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What's the beef?: Debating meat, matters of concern and the emergence of online issue publics

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Abstract

A number of recent scientific publications have called for significant reductions in meat consumption in order to mitigate the negative impacts of the food system on the planet. Public debate around this issue is not straightforward, however, with plant-based and alternative-protein narratives contested by an agro-ecological narrative. These competing narratives are being played out in both scientific and public discourses, with social media emerging as an important vehicle. Seeking to understand the nature of the 'online issue publics' forming around this issue, the paper draws on an analysis of Twitter data to assess 'sustainable meat' narratives as 'matters of concern' (Latour, 2004, Latour, 2018), rooted in the discrepant views, disputes and disagreements that typically coalesce around such issues. To this end, #sustainablemeat AND #ethicalmeat, and #eatlessmeat hashtags, respectively, were compared, as examples of debating meat. Two key insights emerged. Firstly, there is limited evidence of an encompassing debate on Twitter; #eatlessmeat tweets generated more frequent mentions and greater heterogeneity of content than #sustainablemeat tweets. Secondly, the prominence of commercially invested users using Twitter for marketing purposes; #sustainablemeat tweets were orientated toward promoting a business or the production of meat, whereas #eatlessmeat tweets showed a greater association with planetary issues and an evolution of the 'vegan' narrative. Individuals and organisations who are already invested in an issue use specialist hashtags. Specific 'sustainable meat' narratives on Twitter signal the multiplicity of debates that currently surround this contested issue which, as 'matters of concern', is still in the early stages of development.

Keywords: Debating meat; Matters of concern; Online issue publics; Twitter hashtags.

1. Introduction

Public debate about meat eating has intensified in recent years. Public health experts have long linked the overconsumption of meat, particularly red meat such as beef, to rising rates of obesity, heart disease and type-2 diabetes (Garnett, 2014). Animal health and welfare concerns about intensive meat production are also well-established (Mason and Singer, 1980), as indeed is the association between meat production and its negative impact on resources and the environment (Fiddes, 1991, Carolan, 2011, Weis, 2013, Kneafsey et al., 2021). However, the link between meat eating and a range of negative impacts, notably the association between livestock production and increasing greenhouse gas emissions, is a more recent concern informed by a series of high-level academic papers and scientific reports. These studies make a direct connection between meat eating and global environmental change, particularly in relation to climate change (IPCC, 2018, IPCC, 2019, Clark et al., 2020), but also concerning the implications of meat production and consumption for biodiversity, land use and the integrity of other planetary boundaries (Springmann et al., 2018, IPBES, 2019, Willett et al., 2019). The EAT-Lancet Commission (2019) 'Food in the Anthropocene' report, for example, called for a global transformation of the food system, but put a particular emphasis on the need to reduce consumption of red meat (Willett et al., 2019). Debate about the negative impacts of meat eating has intensified in the public sphere, with widespread media and social media coverage of the issue. New social and material practices associated with eating less meat or meat alternatives are also emerging (Morris et al., 2014), with growing support for consumer movements such as 'Meat Free Monday', 'Veganuary' and supermarket, high-street retail and restaurant chains launching vegetarian and plant-based food ranges and menu options. Waitrose's 2018-2019 Food and Drink Report, for example, hailed a 'new vegetarian revolution' in consumer choices, reporting that '13% of the population are now vegetarian or vegan and a further 21% identify themselves as 'flexitarian'' (Waitrose and Partners, 2019, p.6).

The extent to which growing public concern around meat consumption will be sufficient to drive reforms to the way the food system is managed and governed is still not clear. Some commentators have identified an emerging 'biopolitics' of food which has the potential to radically change the way we think

about food within the broader frame of climate change (Sexton, 2018). Certainly, the problematisation of meat eating appears to challenge food and farming business-as-usual models in fundamental ways. The challenge is particularly acute for the livestock sector, with significant implications for rural landscapes in the UK and elsewhere in Europe that are co-produced with pasture-based systems of farming. In this sense, debates around meat reduction can be said to constitute 'matters of concern' (Latour, 2004), arising when there are discrepant views, disputes and disagreements around an issue. The problematisation of meat eating also assigns new responsibilities to individuals in terms of how livestock and protein generally will be provisioned in the future. This raises questions about individual choices and opens up debate about the place of meat in society, and what constitutes a 'sustainable diet' (Mason and Lang, 2017). Problematisation may also highlight structural barriers that exist within the current regime of meat provisioning. Studies of less meat initiatives have shown that whilst they worked well as civic-driven initiatives to encourage debate about meat eating among consumers, their structural impact is often minimal in terms of translation into mainstream practice (Morris et al., 2014).

Nevertheless, public concern is an elusive concept and one that is often difficult to capture in empirical terms. In particular, public concern is often assumed rather than empirically established in policy domains (Fellenor et al., 2019). Decisions around meat eating and the problematisation of social practice through discourses of 'demeatification' (Morris, 2018, p.433) are known to be complex and contested and, like all economic behaviour, embody ethical values (Brunori et al., 2019, Maye et al., 2019). For example, specific critiques of 'meatification' are emerging (Morris, 2018), which lead to different conclusions about meat. These include 'political ecology' studies which question the meat industry's power and the negative effects of livestock farming on climate and ecosystems (e.g. Emel and Neo, 2015) and 'critical animal studies' (e.g. Freeman et al., 2011), which advocate a 'no meat at all' position and contest 'animal industrial-complex' arrangements that discriminates against particular species of animal (Morris, 2018, p.435). As noted in studies of 'flexitarianism' (e.g. de Bakker and Dagevos, 2012), pathways to achieve demeatification (e.g. Sage, 2014) and sustainable transition frameworks for plant-based diets (e.g. Vinnari and Vinnari, 2014), engender a multiplicity of competing ethical values co-existing around eating meat and its potential to transform the food system.

This paper aims to examine the extent and nature of eating meat as an 'issue public' via analysis of key narratives around how, where, and by whom meat-eating is represented. Specifically, we explore the narratives and counter-narratives associated with meat production and consumption reported in academic papers and social media (Twitter).

Our analysis builds on a rich body of multidisciplinary scholarship which has previously examined different aspects of meat through analysis of media sources, including studies of meat eating and climate change (Lee et al., 2014, Almiron and Zoppeddu, 2015, Kristiansen et al., 2020), discourses of veganism (Cole and Morgan, 2011) and demeatification (Morris et al., 2014, Morris, 2018); attitudes towards non-human animals and speciesism (Freeman et al., 2011, Khazaal and Almiron, 2016); and cultured meat media coverage (Goodwin and Shoulders, 2013, Painter et al., 2020). These studies recognise the potentially significant role the media plays in the politics of meat and the formation of public discourses around the issue; most conclude that the media reinforce the meat eating status quo (but see Morris, 2018). To date there have been few studies of the role of social media in these analyses of meat eating (Kristiansen et al., 2020). In seeking to address this gap, we examine coverage of meat eating and meat reduction on Twitter in order to illustrate its influence as a platform for information exchange and debate. We look specifically at its role in simultaneously mobilising actions and politics around meat eating at a moment when 'online issue publics' are emerging which hold together different 'story-networks' celebrating or contesting meat eating (Lee et al., 2014, p.952). This multiplicity of narratives about meat eating (on and offline), signals a contested issue, or 'matters of concern' (Latour, 2004, Latour, 2018, see also Tisenkopfs et al., 2019), that is still in the early stages of development with competing values, narratives and counter-narratives. To make the Twitter analysis manageable, and to examine how specific aspects of meat eating are framed by market and public sphere actors (Kirwan et al., 2017), we select two hashtags for detailed analysis, which represent subsets of debating meat.

The rest of the paper is structured as follows. The next section reviews recent scientific studies that link meat eating to climate change and identifies three 'sustainable meat futures'. In each case ethics plays a role in framing meat futures, including narratives and counter-narratives. The paper then

conceptualises what we mean by 'online issue publics' and introduces Latour's (2004) 'matters of concern' framework. The methods employed to examine social media treatment of debates about meat eating are then summarised. In the following two sections we assess specific 'sustainable meat' narratives in Twitter, comparing #sustainablemeat AND #ethicalmeat, and #eatlessmeat hashtags respectively. The final section relates the analysis back to problematisation and 'matters of concern' and argues these issues help to inform future governance of ruminant livestock and sustainable diets.

2. The problematisation of red meat, the agroecological counter-narrative and the promise of alternative proteins

Publication of the EAT-Lancet Commission report and related publications (e.g. Springmann et al., 2018) represent a key moment in debates about meat and meat eating. The report generated a counter-response from, among others, advocates of ruminant livestock, and triggered a broader debate implicating the emergence of two distinct narratives around sustainable meat futures concretising in scientific and public discourse. These sit alongside a third narrative, associated with alternative proteins (Burton, 2019, Froggatt and Wellesley, 2019, Sexton et al., 2019, Clay et al., 2020), which signifies a new biotechnological transition in agriculture via animal protein synthesis, including the culturing of animal tissues (Burton, 2019, p.35). The narratives indicate differences, for example, in terms of sustainable transition pathways, the role of technology, the status of ruminant livestock and the ethical and cultural values underpinning each. Together the sustainability narratives summarise how debating meat is articulated in the scientific sphere and provide the context for subsequent sections of the paper that analyse selected hashtags on Twitter, as online issue publics.

