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Exploring shale activism on Twitter using spatio-temporal Network Analysis.

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Summary

The spatio-temporal response of online communities towards shale gas development ('fracking') across the UK was explored using Twitter network analysis over 2019. For the first half of the year the debate was driven by a well-informed community based primarily in the North of England with a history of shale gas development. Changes in the political environment in the second half of the year, driven by the general election, saw the co-opting of the online debate, at the national scale, by three political communities clearly seeking to push their own political agendas.

KEYWORDS: Shale gas development, Spatio-temporal patterns, Network analysis, Twitter

1. Introduction

1.1. UK shale gas development

The US shale boom over the past two decades demonstrated that it was possible to exploit domestic shale reserves for huge profit and at the same time alleviate the reliance on foreign imports and provide improved energy security (Cooper et al., 2016). However, extraction of unconventional hydrocarbons using hydraulic fracturing has caused significant controversy, especially in the UK, as many argue the risks associated with extraction, principally induced seismicity, outweigh the economic benefits (Howarth et al., 2011; Inman, 2016; Lal et al., 2007; Thomas et al., 2017; Vidic et al., 2013). After nearly a decade of unsuccessful development, continued pressure on the government, eventually saw England follow in the footsteps of devolved governments resulting in a nationwide moratorium on the 2nd of November 2019 and perhaps signalling the end of shale gas in the UK altogether (Devine Wright et al, in press).

There are significant lessons to be learned from the so called 'shale fail' specifically in monitoring of public opinion to energy technology and building of trust at differing spatial scales in an attempt to avoid significant opposition and activism developing (Andersson-Hudson et al., 2016). This is timely particularly with emerging greener technologies having to fill the energy gap given the government's commitment to net zero by 2050 (Committee on Climate Change, 2019) .

1.2. Twitter network analysis

Social media played a significant role in the development the opposition shale gas movement within

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the UK (Cooper et al., 2016). It enabled the rapid establishment local and national groups and gave them a platform to voice ideas and disperse information and was critical in coordinating protests and marches. Tens of thousands of users have become involved in the shale gas debate with wider environmental, social, and political topics often embroiled. Twitter has the third largest user base (16.7 million users) in the UK and unlike most other platforms conveniently allows researchers to collect data on its users.

This study utilises a network analysis approach, utilising retweets and mentions, to investigate how different online communities engage with Twitter over the course of 2019 in response to different political, social and industry events (Doğu, 2020). Moreover, geolocation techniques and sentiment analysis were used to determine spatio-temporal patterns in public discourse.

2. Methods

1.3. Network construction

Over the course of 2019, tweets containing the key terms: ‘frack’, ‘hydraulic frac’ and ‘shale gas’, from the Twitter API with a timestamp and username. Accounts formed the nodes of the network and retweets (i.e. ‘RT @username’) and mentions (i.e. ‘@username’) were extracted from tweets text and used to build a directional network as forward and backward edges, respectively (Figure 1). Mentions were weighted proportionally to the number of mentions in a tweet (i.e. 4 @ in a tweet would equate to a weight of 0.25). Networks were built in igraph in R (Csardi and Nepusz, 2006).

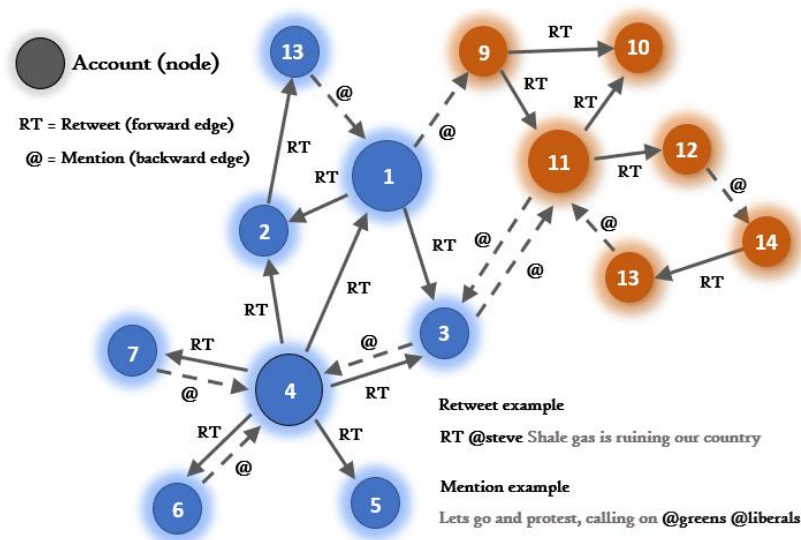


Figure 1. Schematic diagram directional Twitter Network

1.4. Network and text analysis

Each node was assigned a community based on the Walktrap clustering algorithm (Pons and Latapy, 2006) with communities with five or more users being retained. UK tweets were separated from tweets from other English-speaking countries by reviewing the twitter account information of the top 20 users. Tweets were given a sentiment score and hashtags (#) and URLs (https//*) were extracted for later analysis. Term Frequency – inverse Document Frequency (tf-idf) was performed on the largest communities to better understand discourse and motivations of communities over time (Robertson, 2004).

