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A very public cull – The anatomy of an online issue public

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ABSTRACT

Geographers and other social scientists have for some time been interested in how scientific and environmental controversies emerge and become public or collective issues. Social media are now key platforms through which these issues are publically raised and through which groups or publics can organise themselves. As media that generate data and traces of networking activity, these platforms also provide an opportunity for scholars to study the character and constitution of those groupings. In this paper we lay out a method for studying these 'issue publics': emergent groupings involved in publicising an issue. We focus on the controversy surrounding the state-sanctioned cull of wild badgers in England as a contested means of disease management in cattle. We analyse two overlapping groupings to demonstrate how online issue publics function in a variety of ways – from the 'echo chambers' of online sharing of information, to the marshalling of agreements on strategies for action, to more dialogic patterns of debate. We demonstrate the ways in which digital media platforms are themselves performative in the formation of issue publics and that, while this creates issues, we should not retreat into debates around the 'proper object' of research but rather engage with the productive complications of mapping social media data into knowledge (Whatmore, 2009). In turn, we argue that online issue publics are not homogeneous and that the lines of heterogeneity are neither simple or to be expected and merit study as a means to understand the suite of processes and novel contexts involved in the emergence of a public.

1. Introduction

This paper examines how issues are made public (Latour and Weibel, 2005) – how they are enacted and shared through infrastructures that form our contemporary digital milieu. We are interested in studying the processes through which controversies over scientific evidence and environmental values become issues around which people mobilise on social media and in particular on Twitter. Such mobilisations have become more accessible, it is argued (Bruns et al., 2013; Latour et al., 2012; Rogers, 2013), as social media platforms, such as Twitter, become key elements of public space. With albeit circumscribed access to the data generated in social media interactions, the swash and swirl of issue formation and 'publicisation' (making-public [s]) have become available today in ways that facilitate geographical researchers asking and answering research questions that were, perhaps, previously out of reach. Through a case study of Twitter debates around the English badger cull (specifically between 2013 and 14), the aim of this paper is to critically combine digital methods and social theoretical approaches for the study of issue publics, a term we use to describe emergent groupings involved in making an issue something that is publically contested. We argue digital media platforms themselves are performative, participating in the shaping of a public. Anchoring this argument, through empirical analysis of the case study, we demonstrate how an issue public can form in uneven and nuanced ways.

The contribution of this paper is twofold. First, we engage with and innovate methods for examining emerging online publics and contextualise them in social theory. Second, through a novel synthesis of methods and theory we demonstrate the heterogeneity and agonism of online practices in a case study: the public controversy of the English badger cull. Our analysis agrees with others (Marres, 2015; Marres and Moats, 2015) that publics are not of a piece. Forming publics involve work, the performance of authority just as much 'online' as 'offline' and that such delineation is not clear-cut. Whereas previous analyses either quantitatively chart network effects or conduct qualitative discourse analysis, our methodological contribution is to bring together both forms of analysis and theoretically contextualise the results. Thus we advance geographical analysis here by interrogating online publicisation by analysing and bringing into relief the fraught practices of publics in formation, recognising the performativity of digital media platforms, and theoretically contextualising them.

Building from empirical social media research on issue formation,

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we frame our discussion through a synthesis of four cross-disciplinary literatures concerning environmental controversies, the formation of publics around issues, digital activism and social media research methods. In the second section we survey the literatures that frame our investigation and through our synthesis of these debates we clarify our understanding of online publics in relation to the issue that forms the focus for the paper: the controversial culls of wild badgers in the English countryside. In the third section, we discuss research methods, outlining our data sources, and the steps we took to analyse public formation. We present our results in the fourth section, showing how the heterogeneity of online publics are revealed through investigations of liveliness, network roles and dynamics. To conclude we suggest that this and similar approaches to online publics can be used to provide informed understandings of public controversies. We argue it is crucial to understand both that digital media platforms themselves are performative, and participate in the shaping of a public. Furthermore, we argue that this epistemically situates issue 'publicisation' research differently, in novel and perhaps difficult, contexts.

2. Addressing online publics

To contextualise studies of the emergence of public science controversies through social media, in this section, we construct a synthesis of four areas of literature. We move on to discuss epistemological understandings of publics as such and argue towards practices for mapping knowledge polities that can neither be meaningfully labelled simply 'online' (and so potentially dismissed) or abstracted from the specificities of their context, in this example, Twitter. Through a reading together of the synthesis of literature and the onto-political approach to issue publics we introduce, in the final part of this section, the controversy of the culling of badgers in England.

2.1. Controversies, public issues and activism

Online controversies are prominent in contemporary news agendas. There is a small but growing literature, focused in Science and Technology Studies (STS), concerning controversy analysis with and on social media[1] (Marres, 2004, 2015; Marres and Moats, 2015) that tends to advocate the methodology as such and, we argue, needs situating in wider debates concerning scientific controversy, public issues politics, digital media activism and wider studies of social media practices. We bring together these debates in order to situate how and why online issue publics emerge and why it is important to study them.

First, literature on environmental controversies examines the 'scientification of politics' and the 'politicisation of science', as well as the rise of publics that can form around particular issues (Levidow et al., 2007). Social scientists have explored diverse environmental controversies including flooding, GM-Foods, climate change, invasive species and others where competing policy agendas shape research agenda, fuel contestation over evidence and shape public engagement (Venturini, 2009; Whatmore, 2009; Hulme and Mahony, 2010; Crowley et al., 2017). While this literature demonstrates that disagreements around controversial issues are inevitable they are also by no means intractable. Forms of evidence themselves gain contested agency, which we will show is exacerbated when they become 'shareable' online, and the means of conducting debates, such as a consultation or, in this paper, a social media platform, animate the ways publics convene.

Second, literature on the making of public issues offers conceptual tools for understanding both the formation of a public and the nature of those formations. In geography this includes the work of Barnett, Mahoney and others who use political theory and Foucauldian notions of problematization as a means to conceptualise the emergence of publics (Mahony et al., 2010; Barnett, 2014; Barnett and Mahony, 2016). Publics in this literature emerge in relation to inquiries that open up and problematize a situation, and problematization here refers to the set of practices through which the taken for granted, or the generally accepted, become opened up to contestation and truth claims. The latter tends to imply that in the process of publicising the issue, a public starts to emerge. Elsewhere Marres and others have developed a similarly disposed theoretical stance to argue for the entanglements of and attachments to other than human subjects and 'things' within these publics (Marres, 2005; Marres, 2007; Lezaun, 2011; Marres, 2012; Hinchliffe et al., 2014). We argue digital mediation affects the tempo of problematization, on the one hand, and, on the other, allows the interrogation of the entanglements of the participants in a public forum. By critically reading this together with scientific controversies debates and evolving understandings of digital media platforms we advance a novel synthesis for addressing issue publics in digital milieus.

Third, evolving literatures on online activism assist our investigations of how digital media are increasingly central to the constitution of 'politicised spaces' by considering the mediated culture of connectivity or 'platform sociality' (Hands, 2011; Kahn and Kellner, 2004; Van Dijck, 2013). Activists and campaigning organisations utilise these platforms to organise, to reach broader geographic audiences, as well as boosting who can generate authority (Tufekci, 2017; McLean, 2016; Weller et al., 2014; McCaughey and Ayers, 2013). Recent work on digital food activism, for example, addresses more-than-human agencies to investigate how digital devices and infrastructures mediate activism and generate activist assemblages (Schneider et al. 2017). Debates on the role of social media have developed from seeing the technology as simply emancipatory (see Christensen, 2011) to addressing the tension between platforms offering spaces for dissent while, at the same time, operating business plans contingent upon tracking their users (Beer, 2009) and actively interfering in the ways they receive information (Noble, 2018; Pariser, 2011). In this vein, Lezaun (2018:224) considers how 'the logic of [online] connective action' supports the possibilities of publics coming together to facilitate both informational advocacy and the data analytics of audience reached.' Thus, we argue debates on social media activism complicate the synthesis of research on environmental controversies and issue publics by bringing to bear understandings of the ambivalent nature of social media platforms as performative (political) agents themselves, as we will go on to discuss in Sections 2.2 and 3.

