanding banning fireworks to protect animals from unnecessary stress), however we did not detect any obvious social bot activities in our main case study. But even in the #FireworkDebate case, the bot activity is limited to a group of bots retweeting every tweet with a designated hashtag to simulate engagement with the debate, without producing new tweets.

Though Twitter data was our main data source, we also utilised the verbatim transcripts of the oral evidence session and parliamentary debate as an additional data source for our case study (ban of grouse shooting e-petition). These transcripts can be downloaded from Hansard Online (https://hansard.parliament.uk/) in txt format. We used the data mainly as a reference for sentiment analyses of the Twitter data (see next section).

Methodology

Twitter data comes in JSON format and needs heavy processing prior to analysis. For each debate the tweets were compiled into a corpus and R Natural Language Processing and text mining tools were used to process and analyse its textual content (see the Supplementary Information S1.1 and S1.2 for further details). The processing involved in particular tokenizing, thus separating the sentence string into separate words, and stemming, thus determining the stem words, stripping them from their suffixes. Moreover, prior to any analysis, words that are rather poor in meaning on their own, such as "and", "in", are filtered out, because their typical frequency in texts would skew further analyses.

When analysing the tweet content we were in particular interested in establishing main topics that people were talking about in those tweets. To infer the nature of the latent topics embedded in each collection of tweets a bigram-based semantic network analysis was carried out (Wang et al. 2007; Drieger 2013). The text was represented as a network with the nodes referring to words and the weighted, undirected edges between these words indicating a relationship between the words. In the construction of the network, the semantic meaning of the words was discarded and relationships between words were indicated purely by their structural proximity to one another. This is based on the linguistic assumption that "words with similar meanings will occur with similar neighbours if enough text material is available" (Schütze & Pedersen 1995). Thus, if two words co-occurred in a tweet with at most three words separating them, then an edge connected these two words in the semantic network.

Thus the network is based on bigrams, however, in contrast to usual bigram analyses, where two words typically stand in direct proximity, we have decided to increase the proximity window to five (including the two words themselves) because we found that this approach generated significantly better results in topic detection. The edges were weighted by the frequency of the co-occurrence of the two respective words. We used the Force Atlas 2 algorithm to structure the semantic network. The algorithm induces the nodes to repel each other like charged particles, whilst the edges attract their nodes like springs and eventually the network converges to a balanced state (Jacomy et al. 2014).

To detect topics, we made use of the Louvian method for community detection (Blondel et al. 2008). The algorithm attempts to optimise the network modularity. Modularity measures the density of edges inside communities relative to the density of edges outside communities. In large networks this optimisation has to be achieved through heuristic algorithms, since it would be impossible to go through all possible combination iteratively. The Louvian method detects first small communities by optimising modularity locally, then these small communities are grouped and the modularity optimization is repeated (Kido et al. 2016). We found that this approach produced better topic detection results than the more common Latent Dirichlet Allocation topic modelling approaches (Hong & Davison 2010) (see the Supplementary Information S1.3 for further details).

Additionally, we performed an automatic sentiment analysis to gain an overview of the emotions expressed in the Twitter conversations and to determine whether the discussions were predominantly negatively or positively framed. For that purpose, the

corpus was split into individual word tokens and a word frequency table was constructed which was then joined to the AFINN-111 online lexicon (Nielsen 2011) containing sentiment words with pre-coded sentiment scores. This lexicon contains 2,477 words and phrases tagged with a score between minus 5 (negative sentiments) and plus 5 (positive sentiments) and was constructed with short texts in mind, such as those found on social media (Nielsen 2011). Scores were extracted for words in the lexicon that matched the words in our corpus, generating a table with words, their frequency and their sentiment score. Based on the distribution of negative and positive words the overall valence of the conversation framing can be estimated (see the Supplementary Information S1.4 for further details).

Since we are also interested in who is getting involved in these Twitter discussions and how, we not only examined the tweets text, but also their respective Twitter users and retweet patterns. Amongst other things, this enabled us to determine Twitter users who participated in multiple debates. The interactions between Twitter users was analysed through the use of networks, in the form of social network analysis (Scott 2013). A directed edge was defined between two users (nodes) if one had retweeted the other. The edge was weighted by the frequency of retweet interactions in the same direction, i.e. when multiple tweets were retweeted. The Force Atlas 2 algorithm was used to structure the social networks. Communities in the social network were detected using the Louvian method as described earlier. To determine influential users within the network, social network metrics, such as the in-degree (number of incoming edges), betweenness centrality (number of times a node acts as a bridge along the shortest path between two other nodes) and eigenvector centrality were used. Eigenvector centrality evaluates the importance of a node based upon both how many incoming edges they have from other nodes, and how important the nodes are that they are connected to (Hanneman & Riddle 2005). Thus, a retweet by a user who in turn had been retweeted by other users would be valued more highly than a retweet by one who had not. Eigenvector centrality was used in the visualisation of the social network, i.e. the size of the nodes of users was proportional to their relative influence in the network (see the Supplementary Information S1.5 for further details). For central Twitter users we also extracted full names and the profile description from the Twitter data to learn who the users were.

Finally, we were interested in understanding to what extent we find polarization patterns in the social networks based on retweets. We used the Naïve Bayes Classifier (NBC) approach to classify Twitter users making use of their profile descriptions. Naïve Bayes Classifier is a supervised machine learning technique which uses probabilistic learning methods based upon Bayes' theorem assuming independence between the features (in this case, words) (Han et al. 2012; Murphy 2012). The classifier is "naïve" because of the strong independence assumption, since we do not expect the features to be realistically independent. Nevertheless, the classifier produces often very good classification results, because of its simplicity, which makes it relative immune to overfitting (ibid). A training set was manually constructed containing 200 Twitter users and their profile description (features) tagged with one of the three labels "pro-grouse shooting", "anti-grouse

shooting" or "unknown". Learning from the training data the algorithm then predicted the labels (classes) in the remaining dataset based on the features, i.e. words extracted from the profile description. To determine the accuracy of the prediction, we used a validation dataset of 200 other, manually labelled Twitter. The NBC label prediction for this 200 Twitter users was then compared with the manual labels to calculate the prediction accuracy (see the Supplementary Information S1.6 for further details).

