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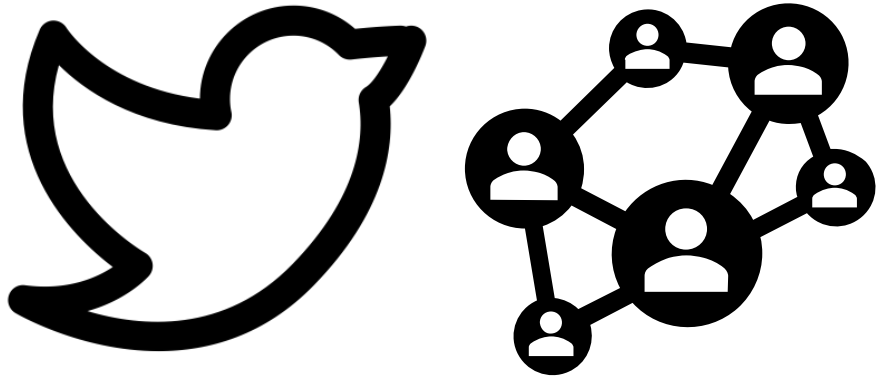

40303440 BEIS Public Attitudes to Science Social Media Analysis Waves 1-4

Report

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Nick Roberts, Amy Busby, Lauren Wiginton

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Research Design

Social Media Analysis provides valuable insights through unsolicited observations of the authentic, unfiltered voice of citizens

Social Media Insights

1 Understand long-term trends

- Identify interest around a topic, sub-topics, or competing topics
- Anticipate future trends in attitudes

2 Identify seasonal effects and key moments

- Learn *when* citizens are naturally interested in an issue
- Communicate at the optimal moment

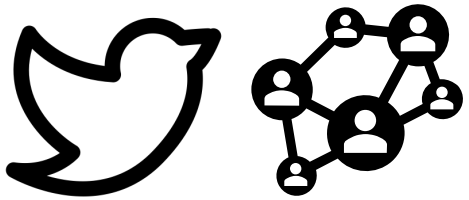
3 Identify and analyse communities and influencers

- Understand their profile, interests and motivations
- Learn who to engage and how to adapt communications

4 Evaluate the content

- Identify language used in communities
- Understand the tone, wording and arguments that resonate

Overview of the Public Attitudes to Science Social Media Analysis



This social media analysis forms part of wider qualitative work to support BEIS's 2018-19 Public Attitudes to Science (PAS) survey. PAS allows policymakers, industry, and experts to reflect upon the opportunities and challenges their work presents to the public, and in turn, can help set out a pathway to where and when those groups should best engage the public. In total, we conducted four waves of qualitative research, each focused on a specific topic of interest and consisting of:

- One week digital dialogue with 30-33 individuals
- Four focus groups with digitally excluded individuals
- Supporting social media analysis for each wave

- **Wave 1 focused on trust in science and scientists** including: perceptions of the role of science in society; aspirations and concerns about science; trust in science, scientists, scientific institutions; sources of scientific information
- **Wave 2 focused on attitudes to the use of artificial intelligence in healthcare** including: perceptions of, aspirations for, concerns about and the acceptability of the development and use of AI in healthcare; and attitudes to data use for this purpose – and variations in trust according to type of organisation
- **Wave 3 focused attitudes to the development and use of robotics technology in the labour market** including: perceptions of, aspirations, and concerns about the development and use of robotics technology; and acceptability of the development and use of robotics technology
- **Wave 4 focused on attitudes to ocean plastics pollution.**

Research objectives

Wave 1:

Explored **trust in the veracity of scientific information** online through a case study exploring trust in alcohol research and guidance. We aimed to identify:

1. The topics being discussed online in relation to alcohol research and guidance and the drivers of conversations
2. The key influencers and communities relating to online discussions about alcohol research and guidance
3. The key themes and patterns of interaction relating to online conversations about alcohol research and guidance

Wave 2:

Explored **attitudes to the use of AI, algorithms, and big data in healthcare** on social media. We aimed to identify:

1. The topics being discussed online in relation to the use of big data, algorithms and AI in healthcare
2. The key influencers and communities relating to online discussions about use of big data, algorithms and AI in healthcare
3. The key themes and patterns of interaction relating to online conversations about use of big data, algorithms and AI in healthcare

Wave 3:

Explored **attitudes to the use of robotics technology in the labour market** on social media. We aimed to identify:

1. The topics being discussed online in relation to the use of robotics technology in the labour market
2. The key influencers and communities relating to online discussions about use of robotics technology in the labour market
3. The key themes and patterns of interaction relating to online conversations about use of robotics technology in the labour market

Wave 4:

Explored **attitudes to the issue of ocean plastics pollution** on social media. We aimed to identify:

1. Explore volumes and spikes around the issue of plastic pollution of the oceans
2. Explore communities and influencers on this topic
3. Explore key themes and trends emerging on social media regarding the issue of plastic pollution of the oceans
4. Through this topic, explore what types of posts drive engagement and involvement on social media

Our analysis involved analysis of volumes, communities, and influencers as well as more qualitative analysis of key trends in the dataset

Volumes

We tracked the changing level of post volumes and explored timeline spikes

Communities and Influencers

We created network visualisation maps to identify key influencers and communities

Key posts and themes

We analyse the content of key posts to identify themes and patterns of interactions

Considerations and limitations of social media analysis

Why social media?

As social media use is now widespread amongst the general public, it is a rich source of citizen's expressions of genuine opinions, in real time and without prompting. This enables us to discover and study overarching trends and tendencies in how people discuss and interact around a particular subject in a less intrusive manner. This allows for unanticipated themes of discussion or evidence behaviours to surface that people may not always want to or think to profess to when asked directly.

In our analysis we collect discussions across a range of social media, but particularly use Twitter data to map conversations, as it is the sole platform that provides the necessary metadata to map interactions between accounts. These maps allow us to easily detect when groups of people coalesce around a particular issue or theme in order to identify larger themes and interest groups around the topic.

This social media report is intended to provide a topline “big picture” view of broader patterns and key arguments within the discussion to complement the other research components. Quantitative measures are based on full data, but qualitative analyses have been performed on a 10% random sample for ease of analysis.

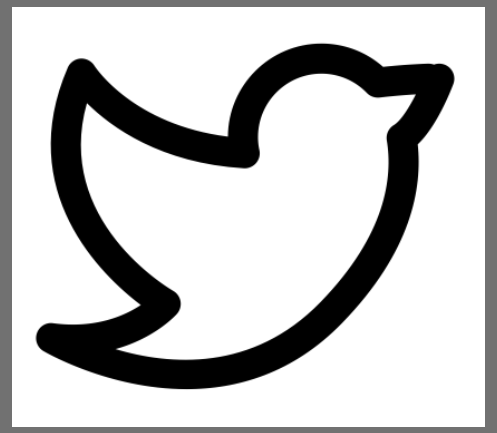
Limitations of social media

When interpreting these findings, it is important to bear in mind that such an analysis can reveal trends in discussion, but does not necessarily represent all possible views and reactions on a subject, and is not intended to indicate how prevalent viewpoints are amongst the general public.

Social media usage skews towards younger users (70% of 16-24 year-olds in the UK claim to use Twitter compared to 25% of 55-65 year-olds*) and not all those who use social media choose to post comments – many use it to passively follow what others have to say on a topic. Similarly, there are certain more sensitive topics that people may feel less inclined to discuss in a public forum.

Discussions captured on social media are thus likely to be biased towards younger, more vocal or engaged profiles, with more limited representation of viewpoints amongst those who are older or less digitally-oriented. Yet as the line between social media and real-world discussions is increasingly blurred, the most prominent viewpoints on social media are likely to influence a larger audience both on- and offline.