Finally, literature on social media practices, data availability and digital methods opens up new possibilities both for the formation of issue publics and their study (Marres, 2015; Marres and Rogers, 2005; Marres and Weltevrede, 2013; Rogers, 2013). In this we answer a growing number of calls within geography and sociology to develop methods that can engage with digitally mediated culture as a means to make sense of far more than 'online' culture (Ash et al., 2016; Leszczynski, 2017; Bruns, 2008; Elwood and Leszczynski, 2011; Crampton et al., 2013; Graham and Zook, 2013; Kinsley, 2014; Kitchin, 2014; Tinati et al., 2014; Rose, 2016). Key to our contribution in this regard is that this paper adapts and advances recent work using participatory web applications as a means to understand people's engagements with more than human natures through digital media (Büscher, 2016; Büscher et al., 2017; Lunstrum, 2017). However, our focus differs by elaborating upon methods for understanding emerging publics rather than theorising changing natures per se. We advance these forms of analysis by employing a combination of quantitative and qualitative methods and synthesised with a social theoretical approach, demonstrated in Section 3.

While the four elements of this synthesis are themselves by no means new, the synthesis we advance here is novel and a means of addressing the nuances of digitally-mediated issue publics. We argue that the critical synthesis of these debates offers an opportunity to interrogate the ways publics emerge, controversy is argued and authority is performed when combined with methods that allow for responsive

[1] We note that controversy analysis work on social media builds on earlier web-based methods (Marres and Rogers, 2000; Marres and Moats, 2015).

analysis to fast-moving events (further discussed in Section 3). However, this asks further questions about the ways in which publics are understood, which is what we turn to now.

2.2. Online publics

There are at least two caricatures of online publics present in popular discussion of social media. The first notion is that these online communities tend to be homogeneous and homophillic, aggregating around already pre-set dispositions. Platforms like Twitter, Facebook and so on, act, in this version of public debate, as echo chambers, self-selecting audiences who hear what they want to hear, perhaps through the programs of the platforms themselves—the so-called 'filter bubble' (Pariser, 2011). Second, there is a suggestion that in a 'post-truth' world, online publics contribute to a cacophony of claims, contestations and conflict. These versions of public debate, marked by homophilly and cacophony are not mutually exclusive of course, as they can both suggest a hopelessly fragmented social world.

An alternative, less apocalyptic, more nuanced reading of public formation stems from a social theory of ordering and organisation (see Law, 1994). In this version of the social, order is always in the making through what Law calls non-coherent assemblages of arguments, evidence, utterances and practices. So when Ruppert and colleagues observe, in relation to online and digital data sources, that "social knowledge is more visibly non-coherent than it was in the recent past" (Ruppert et al., 2013: 42), the invitation is to look for the processes through which ordering is being done. This ordering and the publics that emerge are likely to be heterogeneous rather than adhering to a blueprint. One aim of this paper is to interrogate these versions of publicness in relation to online practices.

These framings of publics present, in turn, alternative methodological strategies. The first, and by far the most common in current analyses of social media, is the controversy map whereby relations traced through social media enable the interrogation of affiliations and 'partisanship'. This is common in computational social science, for example, where inductive approaches to data subsume theory-led social analysis. For example, by virtue of a narrow set of statistical measures, Ipsos Mori's investigation of online public attitudes to science concerning the culling of badgers and other controversies suggested that scientists were more trusted than politicians and were seen as "uncontroversial authority figures online" (Ipsos Mori, 2014: 73). Marres and Rogers' (2005) term for this focus on affiliations is a 'Lippmannian device', with attention focusing "on tracing the organizational affiliations and language commitments of competing contributions/contributors to ground an evaluation of different 'positions' on the 'issue'" (Whatmore, 2009: 591). In our terms, and with an interest in the anatomy of a public controversy, such an approach, as the Ipsos Mori example attests, might simply trace out the variety of interested parties, demonstrating only the different communities or conversations rather than interrogating the liveliness or generative nature of the issue, and the ways in which networks make an issue public. It is in that sense a means of mapping the *extensive* spaces of chatter, but says little about the intensity or generativity of that chatter.

In contrast to this extensive mapping, there is a more onto-political approach, where the non-coherent processes of formation of concerned publics is at issue. For Whatmore, if a "Lippmannian device' was employed in the practice of mapping 'partisan science', this version might be thought of as employing a 'Deweyian device' in the practice of mapping knowledge polities" (Whatmore, 2009: 593). Here, it is not so much the pre-controversy affiliations of actors that are at issue, but the very issue through and by which they assemble. In short, it is the issue or 'what' of politics rather than the 'who' that is central. The organizing question becomes not so much one of adopting a 'demarcationist' approach (Marres, 2015) such as discerning an explanatory structure in a controversy (so grouping participants according to pre-established interests or affiliations). Rather, as Marres and Rogers put it, we are interested in "whether and how issue-networks organize publics" (Marres and Rogers, 2005: 925). Here, issue networks are defined as a heterogeneous set of entities (organisations, individuals, documents, slogans, imagery) that are organized around an issue.

In relation to this Deweyian approach, the affordance of social media offers obvious advantages: These digital issue-networks allow us to trace associations and processes of assemblage. Online media provide "a particular trace of a particular mode of issue-networking: a generally accessible informational trace of a network in the business of publicizing the issue, as well as the networks that have adopted it" (Marres and Rogers, 2005: 925–6). Following the networking activity through this data allows us to gauge their 'heat' (or the liveliness of any particular issue public), and their effectiveness in making something public (Marres and Weltevrede, 2013).

It has been our intention to navigate "through these datascapes with a monadological point of view, which can capture the richness of associations while remaining faithful to the complexity of agents" (Latour et al., 2012: 606). In this sense we adopt an approach familiar to those working in actor network theory (ANT) where the intention is to understand how actors and networks emerge together and make one another (Law, 2004). Within these networks, issues are articulated, contested and above all repeated or shared through infrastructures and devices that form the digital milieu. Of course such issues are often grounded in longer standing debates and it is to the wider context of our particular study that we now turn.

2.3. The culling of badgers in England

Our particular case of a public controversy is the decision to allow trial culls of wildlife (badgers) in the English countryside as a means to control disease in cattle. While it is generally accepted that badgers can act as a reservoir host for bovine tuberculosis, the decision to cull badgers was culturally controversial as well as scientifically contested. Against a background of often class-based urban and rural tensions surrounding fox hunting (Woods, 1998), badgers inhabit a significant place in British popular culture, especially for a highly urbanised society with little direct contact with wild animals (Cassidy, 2012). In terms of the knowledge controversy, the cull has been beset by public disagreements over the use of evidence for and efficacy of a cull (Godfray et al., 2013). For example, an independent review of the 10 year long randomised control cull trials that had taken place in the 1990s concluded, "that badger culling cannot meaningfully contribute to the future control of cattle TB in Britain" (Independent Scientific Group on Cattle TB, 2007: 14). So the decision of the incoming Conservative-led coalition government to pursue culling in 2012 in Somerset and Gloucester, and to extend this to Dorset after the election in 2015, was controversial. This was particularly so as the same scientific evidence was used to authorise a different approach of cattle-led measures and badger vaccination in neighbouring Wales. The ways in which science was mobilised in public debate and decision-making was as a result open to problematization. The pilot culls generated considerable activity including public rallies, marches and petitions, along with attempts to disrupt shooting and produce evidence of sometimes poorly managed cull practices. Conventional broadcast media covered much of the debate, although many of the parties involved were often frustrated that their side of the story was rarely properly represented.

Importantly, interleaved with all of this activity was a considerable use of social media, notably, at the time, Twitter and Facebook. As in many other issue publics, social media provided a means to circulate evidence and information, establish contacts and monitor other media (Lotan et al., 2011; McLean, 2016; Kahn and Kellner, 2004). In other words, social media enabled a form of associative politics through which concerned publics could assemble, contribute and listen to a controversy. Of particular interest to us here are the ways in which online platforms can be used as spaces for debate on the science underpinning a controversy. Indeed, platforms themselves have

performative agency in the emergence of issue publics like those associated with the English badger cull by virtue of the 'grammars of action' (Rieder, 2013) of hashtags and other connective features of social media (explored in Section 3). As we show (see Sections 3 and 4), through these parameters of connectivity different forms of authority are simultaneously performed and open to questioning and study.