Having classified the users in two camps plus a neutral/unknown camp we wanted to know whether Twitter users within each camp are significantly more likely to retweet each other than retweet tweets from Twitter users from the other camp. This would indicate homophily patterns in the social network, that is, people of similar characteristics (same political camp) are more likely to interact with each other, which essentially leads to polarized networks and echo chambers (Calleoni et al. 2014). The Quadratic Assignment Procedure (QAP) method (Krackhardt 1988) was used to test features that affected formation of interactive links in the social network, in particular whether Twitter users who shared the same stance on the petition (political camp classification) were more likely to retweet each other. Firstly, the correlation between the adjacency matrix for user-characteristics and user-interaction was calculated. To determine whether the correlation is higher than we would expect by chance, the QAP uses a non-parametric permutation to permutate the rows and columns of the user interaction matrix and calculate the correlation for each permutation. Repeating permutations 5000 times results in a distribution of correlation coefficients against which the correlation for the actual social network is compared to decide whether there is a significant homophily effect (Lee et al. 2016) (see the Supplementary Information S1.7 for further details).

Findings

Learning Engagement Patterns from Twitter

Previous research has determined a number of factors leading to a petition attracting a high number of signatures; these same factors may be at play in motivating continued engagement. The findings of Hale et al. (2013b) and Yasseri et al. (2013) suggest that the biggest determinant of petition success (in terms of number of signatures obtained) is the number of signatures a petition receives on its first day. The petition receiving good coverage on both traditional (Wright et al. 2012) and social media (Cihon et al. 2016) has also been shown to be a key determinant of success. Both of these factors tie into an idea presented by Berg (2015) that an individual will be more likely to sign a petition if they know others have already done so. As Hoffman points out, it is important to distinguish between political participation and political communication – to what extent is the act of signing an e-petition a way of expressing a political opinion or a desire to bring about change (Hoffman 2012). Levels of engagement on Twitter may be instructive about whether the same factors that mobilise lots of people to sign a petition also encourage them to engage with the process in the longer term.

Drawing from the data on the 16 petitions debated in parliament between March and November 2016, Table 1 shows the number of individuals who signed a petition and the number of those who got involved in their respective Twitter conversations. These figures show high variability, from the petition on UK Aid which led to 7,474 tweets to the one on term time holidays which managed to generate a mere 4 tweets. This suggests that the sustaining of engagement with petitions varies considerably from petition to petition.

Table 1: E-Petitions Debated in Parliament between March and November 2016

Petition	Hashtag	Number of signatures	Number of tweets	Number of users
Invoke Article 50 of The Lisbon Treaty immediately.	#ExitingTheEUDebate	127,111	32	23
Debate in the House the Local Government Pension Scheme Investment Regulations.	#LGPS	105,772	25	23
Ban driven grouse shooting.*	#GrouseShooting	123,077	7,364	2,704
Urge the South Korean Government to end the brutal dog meat trade.	#DogMeatTrade	102,131	2,997	1,113
Stop retrospective changes to the student loans agreement	#StudentLoanDebate	133,969	86	81
Include expressive arts subjects in the Ebacc.	#EbaccDebate	102,499	3,283	1,451
Stop spending a fixed 0.7 per cent slice of our national wealth on Foreign Aid.	#UKAidDebate	235,979	7,474	3,092
Stop Cameron spending British taxpayer's money on Pro-EU Referendum leaflets.	#EUReferendumLeaflet	221,866	48	41
Give the Meningitis B vaccine to ALL children, not just newborn babies.*	#MenB	823,348	141	87
Keep the NHS Bursary.	#NHSBursary	162,568	447	292
The DDRB's proposals to change Junior Doctor's contracts CANNOT go ahead.*	#JuniorDoctors	110,065	224	176
Make an allowance for up to 2 weeks term time leave from school for holiday.	#TermTimeHoliday	127,199	4	4
Fund more research into brain tumours, the biggest cancer killer of under-40s.*	#BraintumouRresearch	120,129	630	282
EU Referendum Rules triggering a 2nd EU Referendum	#EURefDebate	4,149,757	6	4
Make it illegal for a company to require women to wear high heels at work	#HeelsAtWork	152,420	272	75
Restrict the use of fireworks to reduce stress and fear in animals and pets	#FireworkDebate	104,038	92	50

Note: * e-petitions that were granted an oral evidence session prior to the parliamentary debate session. The #MenB petition included two oral evidence sessions.

Furthermore, Table 1 demonstrates that obtaining a high number of signatures does not mean there will be sustained engagement through participation on Twitter. The petition with by far the highest number of signatures (EU Referendum Rules triggering a 2nd EU Referendum) at over four million, attracted just six tweets from four Twitter users, to include the Petitions Committee. However, other petitions do attract lively Twitter conversations such as the ones on as diverse topics as the Ebacc or the dog meat trade, and so clearly in some cases interest is maintained and developed, with Twitter providing an effective platform for encouraging continued participation. The results seem to suggest that petitions that focus on very specific issues that certain social groups feel very strongly about (e.g. animal rights, public health service, etc.) tend to inspire engagement beyond signing a petition. On the other hand, petitions that have more of a protest character (e.g. the EU-referendum related petitions) seem to not inspire further engagement.

As mentioned earlier, some e-petitions are granted oral evidence sessions. Our data shows that the number of tweets and users varies between oral evidence sessions and parliamentary debates. For instance, whilst the #GrouseShooting debate generated 7,364 tweets, the number of tweets commenting on its oral evidence was only 1,661, indicating a much higher number of people involved in the Twitter conversation on the parliamentary debate of this petition.

Using Twitter to Evaluate Citizen Satisfaction with the E-Petition System

We also utilised the Twitter data to analyse the extent to which citizens were happy with the procedure being used in parliament to process the petition and the level of consensus or polarisation expressed in these conversations. Where individuals have used Twitter to engage with e-petitions they have done so in a number of ways. For most petitions there was a bulk of tweets broadcasting information about the fact the debate was taking place, mostly through retweeting the House of Commons Petitions Committee's account. Many conversations also featured tweets directed at MPs putting pressure on them to attend the debate and sharing information about the content of the petition and the arguments surrounding it. In the case of the grouse shooting ban petition in particular Twitter was used to share opinions about the manner in which the debate was carried out and to express frustration about the process.

To understand better the topics covered in the grouse shooting ban debate on Twitter, a semantic network was constructed which is depicted in Figure 1. The network is split into topic clusters identifiable by their different colours. Amongst these clusters several refer to clear criticism of the petition debate procedure. The yellow cluster references the leader of the debate, Steve Double MP, and describes the debate as polarised, favouring the opponents of a ban, frustrating and biased. This relates to the criticism that far more time in the debate was given to the counter arguments opposing the ban, than those in support of it. This is also referenced in the red cluster, which displays reactions to the fact

that Caroline Lucas speaks up in the debate to highlight the importance of maintaining upland peat in controlling climate change, but that she is largely ignored. The focus of this conversation shifts from a discussion of the facts (the purple cluster makes up the only discernible factual topic covering the environmental impacts of burning heather moorland, with reference to flooding, ecology and the environment, and to Calderdale, an area with managed grouse moorland that was hit badly by flooding) to a critique of the fairness of the debate procedure.