1.5. Placing UK users

As the majority of tweets were not geolocated, the Open Street Map geocoding API was used to extract geographic coordinates (Eugster and Schlesinger, 2013). Polygons were then retrieved using the reverse geocoding matched with their Open Street Map id. Weekly tweet response density maps were then plotted for the UK per community for 2019 using local authority level polygons normalised to the number people in the 18-40 age range (highest active group of twitter users).

3. Results and discussion

1.6. Characterising communities

Nineteen UK communities were identified by the clustering algorithm making up 37% of the English-speaking world. Within the UK, its worth noting that only anti shale gas groups were easily identifiable, suggesting large pro-shale groups have not been established on Twitter or have chose to avoid using it within the UK. Four of the largest communities (>2000 users), cumulatively making up 95% of all UK users, were analysed in greater detail using the hashtags, URLs and tf-idf and given names and descriptions (Table 1)

Table 1. Description of the four main communities within the UK shale gas debate.

Com.	Name	Description	Total users	Total tweets	Tweets user ⁻¹ month ⁻¹
1	Left of Centre	Labour and Corbyn supporters, environmentalists, anti-conservative government, anti-Liberal Democrat,	2.0E+4	2.2E+5	9.1E-1
4	Anti-shale gas activists	Shale gas informed, environmentalists, protestors, local groups, communities	8.5E+3	1.1E+5	1.0E+0
9	Anti-establishment	No real political affiliation, government sceptics, focussed on scandals and conspiracy theories	2.9E+3	1.4E+4	3.9E-1
10	Pro-Scottish independence	Scottish National Party supporters, pro Scottish independence, anti-Liberal Democrats	2.9E+3	2.4E+4	7.3E-1

The highest level of engagement is seen in the ‘Left of centre’ and ‘Anti-shale gas activists’ groups, given they have the highest number of total users, 2.0E+4 and 8.5E+3, and tend to tweet more often about shale gas. 9.1E-1 and 1.0E+0 tweets user⁻¹ month⁻¹, respectively. In comparison, the ‘Anti-establishment’ and ‘Pro-Scottish independence’ groups had significantly less engagement overall.

Interestingly, engagement changed over 2019 with the ‘Anti-shale gas activists’ group leading the debate in the first half of the year with topics directly related to shale gas such as ‘the Woodsetts enquiry’ and ‘the trial of 12 protesters’ in June and March, respectively (Figure 2A) and sentiment within this group is high suggesting support for these events (Figure 2C). Eigen centrality scores for this community are also high during this period making them central to the larger debate and in information dispersal across all groups (Figure 2B).

Key political events in the second half of the calendar, driven by the run up to the general election, sees a switching of ownership of the debate by the other 3 groups particularly the ‘Left of centre’ group (Figure 2A+B). For instance, Jo Swinson becoming Liberal Democrat leader and Jeremy Corbyn visiting the Preston New Road site in Lancashire (late July).



Figure 2. 2019 timeseries plots for the communities 1, 4, 9 and 10. A) Proportion of weekly tweets, B) Most influential group and C) Average sentiment over time.

1.7. Spatial-temporal distribution of community response

The ‘Anti-shale gas activists’ group typically had a much stronger response in the in the North of England in the first half of the year centred around event including the trails of fracking protesters, Tour de Yorkshire protests and the Woodsetts enquiry (Figure 3B). Engagement in the North within this community however fades in the second half of the year (D). Other groups have a more homogenous spatio-temporal twitter response for example the pro-Scottish independence group is almost exclusively based in Scotland and the Anti-government group has a greater membership in the South East of England. The largest of these groups (Table 1) ‘Left of centre’ group is reasonably homogeneous across the year except around the seismic events occurring at Preston New Road where there is noticeable increase in support in the North West of England (Figure 3C).