2.1. Eat less meat and sustainable diets: planetary boundaries and the health-environment nexus

EAT-Lancet (Willett et al., 2019) argues for significant reductions in meat and dairy consumption, counterbalanced with increases in the consumption of plant-based foods, in order to feed the global population, reduce the impact of food production-consumption on climate change, and meet the UN

Sustainable Development Goals. The report argues that unhealthy diets "now pose a greater risk to morbidity and mortality than unsafe sex, alcohol, drug and tobacco use combined. Global food production threatens climate stability and ecosystem resilience and constitutes the single largest driver of environmental degradation and planetary boundaries" (EAT-Lancet Commission, 2019, p.5). Their analysis focuses on two end-points of th global food system - final consumption (healthy diets) and production (sustainable food production) – to assess whether 'planetary healthy diets' can be achieved for a global population of 10 billion by 2050. Global scientific targets for healthy diets and sustainable food production are integrated into a common framework as "the safe operating space for food systems, so that planetary health diets (both healthy and environmentally stable) could be identified" (ibid., p.7).

According to the EAT-Lancet report, a planetary healthy diet should be made up of roughly half a plate of vegetables and fruit; the other half, in terms of calories, should be primarily whole grains, plant protein sources, unsaturated plant oils and modest amounts of animal sources of protein. Healthy diets consist largely of a diversity of plant-based foods, low amounts of animal source foods and contain unsaturated fats; with limited amounts of refined grains, processed foods and added sugars (Willett et al., 2019). EAT-Lancet proposes a flexitarian diet, which is mostly plant-based with modest amounts of fish, meat and dairy products. This 'planetary health plate' does not prescribe an exact diet but outlines empirical food groups and ranges of food intakes for local interpretation (EAT-Lancet Commission, 2019, p.10). In regard to sustainable food production, EAT-Lancet examined six of the nine planetary boundaries linked to the food system. The Commission proposes planetary boundary targets that global food production must stay within to avoid potentially catastrophic shifts in Earth Systems. To reduce environmental impact, actions were investigated in terms of: 1. Shifting towards healthy diets; 2. Reduced food loss and waste; and 3. Improved food production practices. Sustainable intensification is the favoured production approach – i.e. land sparing and smart agriculture that utilises digital technology.

The EAT-Lancet report has been important and influential in opening up discussion about strategies for moving towards 'sustainable diets' and an ecologically sustainable food system that addresses

nutritional needs. According to its authors, staying within the safe operating space for food systems requires "substantial shifts toward mostly plant-based dietary patterns, dramatic reductions in food losses and waste, and major improvements in food production practices" (EAT-Lancet Commission, 2019, p.16). This involves radical dietary shifts including a more than 50% reduction in the global consumption of foods such as added sugars and red meat. However, the report has been widely critiqued, including by advocates of grass-fed livestock farming.

2.2. Grass-fed livestock and agroecology: agricultural multifunctionality and pastoralism

Advocates of grass-fed livestock argue that meat production systems based on grass help to sequester carbon and offer a different vision for sustainable meat production. The Sustainable Food Trust, for example, recognise that diets and global food systems need to change but criticise the EAT-Lancet report (Willett et al., 2019) for fundamentally misunderstanding that "some of [its] main dietary recommendations are incompatible with the food production outcomes of truly sustainable farming systems" (Sustainable Food Trust., 2019). They argue that prioritising reductions in beef and lamb consumption over poultry will result in negative environmental and health outcomes. This would make it impossible to introduce sustainable restorative farming systems in places like the UK, where a high proportion of farmland is only suitable for growing grass. Of particular concern is the failure to address reducing poultry meat consumption because poultry are in direct competition with humans for grain. They note the intensive feeding of cattle with grain, for example in the UK, but argue that ruminants in many countries mostly eat grass and arable by-products and that to mitigate "net greenhouse gas emissions, soil degradation, biodiversity, diffuse agrochemical pollution and human health, reductions need to made in meat that is largely fed on grain, not meat that is predominantly fed on grass" (ibid.).

Related contributions present an 'agroecological vision for Europe in 2050' (Poux and Aubert, 2018). This research focuses on the European food system; EAT-Lancet is global. Like EAT-Lancet, it recognises challenges for European agriculture, including preserving biodiversity and natural resources and threats from climate change and calls for a change in diets that are less rich in animal products. The

report also argues for a more through-going agro-ecological transition, which would involve phasing-out of pesticide and organic fertilisers and the deployment of extensive grasslands and landscape infrastructure. Changing European diets opens up space for an agro-ecological transition that does not require maintaining current yields and enables environmental management. Their 2050 scenario for Europe involves widespread adoption of agroecology, the phasing out of vegetable protein imports and the adoption of sustainable diets. This would mean a 35% drop in production compared to 2010 (in Kcal) but would provide healthy food for Europeans while maintaining export capacity, reducing Europe's global food footprint, enabling a 40% reduction in GHG emissions, and improving biodiversity and natural resources (ibid., p.6).

A key difference in this vision compared to EAT-Lancet is the reduction of pigs and poultry (monogastrics) and not ruminants. The level of competition between ruminant feed and human feed is lower. In this meat future, ruminants are promoted as a way to enhance grasslands and foster biodiversity, with different herbivore systems envisaged to maximise the use of extensive grasslands; a key for fostering pastoralism. This agro-ecological framing affords a very different perspective regarding the role of ruminant livestock in sustainable agri-food systems, using ecological concepts to show their central role in tackling climate change and socio-economic agri-food sustainability. These two contrasting 'sustainable meat futures' sit alongside a third 'meat future' that is technology-orientated.

2.3. Lab meat, alternative proteins and promissory narratives

The use of food technology to produce plant-based proteins, edible insect products and cellular meat is also attracting attention (Froggatt and Wellesley, 2019). Cellular agriculture includes lab-grown/cultured/clean/cell-based meat, milk and egg products (Burton, 2019, Clay et al., 2020) and uses cell science techniques to grow animal-derived foods outside the animal body, thereby removing the need to grow animals intensively or to slaughter them. Sexton et al. (2019) show that 'promissory narratives' around meat alternatives have been powerful in expanding consumer uptake and driving the

development of these products. In the case of alternative proteins, this involves creating awareness across a variety of audiences (investors, retailers, the public) and convincing people to invest in them, and to stock them and so forth. However, no products are currently available on the market for cellular agriculture; only promises of what they will achieve when they get to market.

The promises made about these products is part of company marketing strategy, but Sexton et al. (2019) argue that the narratives are also helpful in terms of how they are positioned against the 'status quo'. Their work examines the promises made across the three alternative protein categories in terms of what type of 'goodness' is associated with these products by their developers and revealed five key promises: 1. Healthier bodies (the promise of being healthier than animal foods in terms of higher in protein but also no antibiotics); 2. Feeding the world (promise to feed the projected world population growth using less planetary resources); 3. Better for the environment and animals (promise of offering more environmentally efficient production, no need for intensive livestock, no animal slaughter); 4. Control for sale (promise of increased food safety and traceability via techno-science); and 5. Tastes like animal (not only will the alternatives be good for us and the planet, they will also be indistinguishable in taste).

What emerges from these five promises is a balancing act in terms of retaining, while simultaneously breaking away from, certain aspects of conventional animal foods. For example, promises of removing negative health and environmental impacts, food safety and security concerns but also emphasising the pleasurable and familiar aspects of conventional animal foods. Those in the conventional livestock sector, alongside big agri-food businesses and alternative agri-food producers (organic; slow food), are now responding via counter-narratives that suggest the technologies are 'not a serious threat', 'not real food' and 'not legally defined'. Sexton et al. (2019) view this as a contest of hopes and anxieties across a range of issues, including the welfare of the planet and humans and non-humans, and deep cultural values linked to animal farming and food. Three binaries that have characterised hopes and fears about the foods that we eat are at the heart of the narrative battle: 'real' vs 'fake', 'clean' vs 'dirty', and 'tradition' vs 'progress'. Thus, whilst the products that are contested are new, the binaries reflect a much

longer history of concern about the foods we eat and how they are produced, reflecting cultural values and specific institutional and ideological contexts.

3. Meat eating, matters of concern and online issue publics

From the above we can see how particular food futures are being framed and imagined, with contrasts between technological, science-led pathways and agroecology pathways that emphasise the multifunctionality of farming. These narratives and counter-narratives echo ideological battles about 'food futures' (bio-economy, eco-economy, ecological modernisation, etc.), each redefining and respatialising how and where meat is grown and by whom (Kneafsey et al., 2021). Science is employed as 'matters of fact' to suggest that solutions for the future are known, supporting normative claims that we must eat less meat (Willett et al., 2019). Building on the analysis presented in the previous sections, including past studies of meat discourses using media sources (notably Lee et al., 2014, Morris, 2018, Kristiansen et al., 2020), we examine how debates about meat are manifesting on social media in terms of alternative narratives of personal and collective choice. This contributes to an understanding of the extent to which social media can be said to be implicated in shaping, and possibly polarising, public interest in meat eating as contentious values-laden 'matters of concern'. Media analysis shows, for example, that distinctive story-networks are forming, with the livestock-climate change issue addressed through either technological innovation, individual lifestyle choices or policy action (Lee et al., 2014). The configuration of these story-networks shapes how responsibility is allocated, which often means taking responsibility off the systemic changes that are needed (see also Kristiansen et al., 2020). Media also supply various 'emotional heuristics', which society uses to evaluate new technologies; these media frames provide a shortcut to process information, especially for an issue that audiences may be less familiar with (Painter et al., 2020). This highlights the multiplicity of meat debates that co-exist and raises important questions about meat eating narratives on social media. We use selected examples of the sustainable meat discourse, as represented through hashtags within Twitter, to interrogate how this platform is used to mobilise actions, values and politics. This embraces meat eating as 'matters of concern', emphasising sciences not Science, avoiding normative ready-to-hand fixes, complicating the

fact/value distinction and recognising underlying politics and ethics. As Latour (2004, p.232) puts it, "Matters of fact are only very partial … very polemical, very political renderings of matters of concern".