The dark green cluster contains the Twitter user names of various campaigners and campaign groups, such as animal aid and league against cruel sports as well as Mark Avery, the creator of the petition, and Chris Packham a BBC wildlife presenter who has spoken out in support of the ban. There are negative words around these names, such as "attack" and "vitriol". The cluster in light grey demonstrates that the opposition group, who support grouse shooting and oppose the ban were also present on Twitter. The words found here reflect discussion of the idea that hunting is a primal activity allowing bonding between father and son, and a right that should be protected. These clusters clearly show that this petition has polarised interest groups, both of whom have maintained engagement with the process through their presence on Twitter.
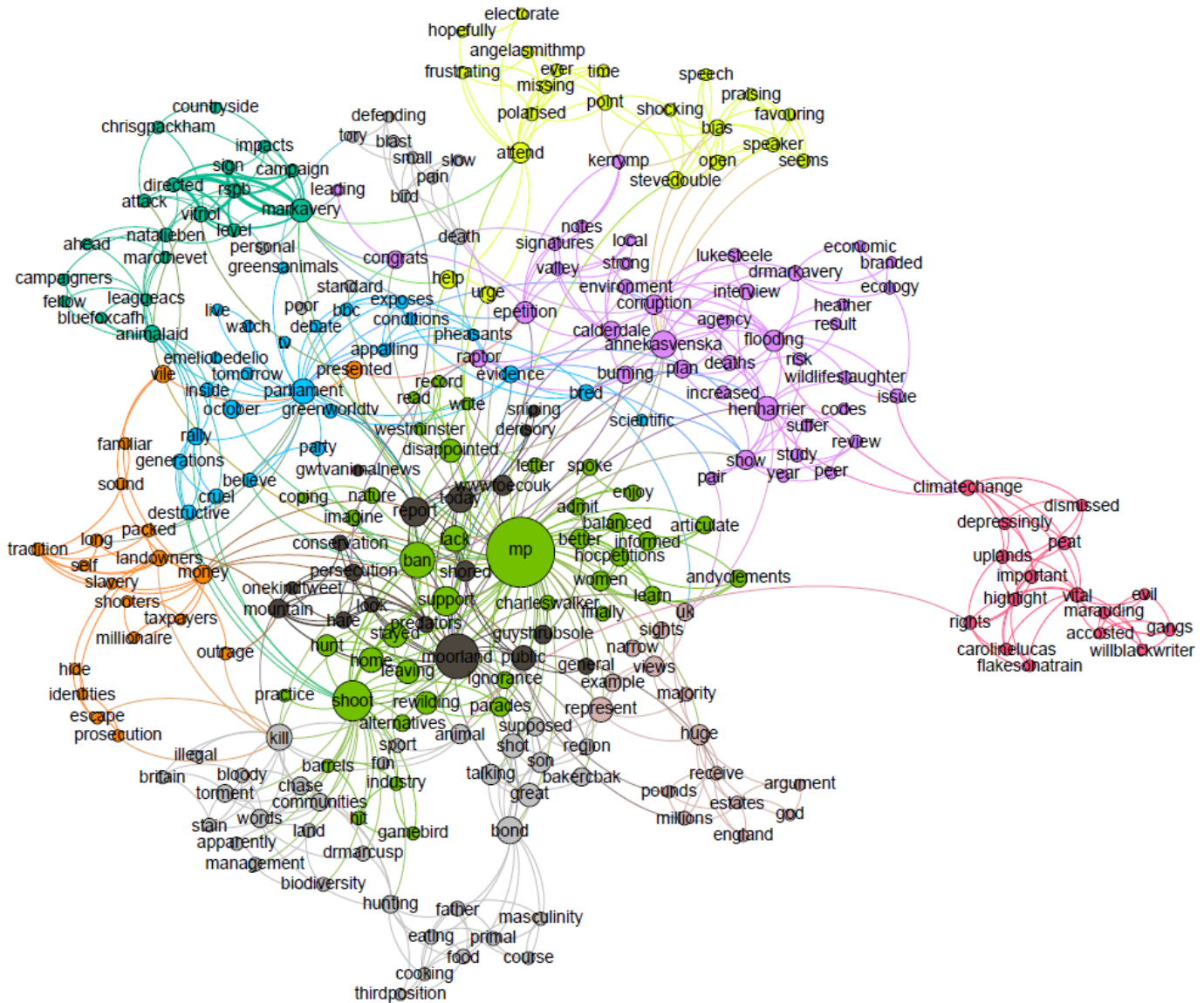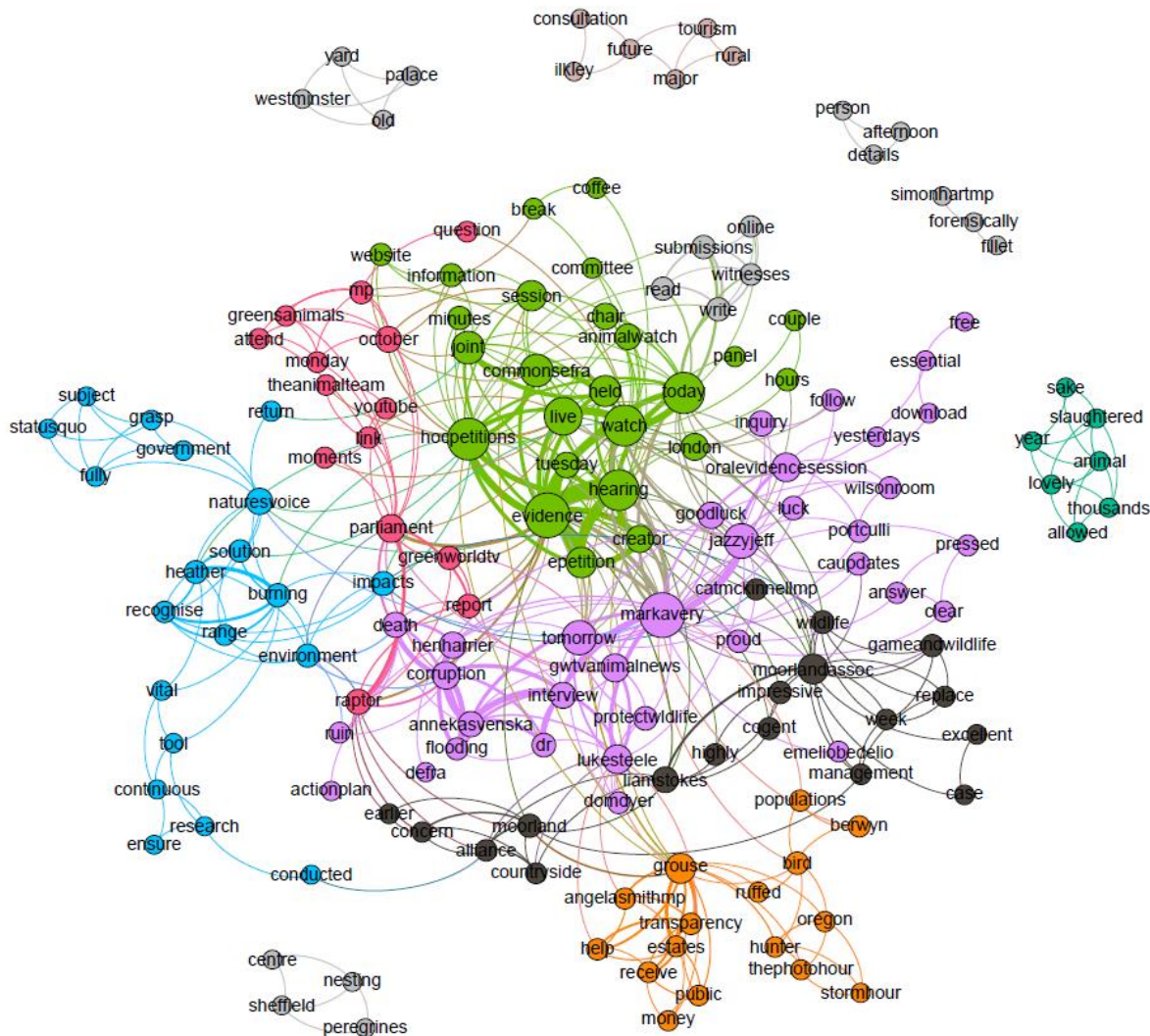
Figure 1: Semantic network based on tweets on the Banning Grouse Shooting e-petition Parliamentary Debate (31.10.16).