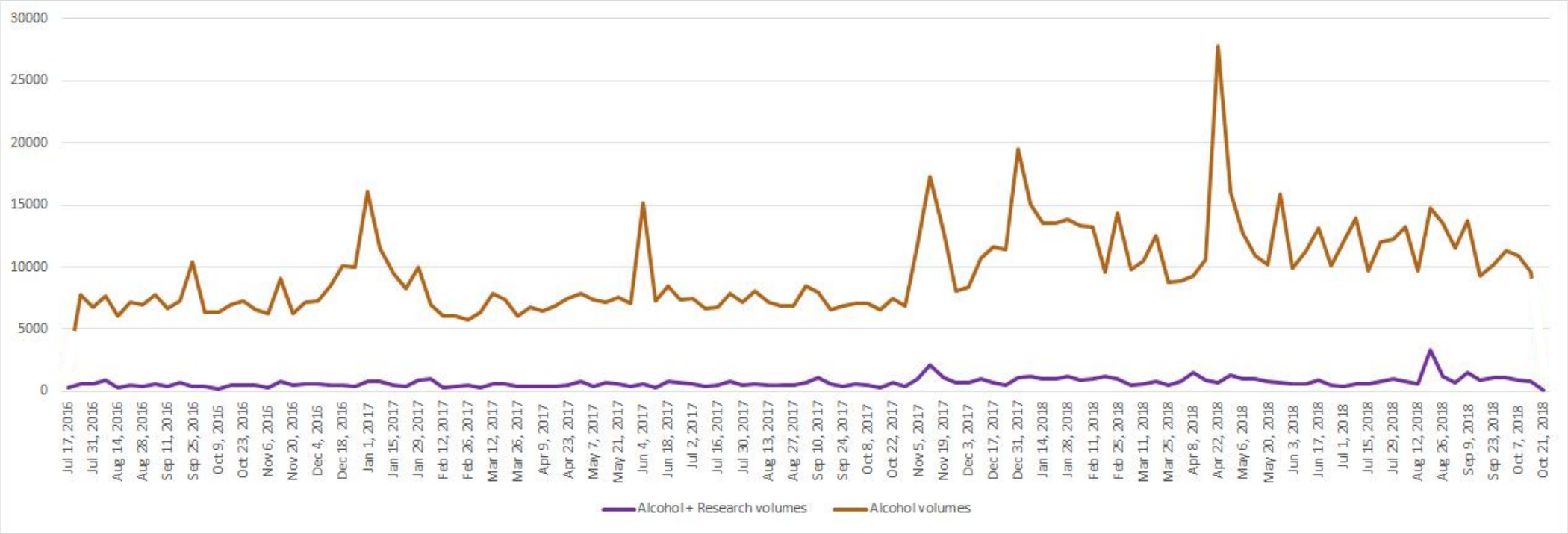
*Source: Kantar Connected Life 2018 study



2.
Wave 1: Attitudes to the veracity of information online: alcohol information and guidance case study

Research Insight	Implication
Professionals and institutions that communicated research in an accessible, relatable way, without the use of complex language tended to receive higher levels of engagement with social media users	When communicating scientific findings to the public, it is key to look for ways that the findings relate to individuals' lives. This helps to establish a personal connection that is more engaging.
While there is a lot of conversation online about alcohol in general, only a small proportion of this is discussion or engagement around alcohol research and findings	There is an opportunity and a need for scientific discussion to connect with how people are talking about alcohol more naturally – how might it engage people in the moments where they are thinking or making decisions about alcohol?
Conversations about alcohol-related research tend to be clustered among professionals and institutions mainly communicating amongst themselves, although two news outlets - The Independent & Daily Mail - managed to create discussion and engagement amongst the general public	Much of the current communication around alcohol can be seen to lack relevance or impartiality, and could benefit from presentation in a more nuanced way that clearly breaks down the risk to an individual in relatable terms
Communications framed in sensationalist or contradictory terms could prompt high levels of responses but these were mostly negative and tended to reinforce pre-existing beliefs	Framing is important – results that contradict habits or expectations might draw attention, but that attention is unlikely to translate into real engagement or behaviour change if it is framed in confrontational terms
Users expressed confusion, scepticism and become dismissive in their responses when they saw scientific evidence as contradictory or biased	Transparency of sources/funding/motivations is important to establishing trust, at least amongst some groups

Posts about research regarding alcohol consumption and in-take constituted a small proportion of the overall volumes about alcohol