Social media, such as Twitter, provide important insights into how 'matters of concern' arise, become mobilised and act as a space and provide a platform for [online] issue publics. This includes the extent to which different 'publics' emerge and engage around the issue and factors that may influence policy and regulatory reforms on the issue. Past studies of public controversy or attention on an issue has looked at 'events' – typically the rise and fall of public attention to issues such as natural disasters or disease outbreaks (Nisbet and Huge, 2006, Urquhart et al., 2017). Studies have also looked at public risk concern and relations between risk communication, public attention and the 'social amplification of risk' (Kasperson et al., 1988). A shared conclusion from this work is the need to recognise a number of 'issue publics' rather than a single, homogenous public and to consider the circumstances under which they emerge and the social processes that enable them to cohere. 'Online issue publics' have a specifically performative role in forming issue publics. They both facilitate 'issue publics' as 'echo chambers' to share information and marshal agreement and also provide virtual spaces for dialogic debate and disagreement (Sandover et al., 2018). Analysis of the bovine TB debate, for example, reveals the way social media mediates and fragments public debate about an issue, suggesting it is necessary to look at the when, who and what of any public controversy in order to link an analysis of the trajectory and intensity of concern with the content and performance of any resulting discourses. Issue publics can be highly heterogeneous in their 'making up' as well as their make-up, which includes their coverage in traditional newspaper media and digital mediation. Building on this work, we view meat eating as 'matters of concern' configuring around constellations of online issue publics, which also involves determining the extent to which the debate is a 'real' public concern (Urquhart et al., 2017).

4.   Research methods

Our analysis was developed in two phases, starting with an exploratory identification and consideration of tweets, followed by detailed analysis of specialist hashtags selected because of their salience in

relation to the issues around meat and sustainability. The exploratory work crystallised around tweets pertaining to 'sustainable meat' and 'ethical meat'. Following advanced searching using the Twitter Application Programming Interface (API), a third-party vendor[1] was used to obtain accurate estimates of the number of tweets and cost, utilising searches such as "#sustainablemeat OR #ethicalmeat OR "sustainable meat" OR "ethical meat" OR (sustainable AND meat) OR "alternative meat" OR "synthetic meat" OR "lab meat" OR "laboratory meat"". Following this work, tweets containing the hashtags #sustainablemeat and/or #ethicalmeat, and #eatlessmeat were obtained from the vendor. Such tweets appeared to be relevant in terms of topic and represented an adequately sized corpus. The latter hashtag was chosen in order to further examine the way specialist hashtags are used by individuals and organisations with an investment in the issue and to assess the mix and heterogeneity of users.

Analysis of the tweets was carried out with Textometrica[2] software (Lindgren and Palm, 2011); an online freeware tool for visualising and exploring co-occurrences of words in discrete textual units through connected concept analysis; an approach that brings the interpretive stance of qualitative approaches to corpuses of text otherwise too large for comprehensive close reading. Textometrica uses min–max normalisation[3] techniques to produce centre-weighted network maps that facilitate the development and organisation of salient topics according to qualitative conceptual coding of the text. Unlike simplistic content-analytic techniques, Textometrica's co-occurrence analysis is based on qualitative concepts that the researcher develops as they move between their reading of textual units and the word lists produced by Textometrica; the researcher can organise semantically associated words as a conceptual cluster. Textometrica does not produce a statistically robust quantitative analysis; the magnitude of co-occurrence-values is taken as indicative of interesting relationships in the text that warrant the consideration of the researcher.

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[1] https://www.trackmyhashtag.com (accessed: 26.07.2020).

[2] http://textometrica.humlab.umu.se/ (accessed: 27.07.2020).

[3] See, for example, AL SHALABI, L., SHAABAN, Z. & KASASBEH, B. 2006. Data mining: A preprocessing engine. *Journal of Computer Science,* 2**,** 735-739..

Different elements of the procured data were extracted for analysis, including tweet date stamps to determine the volume of tweets across time; geolocation to determine the location of people tweeting; a random sample of tweet biographies, i.e. the information with which users describe themselves, to determine the types of user tweeting [extracted by allocating each tweet a randomly generated number, sorting into numerical order, and selecting the initial ten percent]. Tweet content per se was imported into Textometrica as individually demarcated text blocks. Preparing and cleaning the data involved manual removal of any non-textual symbols such as emoticons. Textometrica automatically removes analytically uninteresting words such as 'the'. Manual scrutiny facilitates removal of very high (e.g. sustainablemeat) and low (e.g. local foods) frequency words. Textometrica was also used in a deductive mode. Given the emotive nature of sustainable and ethical meat, it was envisaged that tweets might reflect [emotive] framing elements by utilising negative or positive affective language. Hence, Textometrica was used to assess the data for instances of affective terms appearing in the Affective Norms for English Words (ANEW) list (Bradley and Lang, 1999)[4]. Each affective term returned by Textometrica was assessed in its semantic context to ascertain how the affective term was being deployed.

Table 1 provides a step by step summary of key methodological aspects.

Table 1. Summary of key methodological steps

Phase 1	Procedure
	Exploration of relevant tweets and identification of hashtags, on Twitter
	Estimation of tweet corpus size and procurement of tweets via third party vendor, as a Comma Separate Values (CSV) file
	Manual extraction of tweet elements, e.g. date stamp, from CSV file
Phase 2	Descriptive analysis of, for example, tweet volume; types of user; specialist hashtags; etc.

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[4] A set of normative emotional ratings for English language words. The ANEW list comprised 391 positive affect terms and 751 negative affect terms.

	Identification of themes within the corpus and semantic clustering of tweets using Textometrica
	Exploration of the framing of tweet content in terms of positive or negative affective language, using Textometrica

5. Sustainable-meat online issue public: Twitter narratives and specialist hashtags

This section presents analysis of tweets that firstly relate to #sustainablemeat and #ethicalmeat and secondly relate to #eatlessmeat. For each corpus of data we start by describing the pattern of tweets over time, geolocation data, who was tweeting and how often and then examine in more detail tweet content. We compare differences between the specialist hashtags where appropriate. The analysis shows how the debate is treated on Twitter as 'online issue publics' (Sandover et al., 2018) and the meat-eating debate as 'matters of public concern' (Latour, 2004).

5.1. #Sustainable meat and #ethicalmeat

The corpus consisted of 2492 tweets, of which 1038 were retweets, from 1497 users and dating from April 19 2010 to September 30 2019. These tweets received 11,518,524 impressions. It should be noted that the number of impressions does not necessarily correlate with the actual number of times that tweets were read or engaged with. Of 2942 tweet corpus, 1891 had an identifiable geolocation. Most tweets originated in English speaking countries and appeared to be pro-meat, e.g. promotion of a business. Figure 1 illustrates the trend in the number of tweets across time, which generally increase from year to year -particularly after 2017, though with wide within-year variations throughout.
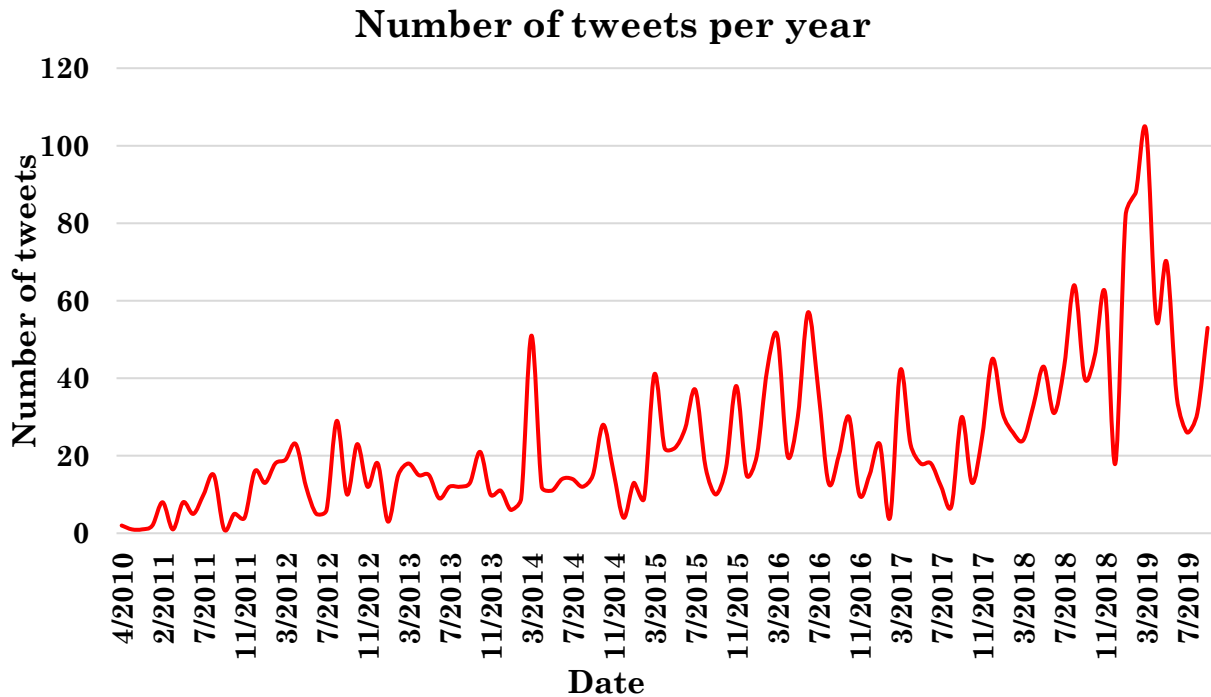
Number of tweets per year

Figure 1. The trend in tweet volume across time

Although there are apparent spikes in tweet volume on several occasions, the number of tweets involved are in fact low. For example, the spike in March 2014 relates to 34 tweets containing #meatscratch, and a URL to a YouTube video dramatising the dangers of antibiotic over-use in livestock and the possible subsequent effects on humans. This originates with a user whose bio states *"Dedicated to improving the food system by feeding you the facts about what you're eating."* This account appears in 2014, around the same time as the YouTube video, and may have been created to promote the film. However, it is not active after 2014. The video only received 1780 views on YouTube. The spike in March 2019 [104 tweets] relate to the term 'rabbit' or 'meatrabbit' and originate with one user with a business oriented toward rabbits and rabbit farming as a meat source. These tweets extoll the virtues of rabbit meat and imply a pro-meat stance is implied. The implicit 'queering' of arguments against meat consumption was a recurrent frame throughout the corpus.