A semantic network was also constructed for the oral evidence session on the grouse shooting ban, which preceded the parliamentary debate. Figure 2 shows that this Twitter conversation remained more factual, less polarised and with little critique of the parliamentary process. Twitter was being used more as a tool to relay information and facts which were presented in parliament to a wider audience during the oral evidence session. It suggested, for instance, that more evidence is needed to fully assess the impact of grouse shooting. This shows up in the orange cluster in Figure 2, with calls for more transparency about who owns grouse moors and in the light blue cluster which suggests more information is needed about the impact of burning heather moorland on the

environment. The dark grey cluster, however, represents comments praising the quality of evidence presented by those in opposition to the ban. This cluster also contains the Twitter user names of various pro-hunting groups, such as moorlandassoc, gameandwildlife and the countryside alliance. This shows that despite this conversation seeming less polarised, both sides of the debate were still taking part. In addition to calls for more evidence, a couple of other clusters also express opinions on the issue. The dark green cluster relates to the idea that grouse shooting is inhumane because it involves killing other animals and the purple cluster mentions some other negative effects associated with grouse shooting, such as flooding and dead hen harriers.

Figure 2: Semantic network based on tweets on the Banning Grouse Shooting e-petition Oral Evidence Session (18/11/16).

Comparison of the two Twitter conversations in Figure 1 and Figure 2 suggests that, at least in this instance, the parliamentary debate may not be conducive to foster

engagement and build trust. There are clear differences in procedure between a parliamentary debate and an oral evidence session. An oral evidence session focuses more on the interrogation of evidence and facts by MPs through evidence given by witnesses. In the case of this petition, the witnesses were the petition creator, Dr Mark Avery, and a representative of RSPB (Royal Society for the Protection of Birds), followed by supporters of an opposing petition (representing the Countryside Alliance and the Moorland Association). A petition parliamentary debate, however, is a discussion amongst MPs alone. And given that a large number of conservative MPs, opponents of the ban on grouse shooting, attended this specific this petition's debate, the parliamentary debate quickly turned into a party politics debate; seeing the low numbers of MPs from the opposition who attended the debate, it soon became mainly a critique of the purpose of the main petition being discussed.[3] The semantic network analysis (Figure 1) suggest that members of the public felt this process did not take sufficient account of the views of the public and of the main petitioner, and that it granted unfair weight and bias towards specific groups perceived tend to hold political favour. This is not necessarily limited to this petition though, as we observed a similar dynamic for instance for the e-petition on "Give the Meningitis B vaccine to ALL children, not just newborn babies" (see Supplementary Information S2.2).

Comparison of the sentiment analysis for the two sets of Twitter conversations, alongside the sentiment analysis of the transcripts of the actual sessions (parliamentary debate and oral evidence session), is also instructive about perceptions of the process (see Figure 3). The majority of the sentiments expressed in the Twitter conversation on the parliamentary debate were negative. This is in stark contrast to the transcript content of the parliamentary debate itself which is far more positive. Moreover, whereas almost all of the negative words highlighted in the debate transcript are objective words related to the topic, such as "shoot" and "ban/banned", in the Twitter conversations the negative words are more emotive ones such as "frustrating", "appalling" and "ignorance". These negative emotive words are not found in the Twitter conversations on the oral evidence session either, where the language is more objective and negative words used related to descriptive terms of grouse shooting. In fact, in the case of the oral evidence session the Twitter conversation is actually more positive than the actual transcript of the evidence session.