To study a controversy on and through social media, we argue, it is necessary to negotiate a series of interlinked, interdisciplinary debates concerning the nature of scientific controversies, problematization in public, mediated practices of dissent and digital methods. We argue this synthesis renders insufficient the precautionary 'demarcationist' (Marres, 2015) approach to tracing networks through data. Instead, we argue for a Deweyian attention to the specificities of the liveliness of the emerging issue publics concerned with the English badger cull, necessarily accepting and not dismissing the performative agency of the social media platform. In the next section we discuss our methodological approach for achieving that aim.

3. Investigating the controversy: approach and methods

In gauging online issue publics, an initial decision surrounds the choice of platforms that offer access to network formation. While not necessarily the most important digital platform, Twitter offers straightforward, if limited, access to user activity data. It is also a platform that has been popular for investigations of broadly defined 'political' actions (Weller et al., 2014; Tinati et al., 2014; Bruns and Liang, 2012). Twitter activity is based around users posting, sharing and forwarding messages (tweets), and employing searchable devices within the concourse of tweets in order to follow users and/ or conversations (flagged with a particular hashtag). Researchers can generate a dataset from this broad activity in order to analyse activity, content and other features, often by using particular search terms that act as a sampling frame for tweets.

Datasets are frequently generated through direct access to the Twitter APIs (Application Programme Interface), which requires knowledge of programming languages in order to collect the desired sample of data. An attractive alternative for many social scientists has been to generate data via a third party service –in our case we used a site called Scraperwiki[2] – a platform enabling access to Twitter's limited sample of tweets through the streaming API via chosen search queries. As has been the case with a number of third party services that enabled free access of this kind, this particular route to scraping Twitter data is no longer available. However academic-led research projects such as COSMOS are enabling limited third party access to Twitter data for social scientists without coding skills (Burnap et al., 2014).

Twitter activity is structured by the use of a number of conversational protocols. Tweets can contain components that form 'grammars of action' (Rieder, 2013): *@mentions* that indicate a response to or provocation of another user or users, *hashtags* that are user-generated categories preceded by a # to mark searchable conversations and *retweets* where information is shared from one user to others. Generating a dataset of Twitter activity usually includes these elements along with other contextual or metadata that are attached to each tweet, including a time stamp and user identifier. However this activity is itself shaped by platform functionality and the socio-political atmospheres surrounding platform evolution and public discourse, including specific media published elsewhere and shared on social media. We argue that, rather than see the agency of the platform either simply as 'bias'—which is a methodological problem to be solved—or as peculiarities of a specific platform-seen to in some way undermine its study—we should treat platforms as performative actors in the emergence of publics. We are thus pursuing what Marres (2015: 665) calls an 'affirmative' approach to 'online bias' which acknowledges 'the ambiguity of digital devices'. In this section we now lay out our approach in more detail before presenting some of the key results from that method.

3.1. Data handling and analysis

Query terms submitted to a platform's API dictate the depth and breadth of a dataset. The dataset in this study was constrained by narrow search terms employed, as we sought tweets in which either or both the conversation markers '#badgercull' and '#tbfree' were used. Clearly search terms and sampling, as for any other method, seek to balance data handling capacity with representation. Hashtags were chosen after scoping the most current and well-used conversation keywords. While this narrowed the dataset generated, the sample itself, contained numerous inter-platform and 'off-hashtag' interactions that were picked out and followed up through rigorous analysis. The generated data required checking and refining via a standardised data preparation approach.[3]

Our investigations focused on interrogating temporal and spatial patterns within the data. Initially, temporal patterns were graphed to display the volumes of tweets over time. Exploring peaks, troughs and volumes of tweets gave a sense of the liveliness of a dataset or issue. Relational analysis involved generating networks that effectively map an issue in terms of the initiators of a post (originator), any user mentions that they included in that post and any re-tweets. These relations between data points or users were then mapped with the distance between nodes (or users) a function of the frequency of connections between those nodes (so if two users refer to one another repeatedly, they will tend to cluster together in the spatial map). Given the size of the data sets this mapping is achieved using a set of statistical visualisation techniques (within a graphical software called Gephi[4]) that lay out the data in such a way that the distance between nodes and the overall graph is as efficient as possible.

Laying out the network in this way allows for calculation of simple network statistics: *Connectedness* for example is a measure of the volume of links between any one node and others (a highly connected node will normally represent a frequently followed, or shared user). *Betweenness Centrality* is a measure of the influence of any node on the network, so "an actor is 'highly between' if there is a high probability that other actors must pass through him [sic] to reach each other" (Rogers, 2013: 27). A node that accumulates a higher score will be more central or essential to that network. Finally, we can estimate the degree of clustering within the network and discern any sub-graph areas or regions within a network.

Producing temporal graphs and social network analysis visualisations offers initial overviews of a dataset and highlight areas for deeper analysis. Measurements of the most active users and the most frequently cited posts brought to the fore key actors and activities for further investigation. Focusing on the retweets of the most significant users[5] enabled us to identify not only *who* became significant out of users of these hashtags, but also *what* matters were being shared most frequently or intensively. This approach produced a sample of tweets arranged by significance in terms of users and topics and formed the basis for further analysis. Content analysis of these network actants was carried out via storyboarding, a technique that involves identifying and assembling the top 3 tweets for each day ordered by their retweet

[2] Scraperwiki (2015) – available at – https://scraperwiki.com/ accessed 24/11/15.

[3] We used the open-source software Open Refine: http://openrefine.org/ accessed 26/4/16.

[4] Gephi is an open-source platform that contains statistical physics algorithms that layout graphs to explore relational network dynamics within datasets. Based on social network analysis these graphs display users ranked by degrees of connection, by centrality or by community clusters, enabling a quick visual grasp of large networks.

[5] The most retweeted tweets of the top 20 users ('screen users'), the top 20 most retweeted users, the top 20 most mentioned as well as the top 20 retweeted tweets were collated.

count. These tweets can then be arranged chronologically to present a narrative line of key topics and shared information (see Rogers, 2013).

Focusing on emerging significant users allowed us to go beyond initial patterns and follow threads extending beyond the initial search terms. Thus, we do not settle on what we call (after Whatmore, 2009) the 'Lippmannian device' of merely tracing connections and institutional affiliations or straightforward homophily in groups – what Marres (2015) refers to as a 'demarcationist approach'. Rather, we advance and develop here a Deweyian approach— or 'empiricist implementation of controversy analysis' after Marres, 2015: 662)—to examine the liveliness of the heterogeneous set of entities that make up an issue public. Our modest methodological innovation, in contrast to solely 'big' data-led network analysis or 'small' data-led discourse analysis is to combine methods to capture the 'big picture' of issue publics but also to 'zoom in' on details that speak to the liveliness and nuance of controversy in-practice. We therefore distil data collections, identify significant moments in the network that may fall outside of temporal spikes as well as detect not only the 'who' and 'when' of an issue public, but also the 'what' and 'how' of network or public formation. The anonymised quotes used here from our data were sampled and selected through these means[6]. In the next section, through the methodology outlined above, we move on to discuss the empirical detail of the issue publics we have identified.

4. Results: Representing platformed issue publics

Issue publics such as those emerging around the English badger cull both make possible forms of connectivity by virtue of the practices of connection, contestation and mediation undertaken by the participants and are also themselves made possible by the 'grammars of action' (Rieder, 2013) of the network platform. In this section we discuss three stages of analysis of such 'platformed' issue publics. First, we diagnose the when, who and what of these formations by interrogating those grammars of action, recognising this as groundwork that, in itself, is analytically insufficient. Thus, second, we make our first Deweyian shift in analysis in order to interrogate the dynamics of authority within these emergent issue publics. Third, we analyse key exchanges, key actants and sub-groups in order to reveal that issue publics emerge through a variety of modes of speech and activity. We argue that the issue publics emerging around the English badger cull have a heterogeneity and contextual specificity that is resistant to easy categorisation.