Several conclusions can be drawn from this analysis of tweet spikes. Firstly, a spike does not necessarily relate to a media or other event that subsequently percolates onto Twitter. As such, a spike in tweet volume cannot be taken as a general concern with an issue. Secondly, attention to an issue is often transient; tweeting does not necessarily reflect an ongoing concern with an issue. Thirdly, raising awareness of an issue may not reflect an ongoing and coordinated effort. Whilst hashtags may be enrolled by a user to extend the reach of a tweet, hashtag use does not necessarily imply an ongoing concern with the issue the hashtag connotes.

Two thousand three hundred and forty-nine tweets originated from a user account that also contained a user biography (bio). One thousand four hundred and ninety-seven users accounted for the entire corpus. However, only 245 users tweeted more than once. The most prolific user tweeted 104 times. This suggests that the use of the hashtags in question, #sustainablemeat and #ethicalmeat, and hence attention to these issues in this context, was transient for 90.2% of users. Of the 8 users tweeting more than 20 times, 5 indicated in their bio that they were meat producers.

One hundred and fifty users with a bio were randomly selected in order to identify the types of users that were tweeting with the #sustainablemeat/#ethicalmeat hashtags. Ten categories were identified (figure 2). The largest single category (32%; category 5; figure 2) included bios classed as "Individual not orientated to meat or environment". Thirty six percent of bios indicated a user orientated toward food production or distribution (Categories 2, 3, 4, 7). Fourteen percent of users were orientated toward meat production (Category 4). Over half of all users [59.3%; categories 2, 3, 4, 6, 7, 8, 9] were orientated toward meat, food and/or sustainability issues. This reflects previous work that suggests Twitter attention to an issue is likely to implicate users with a vested interest in that issue (Fellenor et al., 2017). Hence, caution has to be exercised when it comes to attributing attention to an issue to a 'general' public. Rather it can be argued that general attention to an issue is comprised of a series of 'overlapping public spheres' (Bruns and Burgess, 2015, p.6) of interest, some of which will be transient, others more enduring. Moreover, the existence of these [issue] publics is predicated on a variety of investments

where, for example, the political is also the commercial; further evidenced in subsequent discussion with regard to tweet content.
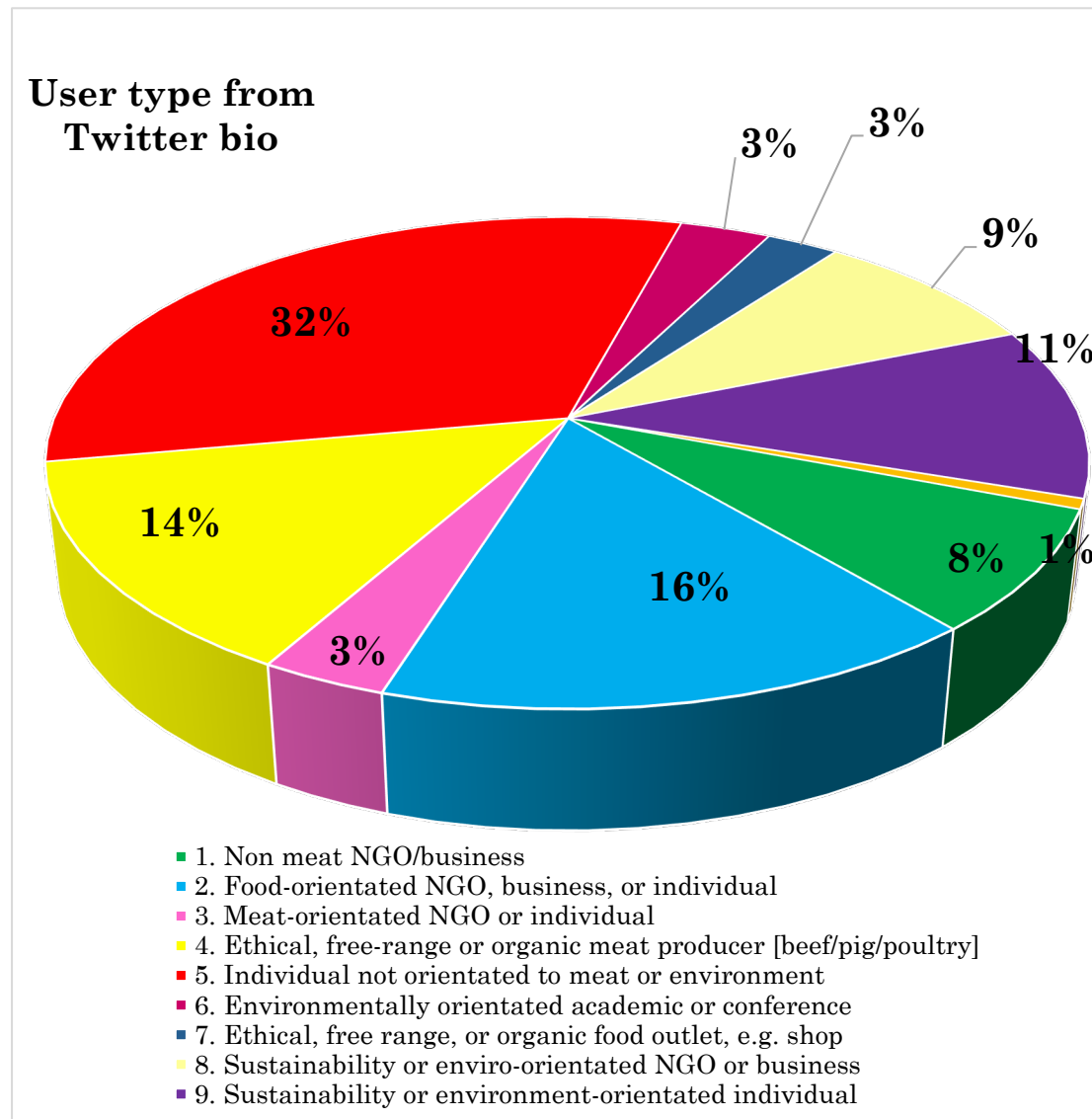

Figure 2. User type from Twitter bio

5.1.1 Tweet content

Textometrica identified 5758 unique terms in the corpus. Following scrutinisation of tweets, terms with a frequency of >30 and <534 were retained; resulting in 94 unique terms. Coding developed concepts that captured the context within which a particular term was used. Overall, 27 concepts were constructed, the ten most frequent of which are illustrated in table 2 and figure 3.

Table 2. Top ten concepts identified for #sustainablemeat and #ethicalmeat tweets

Concept	Document frequency	Example tweet
Sustainable/ethical meat as a selling point	561	Just taken delivery of some fantastic pedigree Saddledack pork from SxSaddlebacks. Great to work with local producers with a passion for the quality & welfare of their livestock. Order online now! #FreeRange #EthicalMeat #EatLessMeatEatBetterMeat
Alternatives for consumption (pro-meat) such as rabbit, goat	488	Delicious field of meat! #meatrabbits #meatrabbit #rabbitmeat #rabbitry #rabbithusbandry #rabbits #rabbit #sustainability #sustainable #sustainablemeat #backyardfarming #urbanfarming
Recipes	475	Pork Neck Steaks with Roasted Radishes, sage Brown Butter & Pink Pearl Apples #sustainablefood #ethicalmeat
Mixed appropriation around the ethics of meat eating	431	1) The pig eater's dilemma: How well should we treat the animals we eat? 2) Watching my 1/2 pig raised by friends get butchered.
Benefits of eating less meat or local meat	238	Climate Change - It's Not the Cows Fault: 'Demand to know from the retailer how this meat was raised the supermarket shelf stacker probably won't know, but your local butcher will.' #goodfood #ethicalmeat #climatechange
Grass fed meat (pro-meat)	189	We're hiring! Join us as we provide 100% #grassfed #koshermeat. Looking for a Customer Happiness Specialist to join our mission-driven company in #SilverSpring, MD #sustainablemeat #glattkosher #pasturedmeat #grassfedbeef #kosher #roshhashana #kosherfood
Meat can/can't be ethical	171	1) Food Writer Becomes a Butcher to Better Understand the Value of Meat 2) humane Meat or Ethical Meat is still a result of the death of an animal that just wanted to live. No animal wants to die to become your next meal! #meat #ethicalmeat #freerange
Extending the reach of arguments	140	Why meat? Why #goatmeat? Why goat meat raised in the GoatsontheGo system? Because we want to feed people in a different way...with livestock that gives more to the world than it takes. Buy now at https://t.co/xLmkciuWEL. #sustainablemeat #ketodiet #paleodiet #lamb #foodie
Artificial meat	102	Dare to try the burger of the future? Foodcheri our partner in France has launched a limited-edition

		INSECT burger! Our HQ have been trying it out, reducing meat consumption to reduce greenhouse gas emissions! #Sustainablemeat #Sustainablefood
Arguments against anti-meat lobby	99	'At least 100 mice are killed per hectare per year to grow grain.' Ordering the vegetarian meal? There's more animal blood on your hands #vegetarian #ethicalmeat #farming

In terms of reference to the top three frequent concepts, most tweets are orientated toward promoting meat and positive meat consumption. This supports Sexton et al. (2019) suggestion that narratives are shaped by producers and retailers, for example to make transparent the food chain, and seek to "evoke and invent more compassionate human–animal relationships" (ibid., p. 2). However, it appears that the ethical and sustainable framing of meat production is primarily driven by commercial objectives, rather than animal welfare concerns. This is commensurate with an assessment of user biographies, where 52.7% of the user bio sample were commercially orientated. In terms of issue publics it is useful to reflect on the relation between online and offline. Taking #sustainablemeat, and the general notion of sustainable meat, as the organising principles around which [Twitter] discursive communities form, the identities of users seems to suggest many with commercial interests or motivations. The suggestion is that socially mediated issue publics often overlap in their motivations with those using Twitter to gain market share.