One element worth exploring in future analysis is whether the live tweeting of sessions by the actual Committee may help reduce the polarisation of views also. Whilst Committee staff live-tweeting the oral evidence sessions, there is no reporting of petition debates. Live-tweeting a session enables the Committee staff to introduce a more neutral voice into discussions, something absent from the petition debates as these are not live tweeted; any comments made on Twitter are generated purely by the public. Although live tweeting may not have changed the public's reaction all together, it is worth considering whether this can also help generate more factually based conversations and less polarisation.
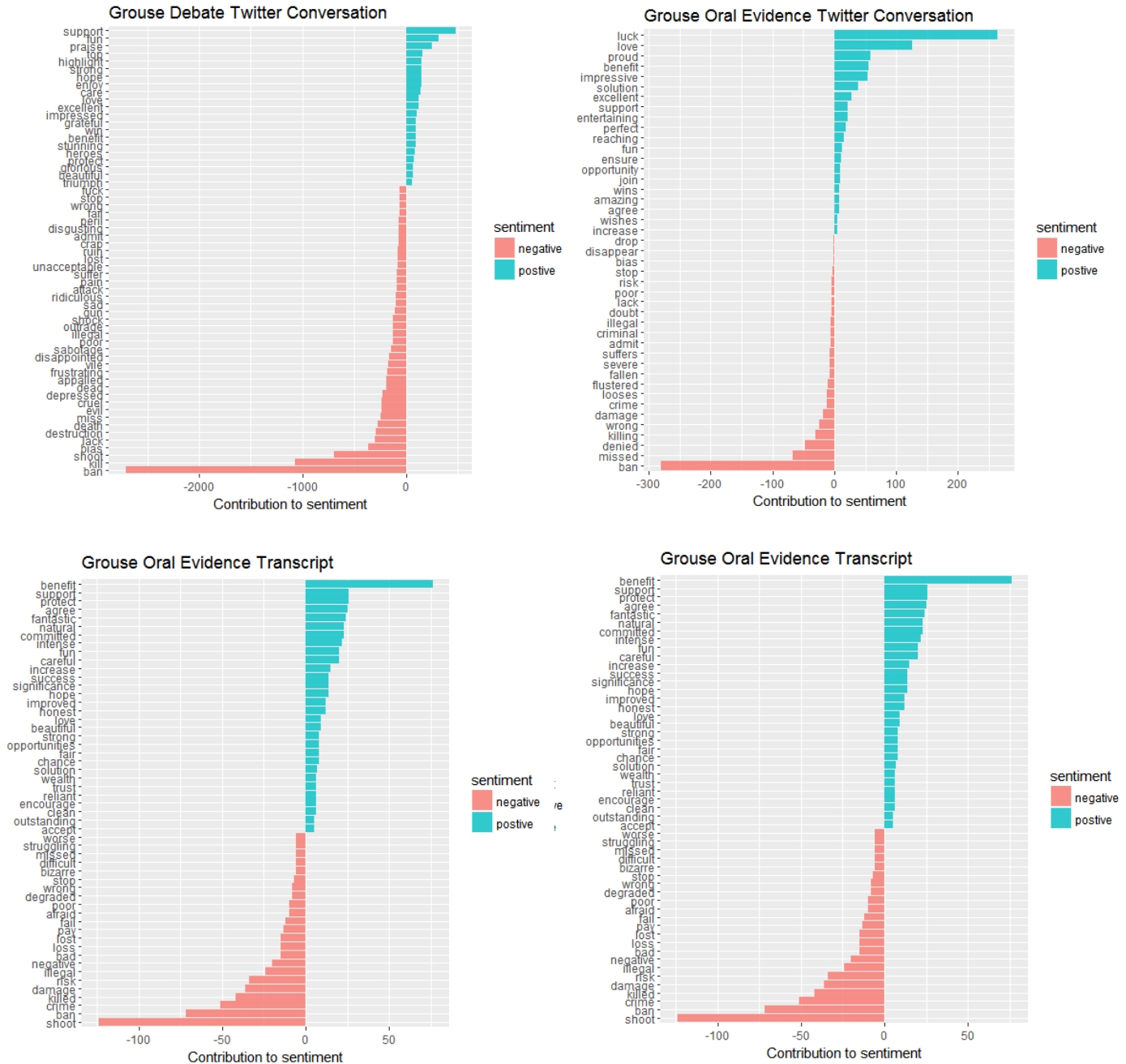
Figure 3: Sentiment analysis of the Twitter conversations on the grouse shooting parliamentary debate and oral evidence session (upper figures) and the transcript of the grouse shooting parliamentary debate oral evidence session (bottom figures)

Who gets involved?

Following up on the hope that e-petitions and their wider Twitter discussion could diversify the group of people engaging with Parliament, we also investigated who got involved in these discussions. We started by interrogating whether there is overlap in the users taking part in different e-petition Twitter discussions to understand whether people are getting involved in different Twitter conversations depending on what issues matter to them or whether certain figures are active across different Twitter conversations regardless of topic. Table 2 shows all users who took part in four or more Twitter conversations for those petitions debates between March and November 2016. Across all of these discussions, only 16 were repeat across several petitions; out of these, nine are users in some way affiliated with the House of Commons and for the remaining seven, the user descriptions offer little insight into the characteristics that may have encouraged them to take part in multiple debates. Overall, the vast majority of individuals getting involved in Twitter discussions are therefore only involved in the one e-petition that matters to them. When considering Twitter users who have taken part in only two or three debates, some more discernible trends emerge though. The most common combination was the grouse shooting debate, the grouse shooting oral evidence session and the dog meat trade debate, with 42 users taking part in all three of these conversations. Of those taking part in two Twitter conversations, the most common combinations were Twitter e-petition debates relating to wildlife and animal rights.

Table 2: Twitter users involved in several e-petition debates on Twitter

User	User Description	N	Debates
ParlyApp (PARLY)	PARLY is a journalism project that focuses on the UK Parliament and the Westminster village, created by @ayestotheright	13	#GrouseShooting OE & PD, #LGPS, #MENB OE & PD, #EBACC, #UKAidDebate, #NHSBursary, #HeelsAtWork, #FireworkDebate #BraintumouRresearch OE, LE & PD
UKParliament (UK Parliament)	Keeping an eye on government, debating laws, approving taxes. This official Twitter feed is produced by the Digital Service in Parliament.	12	#FireworkDebate, #LGPS, #EBACC, #HeelsAtWork, #UKAidDebate, #MENB OE & PD, #EURefDebate, #BraintumouRresearch OE & PD, #StudentLoanDebate, #EUReferendumLeaflet,
HelenJonesMP (Helen Jones MP)	@UKLabour MP for #Warrington North. Chair of the @HoCpetitions. Love gardening and theatre! Contact me at jonesh@parliament.uk, or call my office 01925 232 480.	10	#StudentLoanDebate, #EURefDebate, #BraintumouRresearch OE, LE & PD, #MENB OE, #LGPS, #GrouseShooting OE & PD, #HeelsAtWork
HoCPress (Commons Press Office)	Information, news and statements from the House of Commons Media Relations Team. For more, follow @HouseofCommons & @UKParliament	5	#HeelsAtWork, #BraintumouRresearch OE, #MENB PD, #UKAidDebate, #GrouseShooting OE
dwclark79 (David Clark)	Head of Education and Engagement at @UKParliament. Keep up to date by following @YourUkParl & @UkparlEducation	4	#StudentLoanDebate, #MENB OE & PD, #BraintumouRresearch OE
KateAHoP (deactivate)	Senior University Programme Officer Houses of Parliament universities @parliament.uk	4	#EBACC, #StudentLoanDebate, #MENB PD, #ExitingTheEUDebate