4.1. Understanding the 'When, Who and What' of the network

The development of analytical steps for diagramming and describing key attributes of the datasets enabled the detection of spikes in an issue public (the When), the formation of key network nodes, (the Who) and the predominant means by which activity is expressed within (and is specific to) the network i.e. retweets, @mentions, sharing URLs etc. that form the 'What' of the network. Time-series graphs of #badgercull and #tbfree datasets provided a first view of the temporal patterns of activity within these two issue publics. In broad terms the time graphs showed the ebb and flow of posts within this conversation, as well as the number of posts that mention other users and those that are re-tweets. So, for example, for the #badgercull dataset (see Fig. 1) tweet and retweet activity form a significant spike on 8th October 2013, with a total of 1283 tweets. The spike was coincident with the announcement of a forthcoming report into the cull after the first cull phase ended. 1141 of the posts were retweets and 668 contained mentions. Activity after this spike continued at modest levels before engagement resumed from mid May to early July 2014. At this time there was increasing debate about whether the cull would be extended geographically. The level of retweet activity remained high throughout indicating a network driven by sharing and the generation of a collective knowledge base and identity. A prominent contributor, for example, had this to say and was shared over 100 times (Fig. 2) on the peak day of activity.

This admonition to keep things rational not only seeks to perform a collective identity but also of course reflects a self-conscious reflection of the public nature of the online activity.

In #tbfree (see Fig. 3), a much smaller data set, there was also a degree of 'spikeyness' to the data. Larger spikes occur in spring 2014 when the government released a report on the future for bTB management and when a blog by a farmer who lost his prize bull to bTB was widely shared. On the peak of 3rd April 2014, 197 tweets were posted, of which 165 were retweets and 51 were mentions. Activity on this day was concerned with the statement from the then Secretary of State for Environment Owen Paterson in Parliament on proposals for future control of bTB and Defra's release of figures relating to cattle slaughtered due to bTB.

The most retweeted post on the peak day of 3rd April mentioned Defra and shared their infographic on numbers of cattle slaughtered (see Fig. 4).

Beyond these spikes in activity, we can also start to mark some possible differences between datasets. For example, one noticeable difference is the relative number of mentions, or the ratio between number of tweets and mentions. Throughout December 2013 and January 2014 in the #TBfree dataset, the number of mentions exceeds the number of tweets posted per day. This means that tweeters are tending to mention two or more other users within their tweets. In contrast, within the #Badgercull dataset this rarely happens. This suggests to us a possible difference between these issue publics. While #TBfree had dialogic tendencies (with lots of mentions and reciprocation, and a building or securing of community), #Badgercull was relatively monologic. These early indications suggested that posts were less reciprocal, more about announcing issues, sharing information, making claims and campaigning. From these measures #TBfree was more about conversation and exchange of information.

As an example, news issues tended to spark dialogue and debate within #TBfree. So the news in November 2013 that the Gloucester pilot cull was to end early became a focus for debate. When participants questioned the reasons for early termination, key users including @DefraGovUK and @NFUPolitical reiterated the expert-led and scientific rather than political rationale for the decision (see Fig. 5).

These initial descriptions of the data, its liveliness and early indications of the kinds of exchanges going on (with tendencies towards dialogic and mono-logic speech acts), backed up by some of the content we have taken from our storyboards, demonstrate the internal agonisms of online issue publics. This analysis agrees with others (such as: Bruns et al., 2013; Lezaun, 2018) that publics are not all of a piece. As argued above, previous work has often settled with articulating broad differences. Thus we argue this can only be a starting point– there are clearly details in these differences to be explored. In the next section we take this further to analyse the who and what of conversations by exploring the relational spaces of issue publics.

4.2. Identifying online roles: Authorities, community amplifiers and agitators

Issue publics gather over matters of contention and debate, and as such tend to assemble around key sources of information. In this, the production or performance of various roles become key, and analytical techniques can generate interesting insights into their relative

[6] Ethical issues relating to working with publically available posts were considered throughout the research process. All quotes used here are anonymised and stripped of searchable terms unless they were from a public body under discussion, such as Defra. Coding of graphs ensured all users except for public figures or public bodies remained general and non-identifiable (see Woodfield et al., 2013; Townsend and Wallace, 2016).

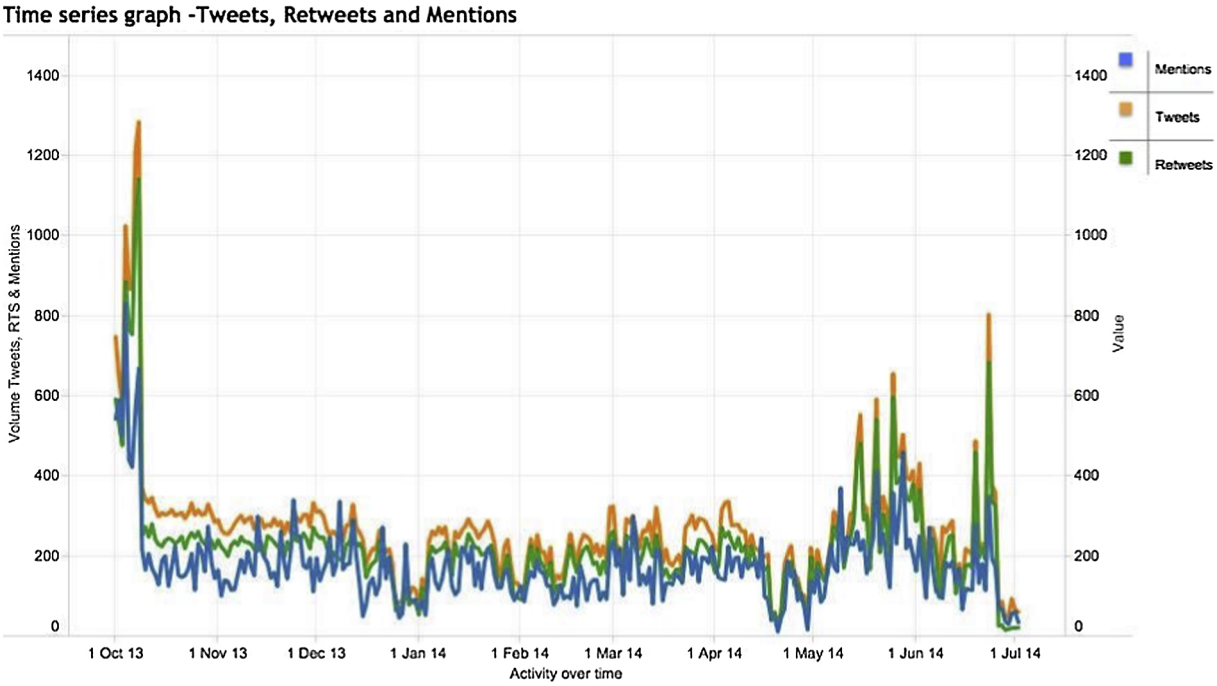

Fig. 1. #badgercull volumes of tweets, retweets and @mentions per day from 01.10.13 to 01.08.14.

Dear all. Please keep up the rational, science based opposition to the #badgercull particularly in light of the cabinet reshuffle.

Fig. 2. Top retweet #badgercull 08/10/2013 re-tweeted 104 times.