From the retained terms, the strongest co-occurrence was between the concepts "Contests claims that ruminants add to greenhouse gases (GHG)" and "Killing or rearing animals in an ethical manner". The former concept describes tweets that suggest livestock animals, such as cows, do not add to GHG emissions; exemplified in table 2. The latter category promotes the notion that meat can be reared ethically for consumption. While some tweets make this explicit, others adopt a sarcastic or humorous approach; *"After some vegan fundamentalists demanded that meat packaging showed the conditions the animals were reared in [....] I thought you might like to see where Quorn is lovingly hand reared"*. As part of a short thread, this tweet is followed up with *"We can't show you where the Quorn is lovingly slaughtered] because it's an inanimate agglomeration of disgustingly extruded GM chemicals, so it*

doesn't need killing". This illustrates the way in which different discourses, e.g. genetically modified

foods, ethical practices and meat consumption are appropriated, and normalised framings subverted.
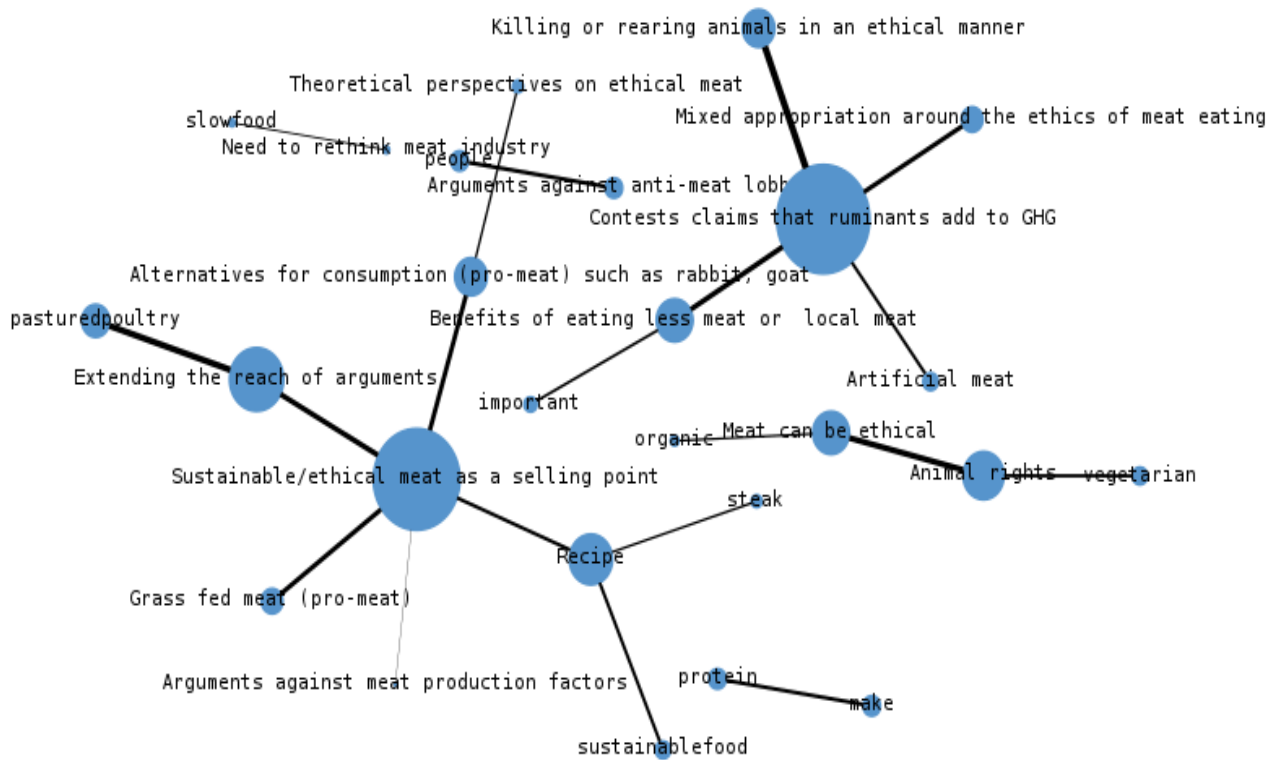

Figure 3. Textometrica map illustrating concepts derived from the overall corpus

5.1.2 Tweets and affect

Of the 5578 unique terms in the corpus, 22 positive affect terms were used in a relevant affective context

with a cumulative frequency of 338. Textometrica selected eight normalised co-occurrences, mapped

into two separate clusters (figure 4). Of these clusters, the strongest co-occurrence occurred between

the terms 'easy' and 'healthy' in only one tweet; *"LIVIN Farms makes growing sustainable and healthy*

protein as easy as compost ...", pertaining to a company manufacturing and selling devices for growing

edible insects at home. The second strongest co-occurrence occurred between 'amazingly' and 'healthy'

in one tweet, *"Camron's new Champagne D'argent breeder rabbits. Originally from France, these*

guys produce an amazingly healthy and flavorful meat…". The user bio indicates a non-profit organic farm that seeks to grow food for the local community on the basis that conditions such as cancer are mitigated by 'healthy' food. The tweets that the two clusters describe reflect how key narratives, within the broad debates around meat, interact. For example, alternatives to typical meat protein, such as insect, pigeon, and rabbit protein, are framed as 'amazing' and 'healthy'. Moreover, these protein sources are abundant and easy to harvest; in keeping with the notion that they will act as food sources to mitigate future challenges such as population increases (Sexton et al., 2019). Of note is that the framings of alternatives to traditional meat sources do not adopt an overtly technological stance. Promoting alternatives may be most effective when technological language is avoided (Bryant and Dillard, 2019). Intersecting with narratives around alternative protein is the idea that traditional sources such as pig and cow, if raised ethically, are healthier and taste better. Hence, an animal raised free range and given a 'stress free death' constitutes ethical meat. Of the seven user-bios associated with these tweets, six are business orientated, i.e. beef producing farms or insect protein start-up. The upshot is that businesses seek to demonstrate an ethical stance toward meat/protein production, but what constitutes 'an ethical stance' is malleable. Nevertheless, this ostensibly represents a more compassionate stance toward [meat] production and processing of animals; *"Some happy lambs leaving our farm for the 6 minute journey down to our abattoir #lowstress #ethicalmeat"*.
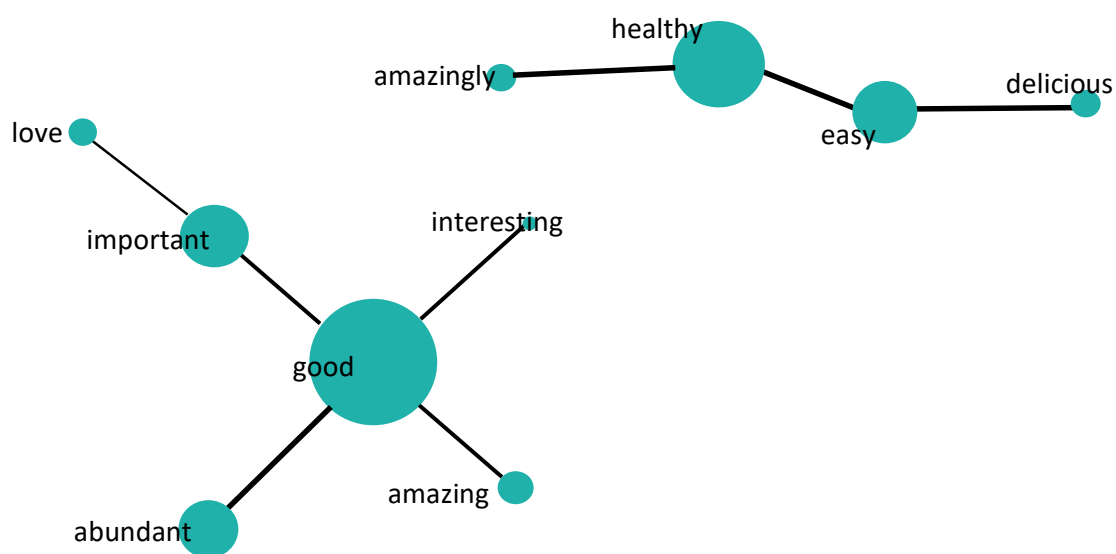

Figure 4. Textometrica map illustrating positive affect terms

Eighteen negative affect terms used in a relevant affective context with a cumulative frequency of 56, were identified. Textometrica selected four normalised co-occurrences, mapped into four separate clusters (figure 5). Of these clusters, the strongest co-occurrence (1) occurred between the terms 'bad' and 'abusive' in only one tweet, *"Industrialised meat = bad for people and abusive to animals"*. Cluster two reflects 'endangered' and 'difficult', in two tweets; *"The problem is, with the way our food supply system is set up, it is very difficult to eat 'Ethical Meat' even if you want to. British fish and chip shops are serving endangered sharks to customers…"*.
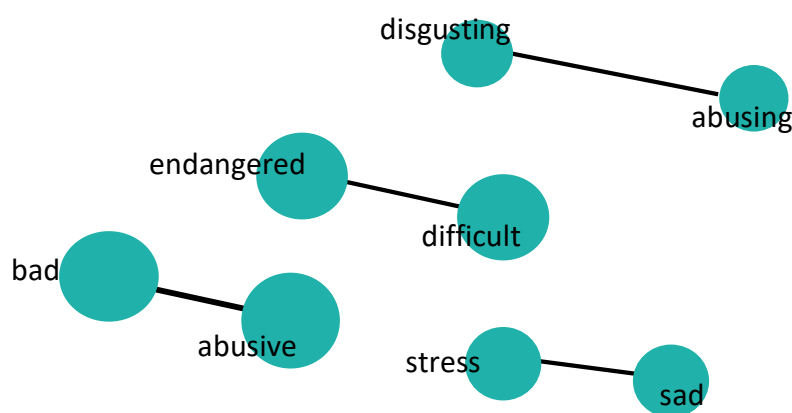

Figure 5. Textometrica map illustrating positive affect terms

Overall, Textometrica suggested that more positive affect terms were being exchanged than negative ones. Positive terms were most often associated with promoting meat consumption via recipes. However, affective term use of both types was very low.