LucindaHoC (Lucinda HoC)	Here to help you get involved with the work of @HouseofCommons	4	#StudentLoanDebate, #MENB PD, #UKAidDebate, #EUReferendumLeaflet
LucindaMaer (Lucinda Maer)	Head of Parliament and Constitution Centre @commons library and North London mum. Retweets not endorsement	4	#EUReferendumLeaflet, #EURefDebate, #MENB PD, #ExitingTheEUDebate
AMWeerasinghe (Anikka Weerasinghe)	On brief hiatus from @HoCPress Democracy, good governance, media, comms & digital. Occasional foodie, frequent art lover. Usual disclaimer on views/RTs apply	4	#BraintumouRresearch OE, #MENB OE, #FireworkDebate, #HeelsAtWork
scarbro8 (Sandra Hanna)	na	5	#GrouseShooting OE & PD, #BraintumouRresearch OE, #EBACC, #UKAidDebate
Emmy_lla (Excellent, arabic)	My life is one part "wait" and another part "what".	4	#UKAidDebate, #FireworkDebate, #StudentLoanDebate, #EURefDebate
PeterRealf (Peter Realf)	na	4	#BraintumouRresearch OE, LE & PD, #UKAidDebate,
smiler1929 (deactivated)	please do not add me to any lists - all will be blocked sorry	4	#BraintumouRresearch OE, #MENB PD, #NHSBursary #UKAidDebate,
aeon456 (Vanessa Frost)	I have nothing to say to mainstream society except – leave me alone	4	#BraintumouRresearch OE, #MENB OE & PD, #EUReferendumLeaflet
Davrwu (David)	Made too many mistakes to be who I wanted to be. I am who I am, warts and all (not original I know). Never holiday with Jessica Fletcher. Tweets are optional.	4	#UKAidDebate, #JuniorDoctors OE, #NHSBursary, #GrouseShooting PD
mflack66 (Mark Flack)	upbeat and pessimistic	4	#JuniorDoctors OE, #UKAidDebate, #GrouseShooting OE & PD

Notes:
- **N:** Number of Twitter e-petition debates the user was involved in, **OE:** Oral Evidence Session, **PD:** Parliamentary Debate;
- The e-petition on Brain Tumour Research had one oral evidence session and report launch event (LE) that Twitter users could comment on as well;
- The Petitions Committee is naturally involved in all Twitter conversations, announcing the parliamentary debate and publicising the hashtag, we therefore did not include them in the table.

Focusing on our case study again, Figure 4 shows the social networks of Twitter users who tweeted during the parliamentary debate and Figure 5, for the oral evidence session. Both social networks (Figures 4 and 5) are based on retweets. The social network in Figure 5 appears less dense because the oral evidence session involved fewer Twitter users (761), compared with the Twitter conversations on the parliamentary debate (2,704). Both Figures show the most influential Twitter users (larger node size) and clusters based on retweets (colours). Figure 4 and 5 show that within these retweet communities there tends to be an influencer who is key in the discussion network and who dominates the conversation. It is also clear that many of the communities are not made up of individuals conversing amongst themselves, but rather they are comprised of a set of users who are all retweeting a common, influential individual. This is inevitable considering that 63% of users only tweeted once. Natalieben for instance (former leader of the Green Party), the most influential node in the green cluster in Figure 4, had the most popular tweet in the conversation which was retweeted 265 times, and she had two additional tweets retweeted over 50 times. The most influential users in the Twitter conversations on the parliamentary debate are also listed with their respective profile description and influence metrics in Table 3. The profile descriptions listed in Table 3 show that all of these

influential users are from the anti-grouse shooting side of the debate, mostly representing nature or animal activists.
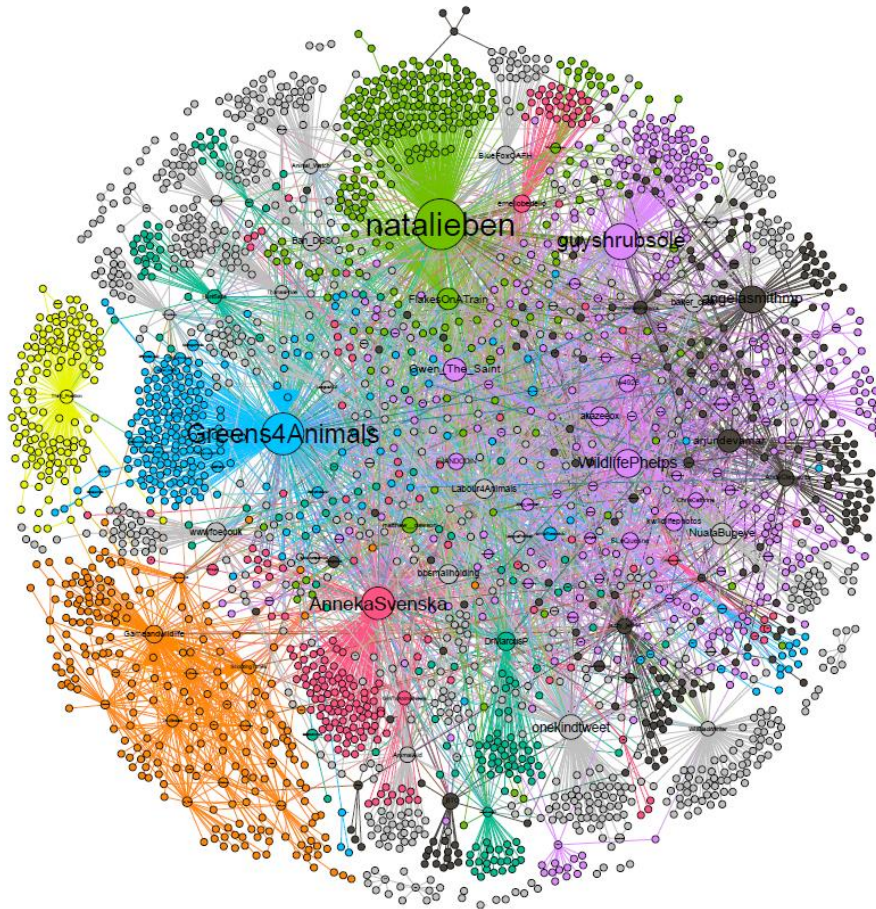

Figure 4: Social network for the Twitter conversation on the Banning Grouse Shooting parliamentary debate. Interactions based on retweets.