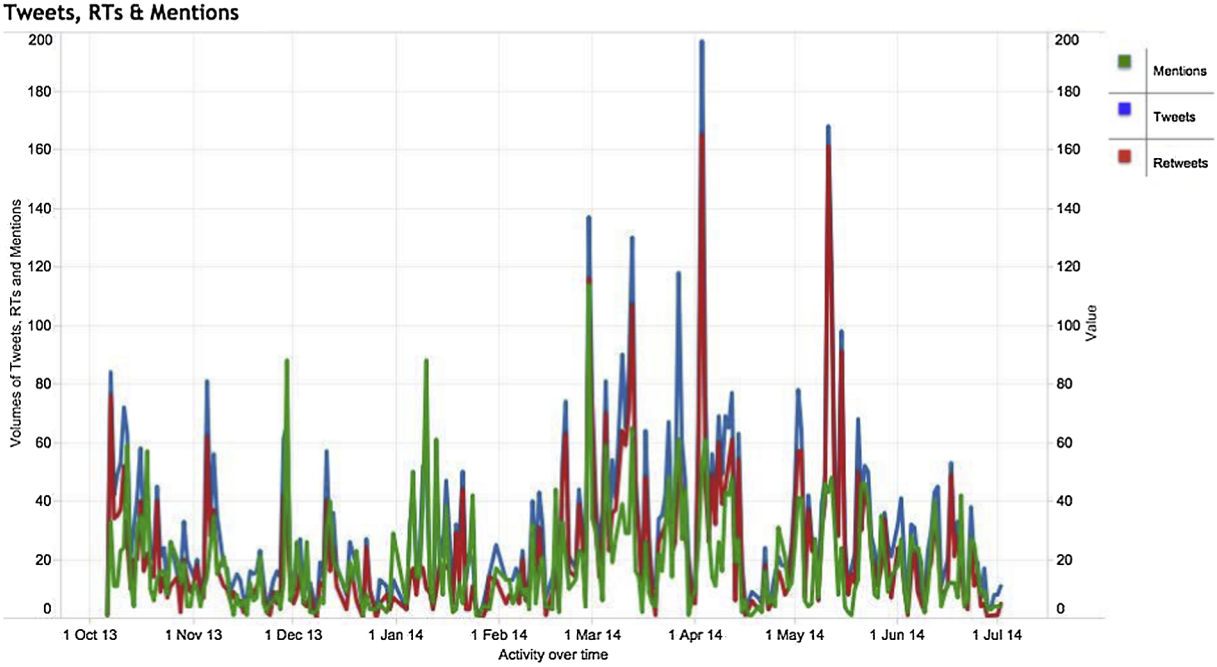

Fig. 3. #tbfree volumes of tweets, retweets and @mentions per day, from 01.10.13 to 01.08.14.

RT @DefraGovUK: 32,620 cattle were slaughtered last year due to bovine TB - that's almost 90 per day #TBFree http://t.co/BimA5sVIeI

Fig. 4. Top retweet #tbfree 03/04/2014–43 times.

RT @DefraGovUK: @** The decision was made jointly by cull companies and @NaturalEngland - licence wasn't revoked. #TBFree

Fig. 5. #tbfree Example RT of @DefraGovUK responding to concerns 29/11/13 (@** are anonymised users).

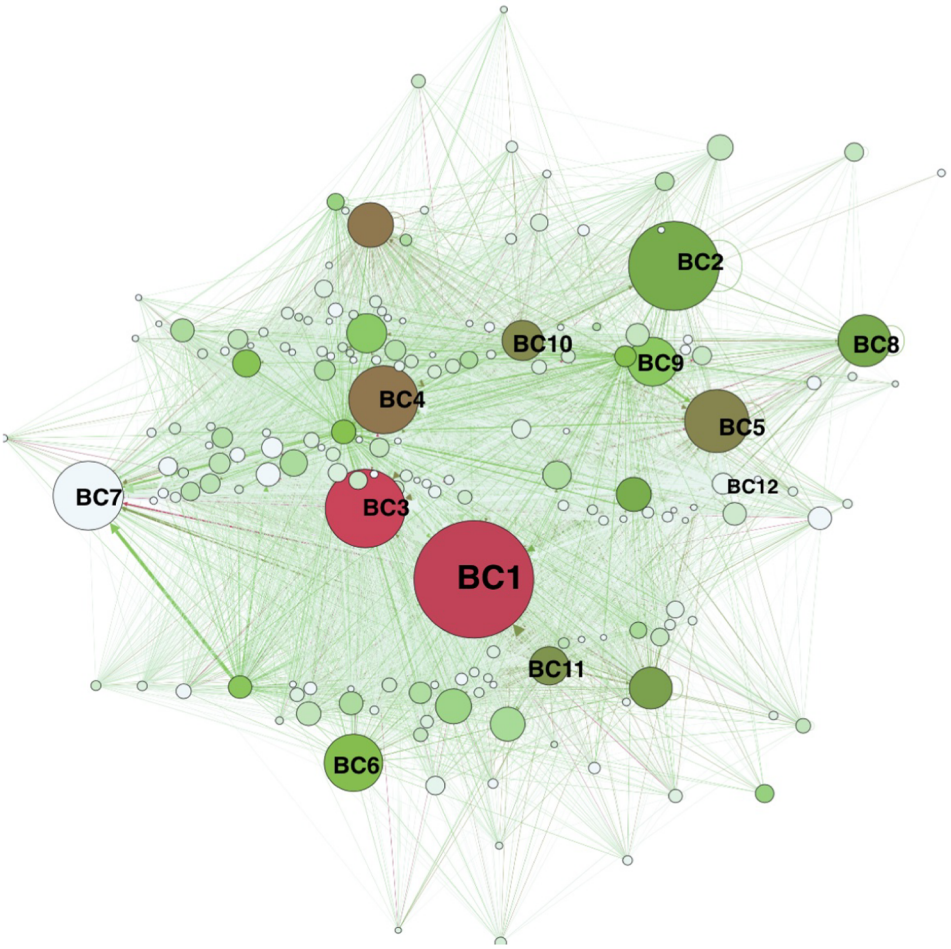

Fig. 6. #badgercull Gephi Visualisation – Colour-Betweenness Centrality, Size-Degree.

importance and styles in public formation. Here we investigate various measures and performances of authority, the importance of different roles in building a network and the role of agitators.

In terms of our issue, the scientific rationale for the chosen disease management strategy had been hotly contested. Ipsos Mori's investigation of online public attitudes to science concluded that scientists were more highly trusted than politicians and were seen as "uncontroversial authority figures online" (Ipsos Mori, 2014: 73). However this approach did not investigate the role of different scientists (often on different sides of the debate), or of non-scientists as users or sharers of scientific and other knowledge online. Online platforms are also spaces where new sources of authority are generated. Celebrity figures, high profile bloggers and activists can emerge, be shared and validated (as well as trolled) through platform activity. In #tbfree and #badgercull the detection of authorities within the network was undertaken through data visualisation, database investigations and content analysis. As we show, and contrary to the Ipsos Mori findings, the highly connected and central users were not necessarily scientists or policy advisers, as unconventional authorities emerged through network activity. We argue that this is in part a consequence of the performative agency of the platform, Twitter, itself – hashtags in particular facilitate alternative performances of discursive authority.

In order to start to identify the various roles within a network, the laid out data was formatted such that node size was proportional to connectivity (or degree). We then used a coloured scale to represent the betweenness centrality of the nodes (their importance to the network or sub-network within which they were located). Red colours denote the highest betweenness centrality score, moving to a brown, pale green and white as the lowest scores (see for example Figs. 6 and 13). We coded the anonymised nodes numerically for ease of reference[7] (see Appendix A for more information on the users).

It is important to remember that the #badgercull dataset comprised 73,510 tweets over a period of 10 months. To feature as a significant node, users had to be highly active throughout and highly connected in order to gain visibility (this implies of course that temporal framing or sampling is significant – short-lived nodes will not be picked up in an analysis that focuses on network features across a lengthy time period. This effect can be offset to some extent by taking the multi-faceted approach that we are describing here). The initial utility of this figure can be gleaned by comparing the three largest nodes (BC1-3) in the #Badgercull network. BC1 was the most active and central in the network. This user represented anti-cull activists who shared original information from the ground or sites of cull activity. This included culling

[7] Each graphic visualisation is coded by their size, colour and network e.g. BC1 denotes –Large Badgercull Red 1 i.e. the largest red node. See Appendix A for The Coding of Usernames in #badgercull and #tbfree

"Brian May calls for resignation of Environment Secretary Owen Paterson over pilot #badgercull http://"

Fig. 7. #badgercull BC3's top retweet 22/10/2013 retweeted 74 times (This tweet quotes material from a mainstream media article and so names have been left in. URLs have been anonymised following the ethical principles discussed above.)

"Killing badgers to combat bTB is ineffective. Gassing badgers is inexcusable. What madness do we face now? #badgercull"

Fig. 8. #badgercull top retweeted tweet (BC6) 12/10/2013 retweeted 264 times.