5.2. #Eatlessmeat

The corpus consisted of 10,143 tweets from 7026 users and dating from May 6 2009 to November 14 2019. 5042 items were retweets (RTs) of 4480 original tweets, and 621 were replies. Of note is that 1068 RTs were of a single tweet affiliated with the Ellen DeGeneres show, dated September 2019; demonstrating the importance of influencers on tweet volume and hence the degree to which content is

shared. The next highest single RT volume was 109, for a single tweet by George Monbiot. The overall corpus received 196,704,195 impressions. Of the 10,143 tweets, 6968 (68%) included a potentially authentic user location and are broadly similar to those for #sustainablemeat/#ethicalmeat. However, of note are significantly lower percentages for #eatlessmeat, in the regions of Canada and Australia, and a higher percentage for all European regions.

Figure 6 illustrates the trend in number of tweets across time. While higher in volume than #sustainablemeat/#ethicalmeat, the volume in number of #eatlessmeat tweets in relation to other popular cotemporaneous hashtags is low. The trend across time is of a linear yet low-level increase in volume. Before 2019, volume peaked at >150 tweets on nine occasions. However, the spike in volume occurring in August and September 2019 relates to only two tweets. The increase approaching September 17 largely reflects two tweets with moderate RTs (52 and 56 RTs). The first of these originates with a user, bio indicating 'climate campaigner'; *""Land is where we live. Land is under growing human pressure. Land is a part of the solution. But land can't do it all. [time to act on climate]"*. Between September 17 and the volume decline occurring around September 23, 1368 tweets were posted. Of these, 1019 were RTs of the single Ellen DeGeneres tweet; *"Be neat. Eat less meat. It's good for the planet, for the animals, and you"*. Once again, despite an apparent spike in tweets containing #eatlessmeat, one cannot assume that people viewing and re-tweeting have any particular investment in an issue beyond [in this case] being a follower of Ellen DeGeneres.

Figure 6. Trend in number of tweets over time
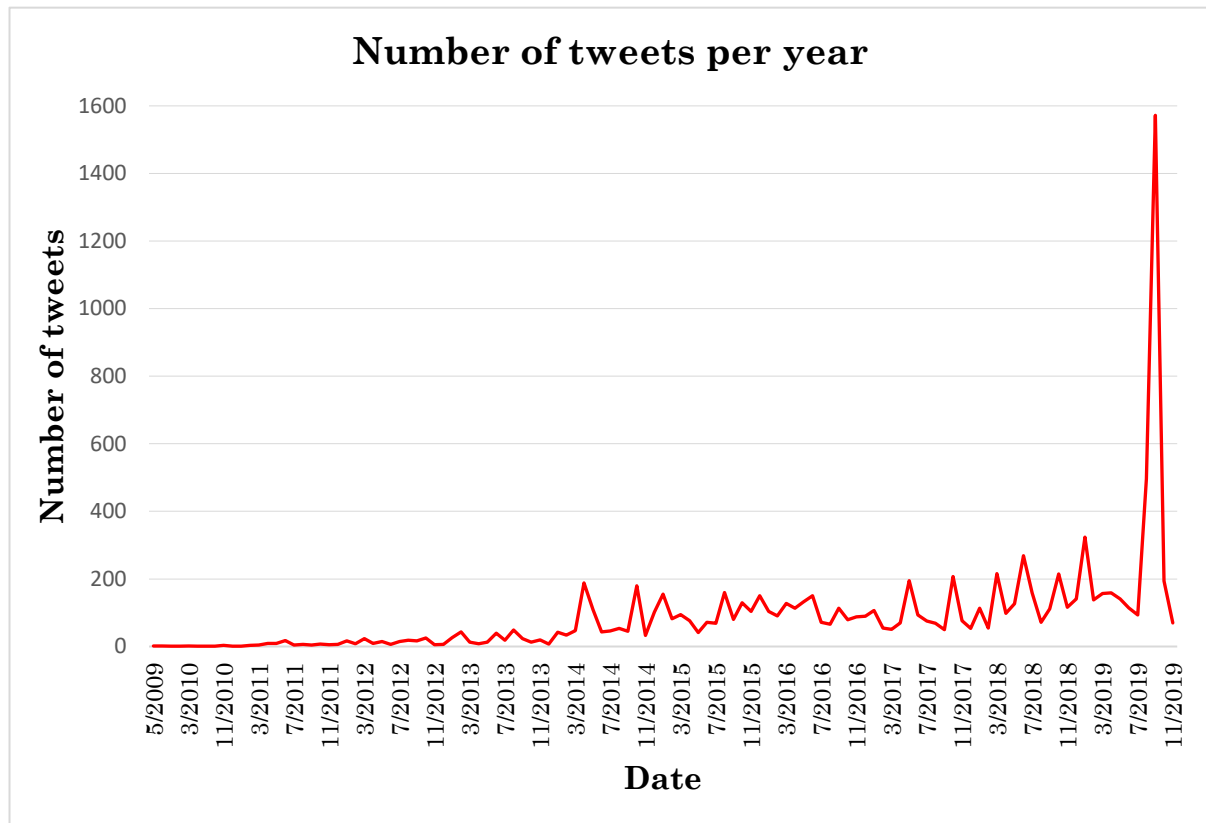
Seven thousand and twenty-six users accounted for the entire corpus of 10,143 tweets. However, only 866 (12%) users tweeted more than once and 152 users fewer than 5 times. The bio of the most prolific user (n=139 tweets) states *"[the] CEO [of a] global public relations agency, that focuses on vegan, plant-based, green and animal friendly businesses"*. The second most prolific tweeter (n=118) was *"Sustain: The alliance for better food and farming advocates food and agriculture policies and practices that help people and the planet"*. In comparison to #eatlessmeat, 16% of users using #sustainablemeat/#ethicalmeat tweeted more than once.

Five percent (n=350) users were randomly sampled and their bio assessed. The most recurrent type of user, 53%, was categorised as "Individual not orientated to meat or environment" (figure 7). This type of bio indicated no organisational affiliations and a diversity of interests, witticisms, and reflections. In total, 21.1% of bios were explicitly aligned with an environmental issue; including food awareness; eating less meat; and sustainability. This drops to 18.8% when bios with a business interest as primary,

are discounted. A primary concern with a business associated with food, irrespective of environmental affiliation, accounted for 11.1% of bios.
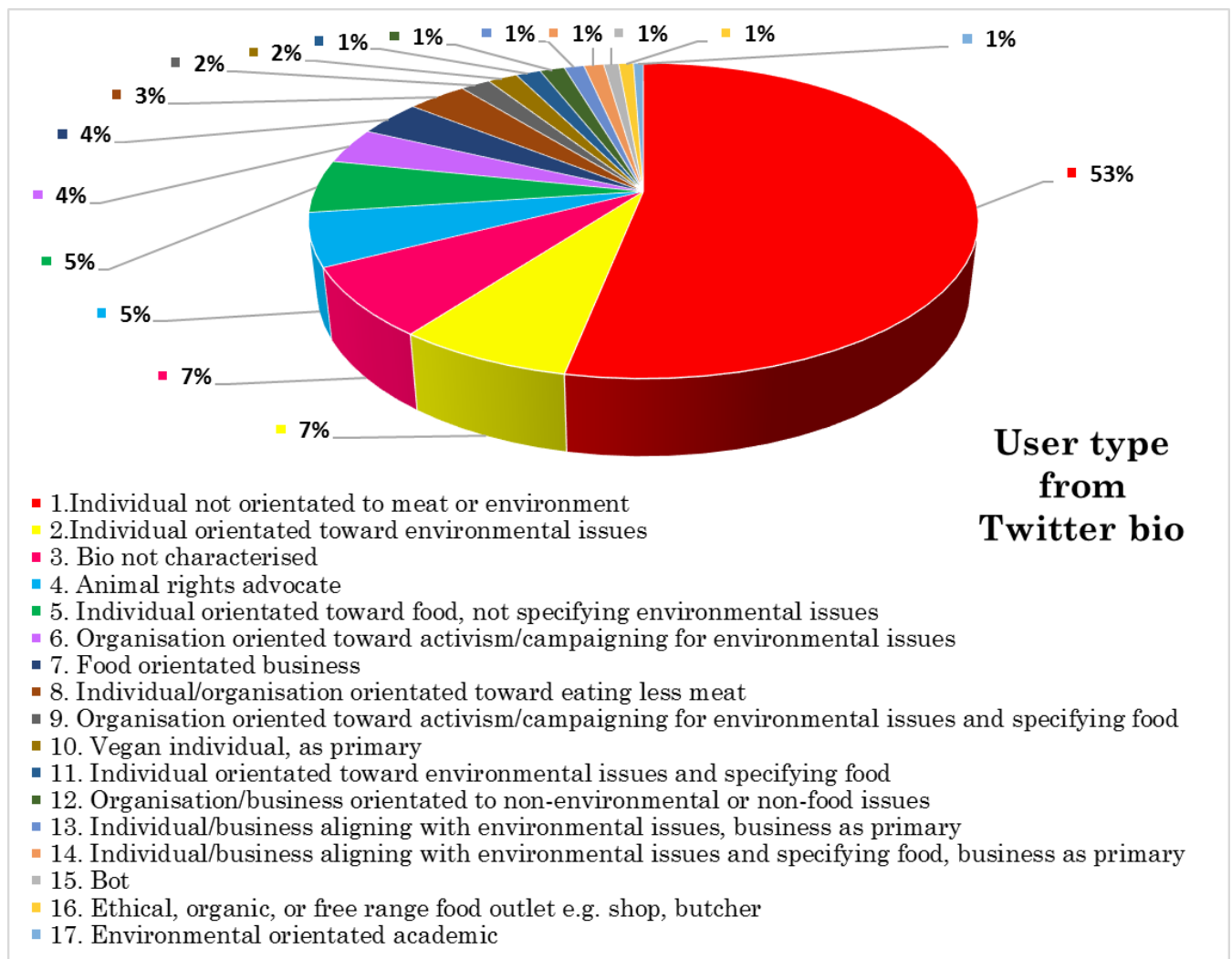
Figure 7. User type from Twitter bio