Total volumes

'Alcohol'
1,121,147 posts

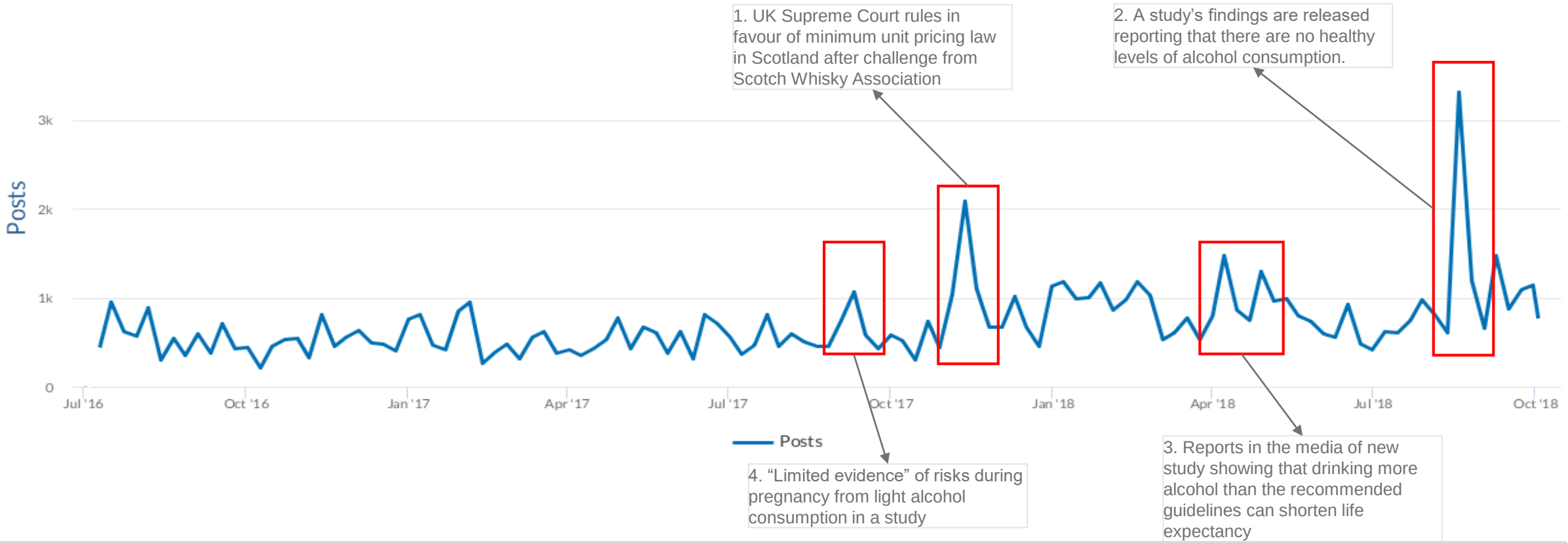
'Alcohol' + research
82,433 posts

There were large volumes of posts about alcohol – but social media users do not commonly use this space to engage with research and discuss scientific guidance about alcohol consumption and intake

Analysis of conversations across the spikes found that:

- **Posts about ‘alcohol,’ as a stand alone topic, were dominated by content about ‘going out’ drinking, getting drunk, and locations** where users were drinking or planning to drink
- **Social media was not used as a space for people to seek guidance from health care professionals**, rather it was commonly used as a space to share information about in-the-moment drinking behaviour and choices
- **Social media users also commonly sought and made recommendations related to drinking choices, opportunities, and alcohol brands** – it was a space where users shared advice and recommendations with regards to alcohol consumption and choices

There were typically around 500-1,000 posts per week about alcohol research – and in the last two years there have been four notable spikes in conversation



Spikes in volume were normally generated by the release of new information regarding research about alcohol consumption in the UK, legal changes that would impact alcohol consumption, and changes to health guidelines

Analysis within these conversation spikes found that:

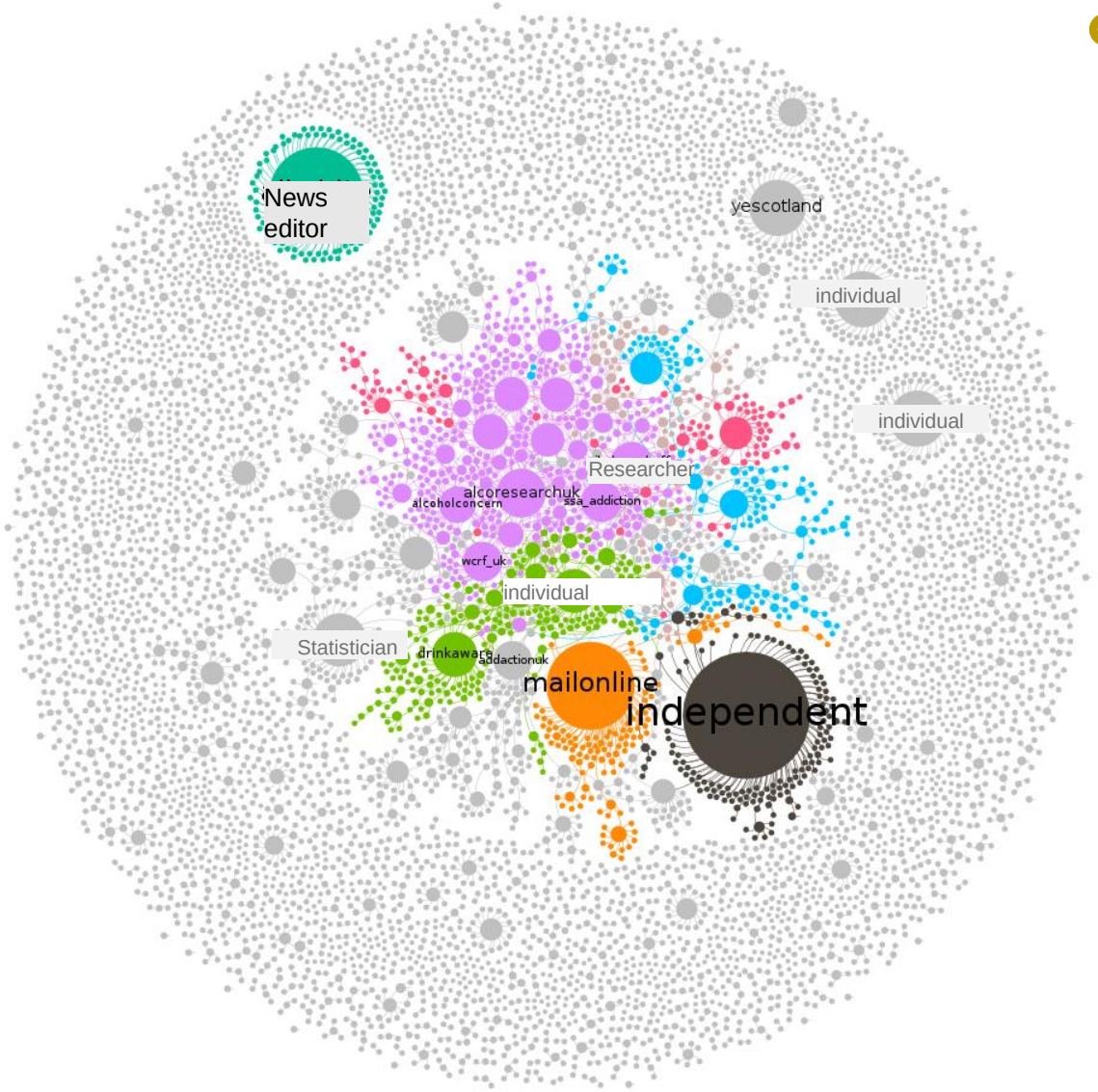
1. **The most significant spike concerned the release of new information regarding alcohol consumption guidelines –** in August 2018 a study's findings were reported by several news outlets, study stated that there are no healthy levels of alcohol consumption. A BBC Health News article generated high levels of engagement and illustrated the typical social media user responses to news about the research, generally negative, dismissive, and sceptical
2. **A report about alcohol reducing life expectancy also drove volume spikes, with mixed responses** - some questioning the veracity of such studies and others expressing a 'makes no difference attitude' – In April 2018 a study's findings were reported by news outlets. The study concluded that drinking more alcohol than the recommended guidelines can shorten life expectancy. A BBC article generated a lot of engagement and typical responses illustrated users distrust and dismissiveness of the research presented in this article
3. **As well as changes to consumption advice, social media activity also spiked in response to changes to alcohol legislation –** in November 2017 articles in news outlets reporting on UK Supreme Court ruling in favour of minimum unit pricing law in Scotland. Social media responses were politicised and focused on the role of the individual and the state with regards to alcohol consumption – with discussion emerging around whether alcoholism is a choice or a medical condition.
4. **In September 2017, although it was a smaller spike, there was an interesting example conversation about alcohol advice for particular groups, e.g. pregnant women.** In September 2017 there were media reports of study which notes 'limited evidence" of risks during pregnancy from light alcohol consumption. In response to a Times article covering this, social media users engaged with the report and called out what they saw to be poor and distorted reporting of science by journalists and the media.