"RT… Hedley Midwinter #badgercull killer who intimidates & threatens sabs by driving at them http://"

Fig. 9. #badgercull BC1 retweet 01/01/2014 retweeted 99 times.

actions witnessed, reports of cull activity, information relating to cull science and sharing posts by popular figures against the cull. BC1 was the most retweeted user overall in the network and in the top 10 of users mentioned in other tweets. The second large red node, BC3, was a collective of badger-friendly farms and was again active across the time period and frequently retweeted. It was not, however, highly mentioned by others, hence their smaller relative size. BC 3 focused on *sharing* online materials that opposed government policy, information that was clearly taken up by other users. BC2, an animal welfare charity, is also well connected within the network and is frequently mentioned but is less central to its formation. This suggests a node *to* which users were directing information on welfare, and who were to a lesser extent tweeting information. Whilst BC2 and BC3 are similarly sized, BC3 is, according to the network measurements, more centrally important to the network by being more active and sharing useful materials.

These investigations of connectedness and centrality through network analysis enable an initial identification of key nodes and types of relations. But it is also essential to combine these maps of activity with other database indicators in order to avoid mistaking betweenness scores for actual influence. BC6, shown in the network as reasonably connected though somewhat average in betweenness centrality. However further database work reveals that they posted the most retweeted tweet in the dataset (see Fig. 8). It is useful in this respect to compare them to another node that was highly re-tweeted but which achieved a higher influence score. BC3 (a collective of badger friendly farms) tended to share URLs from major newspapers, reporting updates and political analysis (see Fig. 7):

This indexical or referential activity effectively 'points' others to read and share materials that are of interest in this online community. In contrast, BC6 (a wildlife cameraperson) commonly posted tweets that voiced their informed opinion. They did not as a rule include URLs within their tweets.

Where some develop authority as trusted sharers of information, others perform authority through providing their informed opinion. Several MPs, wildlife writers and celebrity campaigners used this more op-ed style of expressing their views. Such authority is of course relational – statements do not gain traction unless they are read and approved. In social media analysis re-tweeting a statement can be assumed to infer its importance, so BC6's status as an authority in this conversation or emerging network is evident in their posting a tweet that was the most retweeted in the network. This identification of authority through both content style and sharing suggests that analysts who are too quick to discount network contributions that do not achieve high betweenness scores are failing to account for different kinds of influence.

BC1, on the other hand, combined multiple approaches to tweeting, including providing direct reports of activity in the field including sharing insider knowledge (see Fig. 9):

Through first hand witness accounts, as well as sharing mass media articles, this user became a leading source for those using the badgercull hashtag. The high levels of engagement with their posts gave them a high betweenness centrality score, meaning that they formed a key passage point in network formation.

Other nodes in this network were important in terms of their active responses to posts. These active users amplified originator posts and co-generated authority in the process (Tinati et al., 2014). In this sense, overall network strength is conferred not through a handful of influential actors, but through the different contributions of those involved (initiating, sharing, amplifying and commentating, all become important to the network). Methodologically, it is important to emphasise that understanding roles in network formation requires a combination of network analysis and metrics, and an interrogation of the performative role of speech acts. As we argue in Section 3, our methodological contribution is the particular combination of methods developed here, building upon previous work in communications studies and STS (Bruns et al., 2013; Marres, 2015; Marres and Moats, 2015).

Up to this point we have tended to assume that retweets and mentions signal approval and indicate bi-directional conversations. However, these actions are used not only as a means to promote dialogue but also to 'call out' those with opposing views. For example, @ mentions were persistently used to express dissent in #badgercull. In Fig. 6 the large node BC7 on first inspection appears to be a significantly active node in #badgercull (by connectivity) but one that seemingly has very low betweenness centrality. The node is the Twitter account of Defra, and on closer analysis the high connectivity score was derived from one-way traffic (users mentioning Defra) with no response at all from the government department (hence the low score in terms of betweenness). Zooming in on the node reveals the detail of this relation (Fig. 10). Activists and campaigners were evidently actively engaged in posting to Defra (indicated by the arrows denoting a directional relationship between nodes, with the width of the edges proportional to directed messages). These attempts to provoke response and to criticise (see examples in Figs. 11 and 12) went unanswered within this dataset, with those staffing the Defra feed choosing or being instructed not to engage with the #badgercull thread. These posts clearly mark another form of activity within emerging issue publics. In addition to the already identified authorities and community amplifiers, we can call these positional posts 'agitators'. Again the key issue is to recognise the various roles within a network, and to underline the necessity to interrogate the data using a variety of tools.

4.3. Comparing networks and sub-networks

The #tbfree dataset displays some marked differences compared to #badgercull. Most obviously the size of the dataset, and the number of posts, is considerably smaller than #badgercull (roughly one tenth of the size). The distribution of activity is more evenly spread (see Fig. 13) with fewer dominant nodes as measured by overall connectivity (node diameter). Similarly, influence and authority were less polarised in #tbfree as there were a range of moderately significant nodes engaged

Fig. 10. Defra as Target.

in distinct conversations with fellow users. The most active and notable user in #tbfree was TF1 who posted about the benefits of bovine vaccination as an alternative to badger culling in reducing bTB. This user was not only the most active user in the network, they were also the most retweeted user. This user also regularly posted the latest news around the cull, with these posts being commonly shared throughout the network.

Nevertheless, it would be wrong to simply categorise this community as reasoned and scientific (just as it would be wrong to suggest #badgercull was solely the haunt of agitators). The most retweeted tweet in #tbfree was clearly angry and provocative (see Fig. 14):

The tone of this and other posts from farmers, expressing support to those undergoing bTB herd tests, sat alongside anti-cull tweets as well as information exchange on alternative policies (including vaccinations). #Tbfree therefore can be characterised as a more wide ranging conversation within which an array of positions on the badgercull were voiced and shared. The dataset also included bi-directional activity from institutions and policymaking bodies, like Defra. TF2, a significant user, was the official account of the National Farmers Union (a vehement supporter of the cull policy) and TF3 was the official account of Defra (the government department responsible for policy delivery). This network was clearly the preferred forum for those who wanted to critically engage with, support or defend the government's policy of badger culling in England. Far from being homogeneous, or narrowly homophillic, the network was flatter than #Badgercull, and seemed to involve numerous conversations. The latter opens up the possibility that this and other networks were constituted from more than one subnetwork. In other words, there is a need to discern the degree to which these datasets constitute coherent 'speech halls' with users actively listening across the piece, or a series of more or less self-contained and distinct conversations.

In order to explore the possibility for subnetworks, modularity, a measure of spatial clustering and differentiation, can be calculated. Modularity scores involve a "scalar value between −1 and 1 that measure the density of links inside communities as compared to links between communities" (Blondel et al., 2008: 2). In the case of #tbfree, community clustering occurred at the significant score of 0.5 (Fig. 15). In contrast, #badgercull had low levels of modularity (something we might expect from the increased size and therefore complexity of the dataset, but also suggestive of either a relatively more homogeneous network, or one that shows little signs of spatial patterning).

For #tbfree, three clusters can be broadly coded under their respective colours:

Those identified in blue were largely farmers sharing herd testing experiences and mutual support, with @mentions used to engage others in dialogue. Posting personal stories on a public forum enabled these farmers to respond and interact with others whether they were known or unknown, close by or distant. Helping to generate a form of digital community (see Figs. 16 and 17).

The green community tended to include farmers and related professionals plus public authorities discussing disease management practices. The focus was commonly on the politics and practices of controlling bTB. Users employed both @mentions and retweets. The difference to the blue cluster is highlighted by this tweet by a farmer (see Fig. 18):

This post moves beyond personal experience to include a web link and an impassioned 'shout out' communicating anger at not being TB free, and impatience with policy actions.

The red cluster was a more scientific policy exchange that included some anti-cull/ pro-vaccine campaigners and sources of authority including university scientists and Defra. Further database analysis highlighted how users in the Green cluster and Red cluster combined the use of @mentions and URLs in their attempts to share information. In particular the nodes identified as TF6, TF8, TF9 and T11 in Fig. 13 were engaged in the frequent retweeting of posts with URLs (see Fig. 19):

These users not only retweeted and shared information they also utilised dialogue and discussion as a means to contest knowledge and authority around the practices of managing bTB.