These results contrast somewhat with bio demographics for #sustainablemeat/#ethicalmeat. In the latter case, only 32% of bios were not orientated toward a food or environmental issue. Moreover, 59.3% of #sustainablemeat/#ethicalmeat bios were orientated in way or another toward meat, food and/or sustainability issues. In the case of #eatlessmeat, 74.6% of bios were *not* orientated to either environmental/sustainability or food issues.

Textometrica identified 13,468 unique terms in the corpus. Of these terms, 129 unique terms were retrained following scrutiny of tweets. Of note is that 28 of these terms were hashtags; see below. Co-occurrences were relatively weak, i.e. terms were not appearing together in a homogeneous and uniform manner across the corpus and account for only 43% of the 5101 original tweets and replies. Hence, there is variation in *how* the issues around #eatlessmeat are discussed. Overall, 6 concepts were constructed (Table 2). Due to the heterogeneous content of tweets that contained a given term, constructing a large number of discrete, homogeneous concepts was not possible. To do so would have meant obscuring heterogeneity and conferring greater semantic similarity than actually existed.

Table 3. Top six concepts identified for #eatlessmeat tweets

Concept	Document frequency	Example tweet
Solutions to climate change	1577	To Fight climate Change, the Entire World Will Have to #eatlessmeat.
Veganism as a positive	579	Federal report: vegan diet best for planet What do you think? #EatLessMeat #EatMorePlants As a vegetarian/ vegan, I won't take the time out of my day to do this. I don't force others to change their eating habits. I explain to them why it's better, and the lives that could be saved. #EatLessMeat
Determinants of environmental effects such as climate change	469	Animal agriculture is one of the most damaging problems we face. CO2 emissions, methane, deforestation. #EatLessMeat
Problems associated with climate change	341	Little changes to our diet can go a long way. Yes it might be inconvenient but lol so is global warming. #ClimateStrike #ClimateAction #climatechange #eatlessmeat #MeatlessMondays #veganism
Animal rights	144	ou can judge a man's true character by the way he treats his fellow animals. #Cowspiracy #Vegetarian #Vegan #animalrights #AnimalCruelty #EatLessMeat #NoMoreMeat #BlogPost #jeremieandre_fr
Meals	87	It's so easy these days to eat well (and still have your favourite meals) without meat. Just this

		week I've had: -Amazing vegan bacon pieces - Vegetarian scampi […].

The concept with the greatest document frequency was "Solutions to climate change" [1577 tweets]. This tagline captures key ways in which people believe or suggest environmental issues can be mitigated, including, for example, decreasing the production and consumption of meat/meat products in the belief that production is a major contributor to greenhouse gases. Ideas such as 'meat-free days' can facilitate this process and we might therefore predict an increase in references on Twitter, other social media, and elsewhere to, for example, 'earth-friendly diets' because this is the type of 'frame fragment' (Fellenor et al., 2018) that is easy to propagate and achieves aphoristic status.

In contrast to #sustainablemeat/#ethicalmeat, other hashtags *associated* with the concept "solutions to climate change" are more prolific. Hence, hashtags such as #eatmoreplants, #climatediet, and #meatfreemonday are used to frame the key issues. They also propagate and cluster. Within tweets about "solutions to climate change" there is a low level of reference to the role of governments and/or policies. For example, synonyms of 'government' appear in less than 30 original tweets; synonyms of 'policy' appear in less than 20 original tweets. The term 'health' and the issue of human-health and diet is secondary to concerns about planetary health; 'health' predominantly co-occurs with 'environment' in a secondary cluster not associated with solutions to climate change.

To explore this further tweets (n=463) containing 'health' and its synonyms were separated and analysed as a subset of the #eatlessmeat corpus. The bulk of these tweets primarily involved planetary health, rather than human health, or the two issues together, for example "*This is a great step for animals, the environment, and human health #EatLessMeat #Flexitarian #AnimalWelfare*". Textometrica mapped 11 clusters. Human health issues included the association between detrimental effects and eating less meat, e.g. "*#EatLessMeat will damage human health because vit B12 is essential for human health and brain development. it's only found in animal foods. Vegetarians and vegans are usually deficient […]*", and "*WARNING; eating a meat-based diet may seriously impact upon your*

health. Not recommended for weight-gain [...]". However, the number of such tweets was less than five and this was the case for the strongest co-occurrences around health; of 362 mapped co-occurrences, 115 had the value of one. This occurs when there is high homogeneity between analytical units or when there are a very low number of analytical units, e.g. tweets; the latter case was apparent. Where tweets mentioned 'health', this was largely concerned with planetary health rather than human health. The top concept "solutions to climate change" overlapped with the second most populated concept, "veganism as a positive", in 295 tweets.

5.2.2   Tweets and affect

Of the 13,468 unique terms in the corpus, 75 positive affect terms with a cumulative occurrence of 1228, used in a relevant affective context, were retained. Textometrica selected 47 normalised co-occurrences. The strongest co-occurrences occurred in only one tweet, between 'connected', 'brave', and 'admirable; *"brave and admirable dealing with consequence but must fight the causes #palmoil #sharkfin #ivory [...]"*. Of note is that selected co-occurrences were almost exclusively limited to individual tweets. This suggests that no particular positive affect term was being enrolled for a particular purpose.

Only three co-occurring terms appeared in more than one tweet; 'delicious'/'easy' (10 tweets), 'good'/'love' (11 tweets), and 'delicious'/'love' (11 tweets). 'Good'/'love' was used to connote how much an individual liked a food, e.g. *"I do love a good veggie burger from time to time"*. It also reflects narratives connecting the mode of food production with the quality of food and an implicit ethic, as in "*Yes me too. And good eggs from happy hens. I love orange yolks! Trying to #eatlessmeat too"*. This narrative was apparent in the majority of tweet connecting 'delicious'/'healthy'; *"Up early come and see us from for delicious healthy food"*. The twee*t "These panned seared carrot steaks make an easy and delicious #vegetarian meal"* exemplifies co-occurrences of 'delicious'/'easy'. The narrative connects healthy and delicious [vegetarian] food with ease of production. This is a selling point utilised by users promoting vegan and vegetarian lifestyles. Whereas positive affect terms were most often

associated with promoting meat consumption via recipes for tweets utilising #sustainablemeat and #ethicalmeat, this was not the case with tweets utilising #eatlessmeat. Overall, the number of tweets (n=84) utilising positive affect terms is low. Of the 1228 positive affect terms, the most numerous was 'good' (n=183). This term most frequently appeared in tweets denoting that what is good for human health is good for the planet.

Fifty negative affect terms used in a relevant affective context with a cumulative frequency of 279, were retained. Textometrica selected eleven normalised co-occurrences, mapped into eight separate clusters, figure 8.
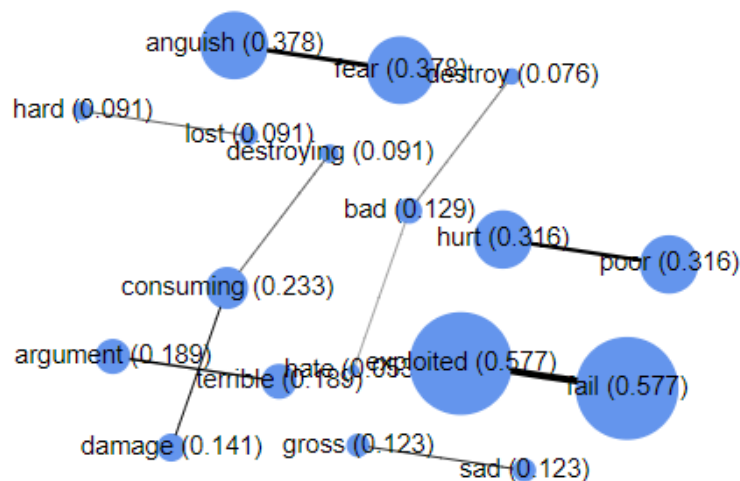

Figure 8. Textometrica map illustrating negative affect terms

Compared to positive affect terms, co-occurrences between negative affect terms were weaker. Moreover, terms were less clustered or co-connected. Each of the selected co-occurrences occur in single tweets; the strongest of which pertains to 'exploited'/'fail'; e.g. *"Over 80% of the worlds #fish have been exploited beyond recovery. When the Ocean fails we fail [...]"*. The most frequently occurring term was 'bad' (35 tweets); used variably. The most common uses were in relation to narratives around meat as unhealthy for human consumption and meat producing practices as unhealthy for the planet. Overall, there is a comparably low level of both positive and negative affective terms,

with negative affect terms the lowest. The percentage of positive affect terms, out of all unique terms for #sustainable/#ethicalmeat, was 0.39%, whereas for #eatlessmeat it was 0.55%. Negative affect terms were 0.32% and 0.37% respectively. The use of affective terms did not tend to co-occur with any one particular type of narrative. This may indicate that the contents of tweets and the associated narratives are more heterogeneous than with #sustainablemeat/#ethicalmeat.