We created a network map of posts about alcohol research on social media to explore the conversation landscape

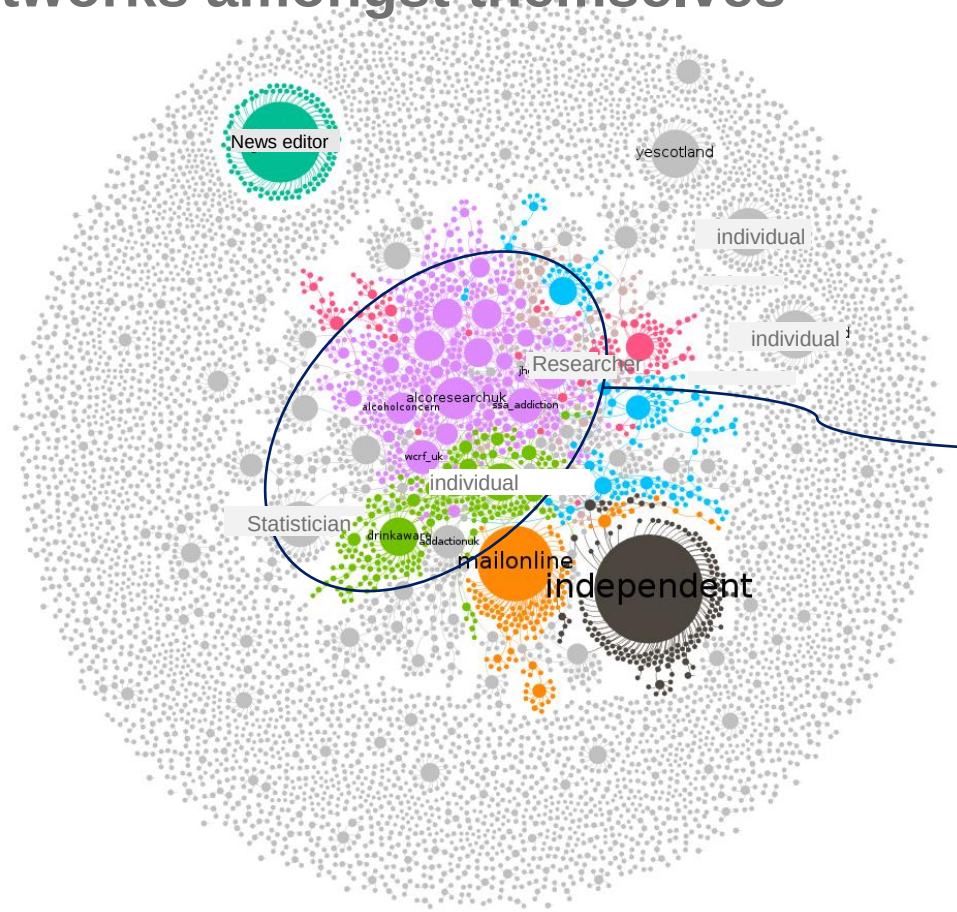
At the centre of this conversation landscape was a clustering of **professionals and institutions** communicating with one another about alcohol research.