The point for now is that while it is possible to characterise 'online' publics as homogeneous echo-chambers organised to protest or to share particular forms of knowledge, closer analysis suggests a different understanding of publics in formation. As we argue in Sections 2 and 3, a shift from a 'demarcationist' approach (Marres, 2015), to a Deweyian (Whatmore, 2009) analysis grants more nuanced understanding of the liveliness of the heterogeneous set of entities making up an issue public. By analysing key exchanges, key actants or through a modularity-led exploration of sub-groups, issue publics emerge through a variety of

RT @**: anti-#badgercull petition now tops 300,000: http://... Deathra (@DefraGovUK), are you listening?

Fig. 11. #badgercull Tweet Posted by National Journalist 25-11-2013 Retweet count 116.

RT @**: Lack of denial from @DefraGovUK implies rumours of 6m closure of ftpaths over #badgercull next yr true. Glos, Som & Dors

Fig. 12. #badgercull Tweet Posted by South West Journalist 29-11-2013 Retweet count 59.

modes of speech and activity. Our final example reinforces this point as it underlines the possibility for exchanges and networks to morph and spill over, suggesting again the heterogeneity of these publics, their contextual specificity and their resistance to easy categorisation.

4.4. Dynamic issue publics

Following one thread of dialogue within #Tbfree revealed a lengthy unhashtagged conversation debating the relative merits of the science behind the cull. This began with a defensive post from TF6 responding to a heated broadcast media (television) debate he had participated in with a celebrity anti-cull campaigner (BC8/9 in the #badgercull dataset) (see Fig. 20).

Here a moment is identified where a post acts as a springboard for wider debate between pro and anti-cull users as a stream of 279 replies was posted largely without hashtags. This conversation, detected through content analysis, marks a moment where vitriol and rancour eventually led to debates on wildlife control via sharing scientific reports and eventual contributions from current wildlife researchers:

The anonymised tweet in Fig. 21 points to this wider debate occurring outside the hashtag over a number of days that drew in a number of discussants. It is one of several that cited recent scientific papers and eventually led to scientists who published the shared research papers to be drawn into online discussion (see Figs. 22 and 23).

Discussing the range of scientific work and opinion raised a short-lived opening for moving beyond the seemingly intractable conflict, as confrontation evolved into sharing insights and science-based evidence. In this instance, the various and somewhat fragmented issue publics started to come together in order to divide (Latour, 2005), to air differences and to debate positions. The difficulty in maintaining such publics, especially but not only on social media platforms, remains a key topic for experimentation and understanding.

We have provided a stepwise method and anatomy of the issue of the English badger cull and its attendant publics by engaging with data generated through social media activity, centred upon (but not limited to) the hashtags #badgercull and #tbfree. In doing so, like Marres (2015) and Marres and Moats (2015), we have demonstrated the utility of social media data for interrogating issue publics. As a corollary we

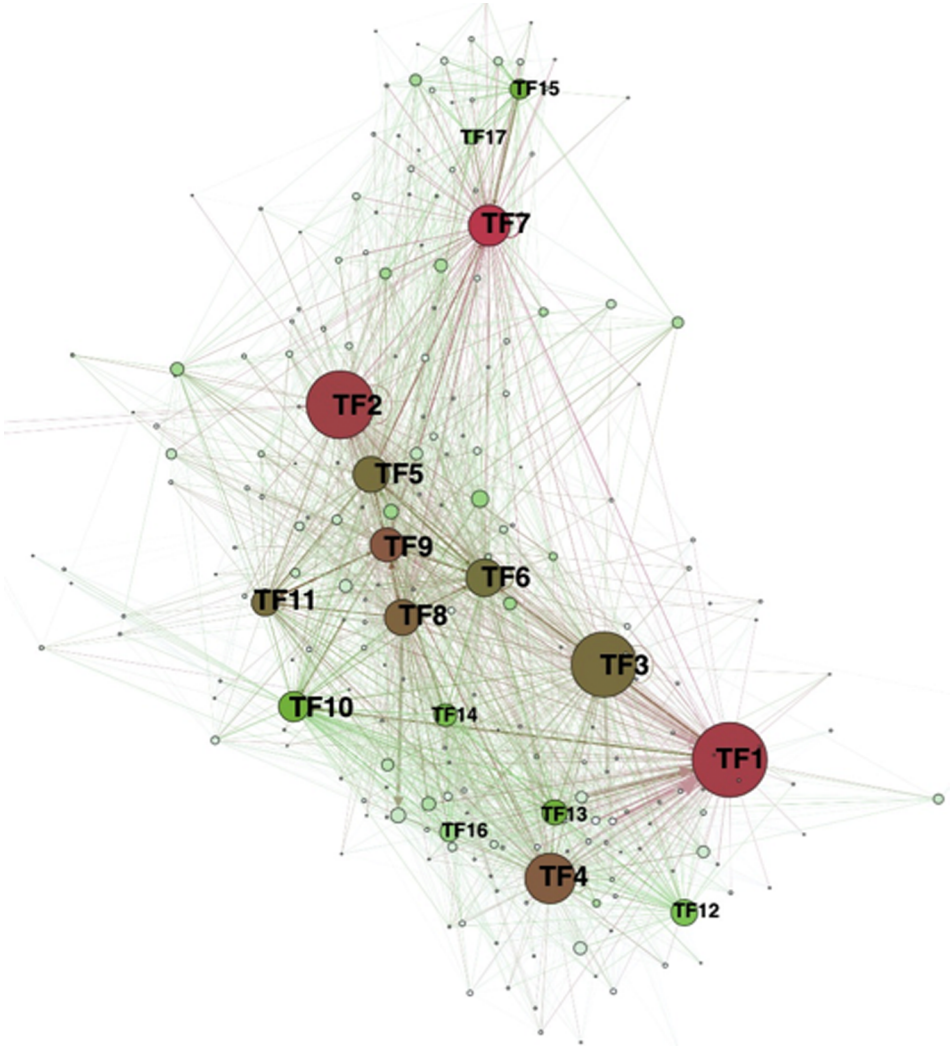

Fig. 13. #tbfree Gephi Visualisation – Colour-Betweenness Centrality, Size-Degree.

"RT @**: If badger activists are going to tweet cute pics of baby badgers then I'll tweet a cute pic of a baby calf #tbfree http://..."

Fig. 14. #tbfree Top retweeted Tweet 11/10/2013 91 retweets.

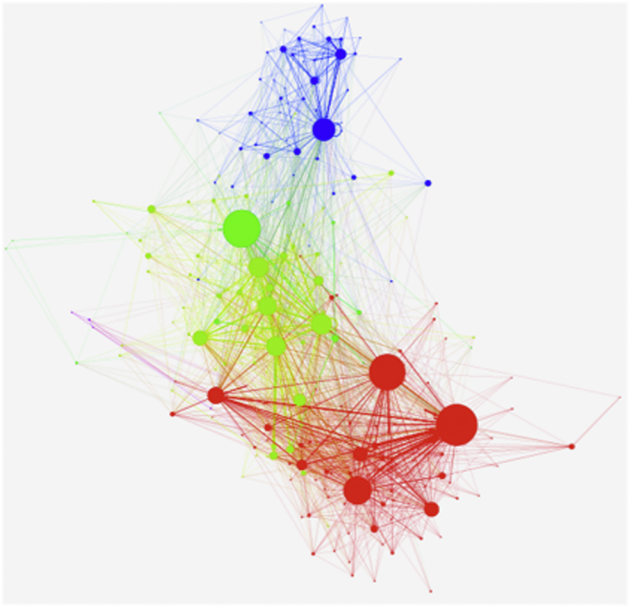

Fig. 15. #tbfree community clusters coloured by modularity.

argue social media platforms, such as Twitter, are themselves important performative actors in the emergence of issue publics. Furthermore, extending beyond previous work, we have underlined the importance of a multifaceted approach for geographical research, of utilising quantitative tools of network analysis in order to get a feel for relatively large data sets that we interrogated qualitatively. We have highlighted the need to use those tools critically, and to interrogate their assumptions by engaging in rigorous analysis not only in terms of the networks of data, but also in the content and styles of social media activity.