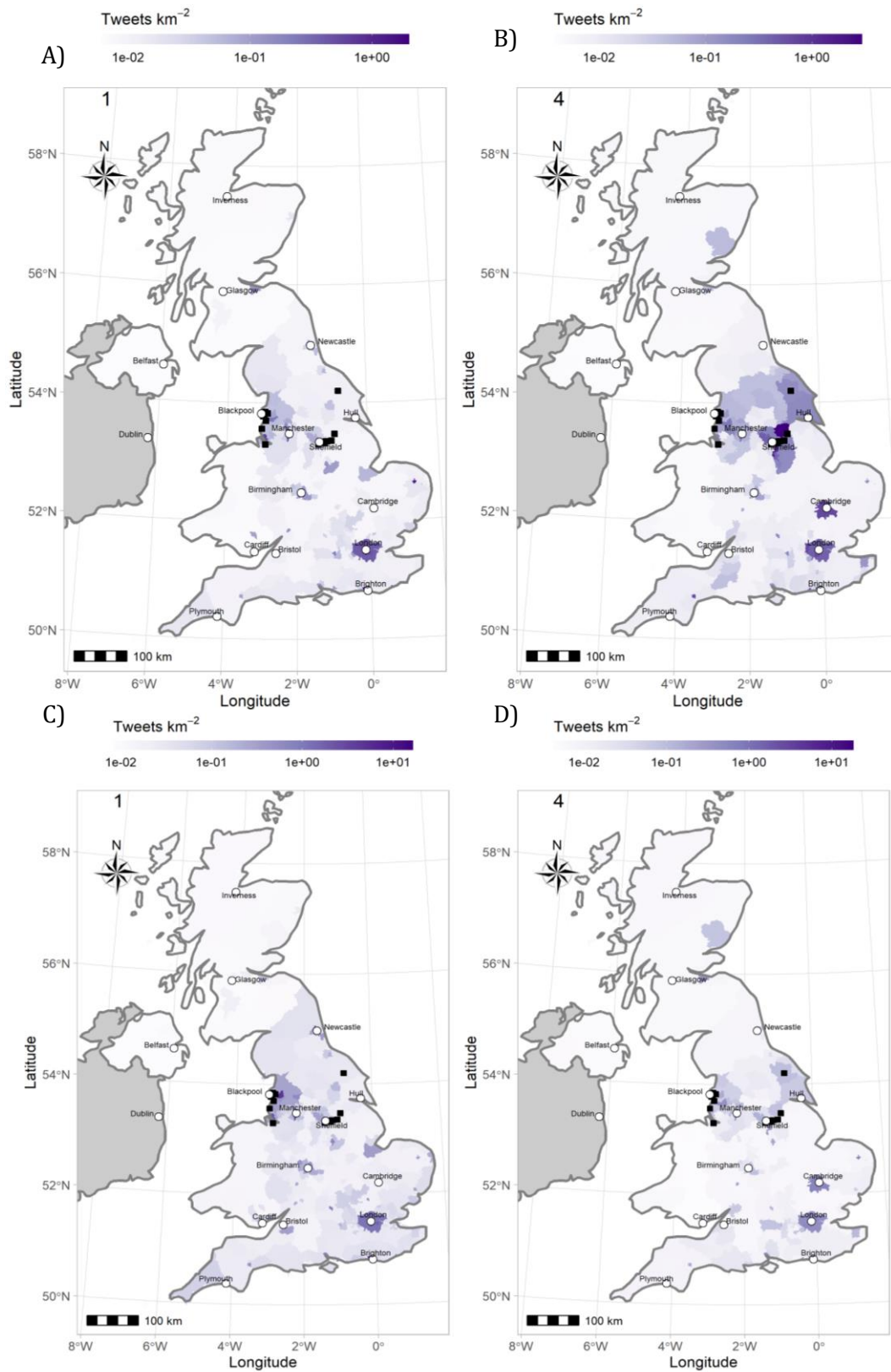


Figure 3. Spatial distributions of tweets for communities ‘Left of Centre’ (A + C) and Anti-shale gas activists (B + D) in March (A + B) and August (C + D)

4. Conclusions

Collectively, the evidence suggests a strong support in the North of England by anti-shale gas activists, who are well informed and closely follow industry and political developments associated with the shale gas industry. Engagement from this group falls off in the second half of the year as the shale gas debate becomes increasingly more political and as it is co-opted by the other groups and used in their own political narratives. After this point discourse also becomes more negative and the even occurrence of moratorium (2020-11-02) and general election (2020-12-12) do little to change the pattern in opinion suggesting twitter users overall were not convinced that political commitments would bring about real change in shale gas development.

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