Two news outlets dominated the space as influencers, as they had the largest impact on conversation (represented by the size of the circle) and were making connections with the central cluster.

Several outliers were also present in, but made no connections with the central cluster, indicating that they generated attention but not larger discussion about the issue.



Health sector professionals and institutions constituted the largest community for this topic – but they were primarily clustering, communicating, and building networks amongst themselves



Community members

- Individuals working in medical/healthcare sector, charities and research agencies. Some representing themselves and some posting on behalf of their charity or organisation
- Charities such as Alcohol Research UK, Alcohol Concern, Addaction, Drinkaware, World Cancer Research UK

Conversation focus

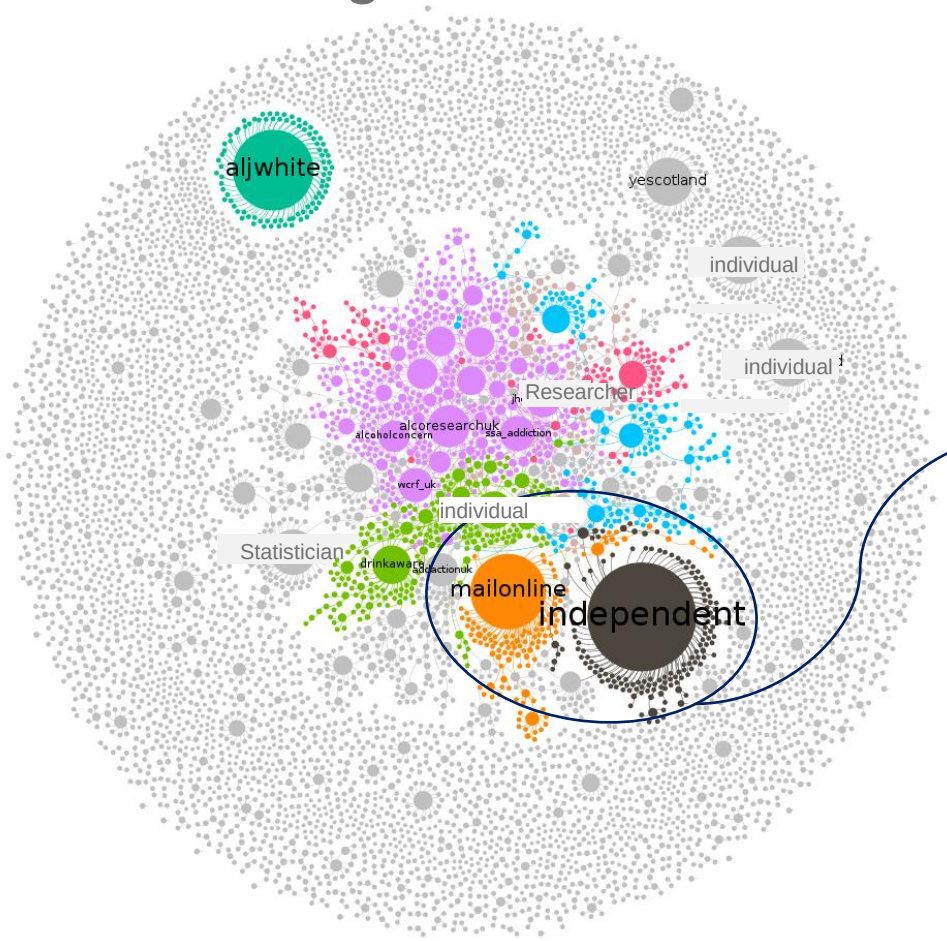
- Raising awareness about effects of alcohol consumption on health by posting advice along with links to research
- Providing evidence supported advice on alcohol consumption
- Conducting and publishing research about alcohol consumption

This clustering suggests that information being disseminated by health professionals and organisations is not reaching or being engaged with by general public social media users, and is circulating more amongst experts.