Table 3: Most influential users in the Twitter conversation on the Banning Grouse Shooting parliamentary debate, ordered by Eigenvector centrality

User	Profile Description	Indegree	Betweenness Centrality	Eigenvector Centrality
Natalieben (Natalie Bennett)	Former leader of @TheGreenParty of England and Wales. #VoteGreen2016 Follows aren't an endorsement	389	81,471	1.00
Greens4Animals (Greens4Animals)	Green Party 2015 General Election Manifesto for Animals https://t.co/1HHR31hMVB find us on facebook https://t.co/DKPmTWiRgN	328	92,814	0.90
AnnekaSvenska (Anneka Svenska)	Wildlife TV Presenter & Film Maker. Founder of Green World TV. Adore wolves! EXPLORER! Always say YES in life! All views my own @GWTVAnimalNews @angels4innocent	228	43,872	0.59
Labour4Animals (LAWS for Animals)	Support for the Labour Animal Welfare Society: Set up in 1992 LAWS believes humans have obligations	56	25,185	0.45

	toward animals. #Labour4Animals #LAWS4Animals #KeepTheBan			
jw4926 (Jo)	Mountain wanderer. Eco-zealot. No lists please - I will block. 'We can only be kept in the cages we refuse to see' RTs not necessarily endorsements ...	45	25,577	0.45
Guyshrubsole (Guy Shrubsole)	Campaigner at Friends of the Earth. I tweet about climate change, nature, coal, floods, land, politics. All views my own.	151	-	0.44
NualaBugeye (Nuala Bugeye)	Keeps laughing to keep (vaguely) sane. #stopthecull #keeptheban #cullthetories	89	36,454	0.41
Akazeeox (John E. Walsh)	Birder, Spider Lover, Wannabe Philanthropist, (Online!) Storm Chaser, Learning Technologist... These are my own views and not those of my employer, etc...	43	31,528	0.41
WildlifePhelps (Simon Phelps)	Conservationist, wildlife photographer, naturalist and writer based in the UK. @AFONature Committee Member. Views my own.	77	41,606	0.41
Owen_The_Saint (Owen)	I'm here to make the world a better place	38	19,409	0.40
Bird_Crime (No_More)	NA	13	6,781	0.38
Fittontom (Tom Fitton)	A lot of the conflict you have in your life exists simply because you're not living in alignment; you're not being true to yourself - @stevemaraboli #quote	1	149	0.34
baker_cbak (deactivated)	Science man. Amateur comic and footy player. Quite good at telling jokes, rubbish at football.	70	13,980	0.31
sperhabb (sperhabb)	NA	3	17,422	0.27
onekindtweet (OneKind)	Ending cruelty to Scotland's animals since 1911. Protecting our pets, wildlife & farm animals. Follow & help us end cruelty!	141	1,570	0.27
arjundevamar (Arjun Amar)	Senior Lecturer @ FitzPatrick Institute of African Ornithology @Fitztitute University of Cape Town. Interests in Ornithology, Ecology, Human-Wildlife Conflicts.	80	567	0.27
EJANDODIN (ALAN PETRIE)	NA	13	14,412	0.26
Angelasmithmp (Angela Smith)	Labour Member of Parliament for Penistone & Stocksbridge; Rolling Stones fan, Owls fan & keen walker.	90	1,617	0.26
DrMarcusP (Marcus Papadopoulos)	Publisher/Editor of Politics First; TV commentator and expert on Russia/USSR, Former Yugoslavia, Syria and British politics; animal rights guardian; vegan.	130	-	0.25
Carolinelufc (Caroline)	#sodden570 #sunburnt600	4	2,066	0.25

Close inspection of the social network in Figure 4 shows that the orange cluster in the bottom left contains many of the pro-grouse shooting Twitter users, such as GameandWildlife (a game conservation charity), ShootingTimes (shooting magazines) and LNJStokes (Countryside Alliance head of shooting) and at the middle of the yellow cluster slightly above it is Third Position (an alt-right news network). This cluster is not well connected to the rest of the social network. Although many of the users in this cluster come out near the top of the table for in-degrees (number of times they were retweeted) they do not come out as high for Eigenvector Centrality because the users they were being retweeted by were not being retweeted much themselves. That is, these users are not as influential as those listed in Table 3 because their messages are not retweeted by other influential Twitter users.
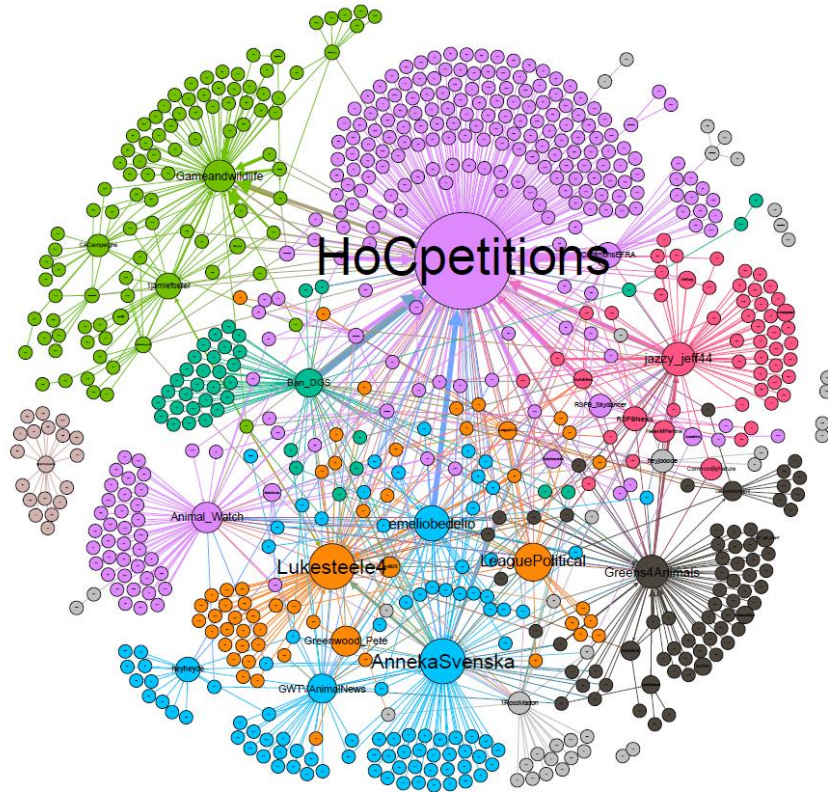
Figure 5: Social network for the Twitter conversation on the Banning Grouse Shooting oral evidence session. Interactions based on retweets.

In political Twitter discussions it is common for users to organise themselves into either two distinct, polarised crowds that do not interact and/or possessing discrete ideologies (Smith et al. 2014). The social networks in Figure 4 and Figure 5 based upon retweets show that this pattern is found here. In each of the communities displayed, in various colours, there is more interaction between members within the community, than with members outside of it.