5. Concluding discussion: The importance of non-coherent publics

In working through the detail of the issue publics that developed around the 2013–14 English badger cull controversy, we have made three principal arguments: First, issue publics are Deweyian 'problem spaces' (Marres, 2005 pace Dewey, 2012 (1927)). As such they draw together a variety of expertise, authority, modes of communicating and communicative practices. We have demonstrated the variety of community building, identity making and provocative acts that characterise the performance of emergent publics, complementing cross-disciplinary work in wider social media analysis (Bruns and Burgess, 2011; Burgess and Sauter, 2015; Thelwall et al., 2012; Weber et al., 2012). Furthermore, we have demonstrated that the digital media platform itself is performative – the attributes of the medium and mechanisms or interrelation contribute towards issue public formation. Thus in our analysis, 'online' publics are dynamic and mixed affairs. The point here is that there is space to engage with the depth and detail of issue publics in order that they can be taken seriously. In the case of the badger cull controversy, the tendency elsewhere has been to assume a polarised and intractable conflict (Price et al., 2017). And yet, in the details of these publics-in-formation, we start to see the ways in which groups and sub-groups reason with one another, engage with science and scientists, make pleas for particular forms of evidence and try to mobilise resources. Understanding these processes of formation, and the consideration given to the issues, promotes a more hopeful political assessment that turns intractable conflict into an appreciation of key contrasts and possible areas for agreement. 'Grammars of action' (Rieder, 2013) make possible, or easier, important aspects of this formation. Hashtags are a mobilising factor for network connections. They are a key element both in the ways users negotiated the controversy but also in which we are able to research that negotiation. Thus we argue platforms themselves are performative. This is not necessarily a methodological 'problem' to be solved, but rather an important element in emergent publics.

Second, supporting Marres and Moats (2015), we have demonstrated the utility of rigorous social science analysis of social media data and advanced these forms of analysis by combining quantitative and qualitative methods and synthesising these with a social theoretical approach. Close readings of the data involved cutting the data in different ways via data visualisations and content analysis, which enabled the identification and tracing of key moments of issue public formation that went beyond the hashtag. While the push towards big– and other data-led forms of analysis invites us to adopt a data- rather than theory-led programme of research (Anderson, 2008; Ipsos Mori, 2014; Lazer et al., 2009), our investigation suggests that theories are already embedded in these forms of data analysis. Adopting Marres and Rogers's terminology of a Deweyian rather than Lippmanian device, we have demonstrated the value in interrogating the non-coherence of social media data rather than allow automated readings of affiliations. Alongside colleagues across the social sciences moving beyond the novelty of digital methods (Burrows and Savage, 2014; Crampton et al., 2013; Marres, 2015), we recognise the research value of social media data as a means to developing robust insights into social and cultural processes. To that end, we have sought to marry the initial powers of data sifting and lay out with the well-honed cultural analyses of social interactions. By triangulating methods and by combining the indicative results of social network analyses with an interest in what is shared, we can use these data to generate useful and robust knowledge.

Anatomising these two mediated issue publics began with tracing the digital matters shared to examine *how* liveliness was generated. Combined with investigating the 'When, Who and What' of issue publics, enabled us to typologise these emergent associations and understand moments of cohesion, agitation and debate. By investigating how authority was performed in these two linked issue publics we have established that authorities can emerge from within these publics via activity driving associative politics. Authority within 'online' publics does not necessarily require corresponding status outside of digital platforms; relying instead upon original insights to the controversy under debate. As observed elsewhere (Hands, 2011; Ipsos Mori, 2014), this has implications for institutional authorities striving to get their messages across in crowded forums.

Finally, all of this makes a difference to the issue at hand. Unlike early reports of online activity with respect to the controversy (such as Ipsos Mori, 2014; Weber et al., 2012), we would not conclude that

Night you lot. Thanks for today. Sleep tight @** - slightly clearer mind tonight. Best of luck for tomoz @** #tbfree ?

Fig. 16. #tbfree T7 tweet mentioning two other farmers 27-03-2014.

RT @**: That's us all done and we are #tbfree! Happy days! One less thing to worry about #teamdairy

Fig. 17. #tbfree Farmer tweet mentioning another farmer 16-01-14 retweet count 5.

Bad week, coming to terms with this girl and her unborn calf facing a BADGER INFECTED DEATH SENTENCE not #tbfree http:/

Fig. 18. #tbfree Farmer 05-05-2014 retweet count 42.

RT @**: "Politics is getting in the way of tackling UK's biggest rural crisis." Think few would argue with that. http://

Fig. 19. #tbfree Tweet posted by TF8 01-06-2014.

I'd like to invite all haters and trolls to meet me face to face for a 2way discussion about this disease. Who would like to come? #tbfree

Fig. 20. TF6 Tweet on 01/03/2014–25 retweets.

@** @** @** @** This is worth a read: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0039250 ...

Fig. 21. Tweet reply to TF6 citing scientific report 05/03/2014.

@** @** What was the effect found to be on adults in that study?

Fig. 22. #tbfree Tweet to scientist 11/03/2014.

@** @** A reduction in new incident cases in vaccinated adults.

Fig. 23. #tbfree Reply from Scientist to pro-cull user.

activities on social media simply mirror discrete clusters of pro- or anti-government policy. Neither would we conclude that such 'online' practices are somehow separate from 'offline' political activities. These mediated communities clearly generate publics in terms of both who and what is being shared or passed on. We argue it is crucial to understand that digital media platforms themselves are performative, and participate in the shaping of a public. Furthermore, we argue that this epistemically situates issue 'publicisation' research differently, in novel and perhaps difficult, contexts. Rather than debate, or presuppose, the ontological character of 'digital' or 'online' debates, we instead attend to the 'productive confusions' of mediation. We demonstrate that the debates concerning the cull of badgers on Twitter had their own character that is worthy of study in itself. A corollary is that rather than seeing the perceived biases of particular platforms as methodological problems to be solved in order to see 'real' underlying issues, we show that the performative agency of the platforms is an important formative element of issue publics that cannot be ignored. It is neither useful to treat controversies made public with and through digital media as a window onto 'real' un-mediated, issues nor as entirely separate 'virtual' debates – they are epistemic contexts themselves. Specific platforms themselves may, of course, come and go, and our media practices inevitably change. Nevertheless, contemporary digital media platforms are sites of vibrant and nuanced formulations and performances of controversies that warrant serious and detailed attention if geographers are to understand the processes involved and the make-up of issue publics.

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Appendix A

Social Network Analysis graphs coloured by Betweenness Centrality – Red – Brown – Green – White represents – Highest to Lowest betweenness centrality

Fig. 6 #badgercull Social Network Analysis graph
Key

BC1 –User representing anti-cull activists
BC2 –Long established anti-hunting charity
BC3 –User representing 'badger-friendly' farmers
BC4 –Leading animal welfare activist
BC5 –Anti-cull charity
BC6 –Leading Wildlife cameraperson
BC7 –Defra account
BC8 –Account of famous Anti-cull campaigner
BC9 –Account of famous Anti-cull campaigner
BC10 –High level retweeter
BC11 –High level retweeter and participant
BC12 –High level retweeter

Fig. 12 #tbfree Social Network Analysis graph
Key

TF1 –User promoting badger vaccines
TF2 –NFU account
TF3 –Defra account
TF4 –Anti-cull scientist
TF5 –Pro cull farmer
TF6 –Pro cull farm vet
TF7 – High profile Farmer
TF8 – Pro cull farmer
TF9 – Pro cull farmer

TF10 –Academic Researcher
TF11 –Editor of bTB information website
TF12 –User representing 'badger-friendly' farmers
TF13 –Anti-cull campaigners/activists
TF14 –Animal Welfare campaigner
TF15 –Relief Milker
TF16 –Anti-cull campaigner/activist
TF17 –Campaigning dairy farmer

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