It is useful to consider hashtags that co-occur with #eatlessmeat. Textometrica analysis conducted on selected hashtags with an occurrence of more than ten resulted in 168 unique tags occurring a total of 5002 times in 5094 tweets. Different aspects of the determinants of environmental effects and their solutions can become associated by concatenating hashtags. Less than 7% of tweets containing top occurring hashtags were about animal welfare; suggesting that hashtags and content associated with #eatlessmeat is primarily enrolled to frame issues associated with environmental effects. Table 4 shows the highest co-occurring hashtags. Climate change is the most frequent. It is useful to reflect on how hashtag use and audience are connected. For example, in *"#PLEASE #eatlessmeat. #cow #fish #chicken #pig #beef #pork #poultry #factoryfarming #nuggets #burger #pulledpork #steak #bbq #cookout #dinner #lunch #chickentenders #pizza"*, the various hashtags will, if selected, appear in the feeds of users with a particular interest in the tag. It is notable that none of the most commonly occurring hashtags are explicitly concerned with artificial or lab-based meat alternatives; this is considered below.

Table 4. Hashtags with highest occurrence [excluding #eatlessmeat]

Number	Hashtag	Number of occurrences in corpus [5094 tweets]
1	#climatechange	312
2	#meatlessmonday	204
3	#flexitarian	176
4	#plantbased	147
5	#govegan	122

6	#sustainability	101
7	#health	89
8	#meat	87
9	#environment	84
10	#savetheplanet	76
11	#eatmoreplants	72
12	#cowspiracy	67
13	#climateaction	61
14	#eatfortheplanet	56
15	#meatfreemonday	56
16	#reducetarian	56
17	#food	54
18	#animalcruelty	50
19	#blog	50
20	#animalrights	49

6. Discussion and conclusion

There is growing evidence that public debate surrounding eating less meat is becoming increasingly complex, with advocates of reductions in meat consumption being challenged by counter narratives that seek to defend meat-based diets, the livestock industry and the rural livelihoods associated with it. As Sexton et al. (2019) argue, there is value in seeking to move beyond 'us versus them' framings, focusing more instead on identifying the shared values, hopes and anxieties for sustainable meat futures. One way of doing this is to follow Latour (2004) and to recognise eat less meat narratives and counter narratives as partial, polemical and political renderings of reality. That is, to analyse them as 'matters of concern' that are emergent and open to contestation as part of a long transition to an alternative food and farming future rather than being fixed, stable and indisputable (ibid.). This 'matters of concern'

framing has particular value from a food governance perspective because it draws attention to the multiple perspectives, interests and stakes that are play, none of which can be reconciled merely by appealing to the indisputability of the scientific case for eating less meat (Tisenkopfs et al., 2019). It also draws attention to the idea that factual claims often shut down ethical disputes and spaces for normative reflection which, in turn, eliminates alternative possibilities (ibid.) and legitimises imagined futures in the present (Kneafsey et al., 2021).

The challenge for this paper was to decide where to look for evidence of these ethical questions and factual renderings and contestations. In other words, how can we appreciate different positions in order for them to be eventually resolved or to co-exist? Our focus on the way in which the eat less meat narrative has been circulating on social media platforms such as Twitter is justified by the increasingly important role social media plays as a platform that draws together different expertise, authority and communicative practices (Sandover et al., 2018). Social media provides a lens through which to observe how groups and sub-groups engage, mobilise and reason with one another. Twitter is an increasingly important vehicle for individuals and other entities to respond to those advocating specific viewpoints and to exchange views and viewpoints of their own.

The analysis of Twitter data presented hereoffers new insights into the way debates about sustainable meat are emerging in media sources as matters of concern (building on work by Lee et al., 2014, Morris, 2018 and others), as well as showing how this particular communication media generates new issue publics in terms of what is shared, and how discussions are configured. Two key findings warrant discussion. First, limited evidence of a heterogeneous and encompassing debate on Twitter around eating meat. Instead, the debate was more focused around specialist hashtags from those already invested in an issue generating the most tweets. This means that the conversation around specialist hashtags does not necessarily reflect the conversations held by a more heterogeneous mix of users. From the analysis, we also see how the #eatlessmeat hashtag is generating more frequent mentions and greater heterogeneity of content than #sustainablemeat tweets, including postings relating to ethical meat consumption that reflect planetary concerns rather than animal welfare. We also observe that while

affective terms were used infrequently across both #sustainablemeat and #eatlessmeat hashtags, there was greater diversity in the type of user for #eatlessmeat. This may reflect the ability of the hashtag to be enrolled for a greater range of purposes, in comparison to #sustainablemeat/#ethicalmeat. That there has been a gradual increase in tweet volume with #eatlessmeat across time, compared to #sustainablemeat/#ethicalmeat, may reflect the greater salience and connectedness of 'planetary' issues.

The second key finding relates to the prominence of commercial interests and their ability to use Twitter as a marketing tool (this is in line with studies of printed media, especially in relation to cultured meat (Painter et al., 2020), where strong news pegs were prompted by an industry source). The analysis shows that in comparison to #eatlessmeat, the majority of tweets using #sustainable meat/#ethicalmeat hashtags were orientated toward promoting a business or the production and marketing of a meat substitute. In other words, the hashtag is largely used to talk about commercial enterprise. Twitter affords a means of signalling a socially normative stance toward an issue while at the same time providing the means to advertise a business and increase market share; alongside tweets that denote organisational and individual ideological standpoints. In comparison, the #eatlessmeat corpus reflected a higher percentage of user bios not affiliated with a particular business or environmental concern. This might be accounted for by the connotations of the hashtags; #eatlessmeat does not lend itself to promoting a meat-orientated business. Further, #eatlessmeat shows a greater association with planetary issues than human health issues; the greatest proportion of tweets involved framing such issues in terms of determinants, effects, and solutions. There also appears to be an evolution of the 'vegan' narrative, involving a shift from primarily animal welfare concerns to planetary concerns.

Our analysis of two hashtags, as subsets of the sustainable meat narrative, suggest there is still some way to go if we are to progress from 'us vs them' to a more 'shared values and actions' framing of the meat issue. There is a distinction in our dataset, for example, between the #sustainable meat hashtag, which reflects how business actors (in the market sphere) frame the debate, and #eatlessmeat, which is more related to the public sphere. This supports the idea that narratives of sustainability are 'multiple realities' framed in different ways in public, scientific, market and policy spheres (Kirwan et al., 2017).

These findings raise wider questions about the way Twitter is used by business entities to signal and advertise ethical stances towards an issue like eating meat. To this extent, Twitter may more likely be a vehicle for accommodation rather than transformation of the food system. This is not necessarily problematic. However, it demonstrates the "performative agency of (such) platforms' in forming issue publics" (Sandover et al., 2018, p.117). Nonetheless, the role played by social media platforms in forming issue publics is perhaps only one aspect of what in effect amounts to ontological questions about the nature of such publics. For example, a basic assumption is that various subsets of the public follow particular issues of interest to them, with the caveat that it is the political context that helps these individuals obtain issue-specific information (Henderson, 2014). In the context of sustainable meat and Twitter, the political is entangled with commercial, ethical, and environmental narratives and subject positions that appear to be fluid and partial; commitments are multidimensional and heterogeneous. This contrasts with Luskin's (1990) framework for political knowledge, where certain individuals are motivated and capable of informing their political position themselves, Twitter does not represent a space where individuals are necessarily motivated to acquire [political] information about issues of personal concern. Twitter problematises simple notions of issue publics because it affords an insight into aspects that blur the boundaries between individual/social, political/commercial, and so forth. As such, the notion of the 'issue public' is best thought of a means of sensitising towards these aspects, rather than a more determined and bounded thing in itself.

A key narrative in the Twitter corpus is the emergence of how to be a meat eater but to do it ethically and in tune with nature. We observe a shift toward ethically or sustainable produced meat rather than an anti-meat stance. From a food system perspective, these particular online issue publics and their epistemic contexts coalesce more around less meat rather than no meat futures. However, we cannot conclude that involvement in a conversation indicates anything other than transient attention; i.e. tweet numbers are not necessarily a good indicator of sentiment. The relative volume of tweets around sustainable meat and using specialist hashtags are low. Hence the debate, as such, is taking place within a limited domain. This certainly appears to be the case in relation to tweets pertaining to artificial/laboratory-based alternatives. Whilst these topics were evidenced (as noted in table 2), tweet

numbers were low in relation to other topics; as were specialist hashtags. This may reflect that technological advancements, such as cultured meat, currently remain in the early stages of development. As such, we would expect to witness increased prominence in [Twitter] discussion only when they become more developed as a viable alternative and consequently afford greater representation in other online and offline media. Twitter can only tell us so much about an issue as complex and contested as eating meat and so far it suggests that in terms of volume at least, meat eating as 'matters of concern' is still in the early stages of development. However, as Twitter and social media use continues to grow and is used to promote particular discourses and interests, these media are likely to have a role in future in articulating and amplifying public concern.

Acknowledgements

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