We also found statistical evidence of homophily in the social networks, meaning that individuals preferentially interact with those who share similar opinions to them. As a result, the communities tend to be composed of individuals who are similar to each other. A simple measure of similarity was used here based purely upon whether two individuals were either both against or both in favour of grouse shooting. Of the 2,704 individuals who took part in the conversation on the parliamentary debate, 925 were identified by the Naïve Bayes Classifier to be anti-grouse shooting and 161 were identified as pro-grouse shooting. The profile descriptions of the remaining 1,618 users did not contain sufficient information to allow placing them into either of these camps. The Naïve Bayes Classifier had an accuracy of around 72%. For the purpose of this analysis, users with an unknown classification were excluded so as not to confound the results, and so only interactions between users where the classification for both was known were considered.

For these interactions there was a positive correlation of 0.57 between the classification of one user and the classification of the other, if the two interacted through retweets. A Quadratic Assignment Procedure (QAP) test was also carried out to test the significance of this result. The results of this found a correlation of 0.022 ($p < 0.01$), thus the correlation for our actual, empirical, network is significantly higher than the correlation distribution resulting from random permutations. This correlation is lower than that quoted above as because the QAP includes pairs of users where no interaction is present. We can therefore conclude that this Twitter network exhibits homophily, with both those users against grouse shooting and those in favour of it interacting preferentially with those of a similar opinion.

The same depth of analysis has not been carried out on the Twitter conversation around the grouse shooting oral evidence session; however a simple comparison of the nodes in the two networks reveals considerable overlap in the users present in the two conversations. Of the 761 individuals in the conversation on the oral evidence session, 468 also engaged in the conversation on the parliamentary debate. We also found 772 interaction pairs across both conversations, with 387 of these based on a mention and 366 on a retweet. The most retweeted, influential, users are also similar, with the bulk of them being anti-grouse shooting campaigners. Again, the top left of the network shows two clusters which are controlled by pro-grouse shooting groups, with little connectivity to the rest of the network.

Conclusion

Our paper shows that the analysis of Twitter conversations does help us better understand how the public engages with e-petitions and the way these are processed in parliament. Hale et al had demonstrated in 2013 that the analysis of the role played by social media in generating support for e-petitions is a powerful tool to better understand political online activism. Here we go a step further by showing that it also helps us better understand how the public reacts to the way Parliament deals with their e-petitions. This is important for a number of reasons. First, because processes affect the way the public perceives the value of presenting petitions (Carman, 2010). Secondly, because "more participation does not necessarily mean more democracy" (Wilson 1999, 258) and grounding our evaluation of the success of petitions merely on quantifiable indicators (number of signatures, number of tweets) fails to capture the key issue of whether it actually achieved its aim of deepening engagement. This brings us to the third reason why it matters: because the UK Parliament's new e-petitions system was introduced to "bring about a significant enhancement of the relationship between petitioning public and their elected representatives" (Procedure Committee, 2014, 31). This implies the development of a perception that the institution listens to the public's concerns expressed in a petition.

The new petitioning system is far clearer and transparent than the previous versions led by the Government. It offers clear routes and processes to deal with petitions, with most petitions obtaining over 100,000 signatures leading to a parliamentary debate. These debates are seen as the crème de la crème of the system – the highlight of petitioning

Parliament, to be able to obtain a parliamentary debate. But in many ways there has been little consideration as to what the debates actually do. Do they do justice to the petitions being discussed? Do petitioners and signatories feel represented in the discussions? Twitter discussions enables us to tap into real-time reactions from the public to how their petitions are being dealt with in parliament.

Our analysis is mainly focused on a case study, but our results suggest important findings. Overall they show that just because an e-petition has obtained a very high number of signatures, it does not mean that the public sustains strong engagement with the issue; those that do, tend to relate to more specific petitions. This is an indicator of different types of petitions, submitted for different purposes, performing different roles. In short, they divide between protest petitions and substantive petitions (Leston-Bandeira, 2017). Protest petitions tend to refer to ad-hoc events and aim mainly to make a point; substantive petitions refer to more specific issues that tend to refer to longer-term issues about which petitioners feel very strongly. Twitter engagement confirms that substantive petitions tend to lead to more sustained engagement from the public.

The in-depth analysis of our case study on the grouse shooting ban petition suggests two important findings to better understand the way the public may react to how petitions are dealt with in parliament. First of all, a well-attended parliamentary debate with plenty of participation from MPs does not necessarily equal an outcome well received by the public; the highlight of a process or not, it does not mean it is interpreted in that way by the interested public. The voices expressed in the debate and the extent to which these reflect the intentions submitted through the petition in question are far more important. Petition debates tend to be conducted as any other Westminster Hall debate. Our analysis suggests that they should perhaps reflect more their distinct nature which derives from the originating petitions.

Secondly, the public tends to reflect in a more polarised way to parliamentary debates than to oral evidence sessions. This will be of no surprise for those familiar with Westminster. Debates are conducted under long embedded traditions of adversarial politics. Oral evidence sessions, on the contrary, which take place in committee tend to be more of a consensual affair. The focus is on the witnesses and on their interrogation to establish facts and evidence. Our analysis of Twitter conversations confirms that the public react more negatively to parliamentary debates than to oral evidence sessions, on which discussions focus more on neutral and factual information.

Finally our analysis also shows that, at least in the case study we focused on here, Twitter discussions on e-petitions take place within closed social networks. Homophily predominates the Twitter discussions, meaning that these discussions do not necessarily lead to a widening of engagement. That instead the public converses with people who tend to think as them and there is little interaction between different communities. This would suggest that the promotion of Twitter discussions on e-petitions does not necessarily lead to enhanced engagement.

Our paper also demonstrates the value of big data analysis to understand modern tools such as e-petitions, as they enable us to observe public reactions in real-time. This is of

particular value seeing the popularity of social media to widen public engagement with Parliament. Whilst Parliament needs to be seen to utilise these tools to enhance its engagement methods, our paper shows that evaluation of how these tools are used and received by the public is key to be able to harness their potential for engagement.

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[1] The system is known as the UK Government and Parliament collaborative system. However we will refer to it as the UK Parliament's e-petitions system for ease of reference. To note also that this is in fact a House of Commons and Government collaborative system. It does not include the House of Lords.

[2] According to recent estimates around 19-23% of the UK population (45% of online adults) have a Twitter account, 65% of these are under 34 years old (http://www.rosemcgrory.co.uk/2017/01/03/uk-social-media-statistics-for-2017/, accessed 20/02/2017).

[3] The petition asking for a ban on grouse shooting was the one that led to the debate, having obtained more than 100,000 signatures. But, as often is the case, if there are other petitions on the same topic, the Petitions Committee also schedules these for the debate. In this case, the other petition favoured grouse shooting. It had gained just over 25,000 signatures by the time it closed.