Within this community …

1. Charities used Twitter to raise awareness about alcohol consumption guidelines and evidence of alcohol related health risks, in general and during key life stages
2. Professionals posted on behalf of themselves and/or their organisation – but these posts again generated low engagement
3. Health care professionals and research agencies posted to highlight new evidence related to health effects of alcohol consumption
4. Health care professionals and research agencies posted to highlight new evidence related to health effects of alcohol consumption
5. Non-professionals in this community tended to post about statistics and studies - in this instance they posted about alcohol related research

While there were numerous news outlets posting articles about alcohol related research findings – two dominated the conversation landscape



Communities

- The Independent and Daily Mail online
- Compared to other communities in this landscape, news outlets have twitter followers in the millions while others have followers ranging from low to mid thousands

Conversation focus

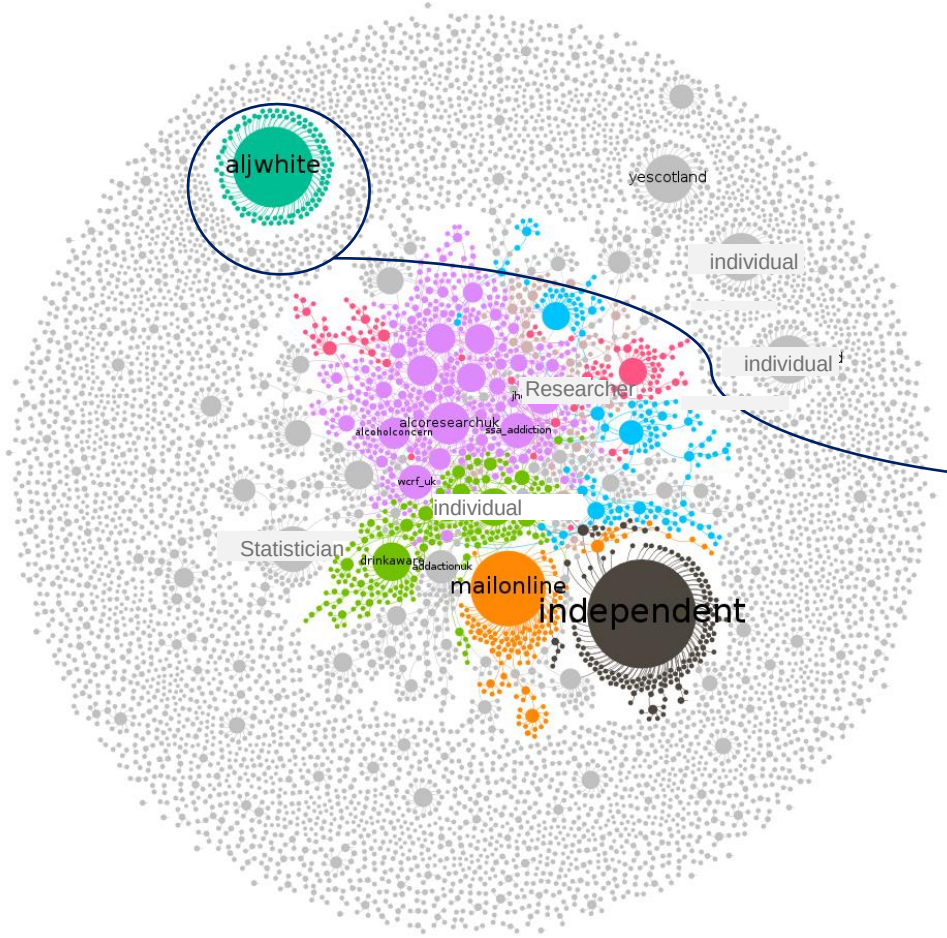
- Posting articles about alcohol related research findings
- Generating discussion among readers about research findings
- Making a few connections with the cluster of health sector professionals and institutions - although this was limited

These news outlets were interacting, in a limited way, with the central cluster of professionals and institutions. There was little interaction between the audiences, but they were posting similar content

Within this community …

1. **The Independent was a key influencer in the landscape** - its posts had the greatest impact on the conversation in this community - content of posts was mainly articles summarising new research findings related to the effects of alcohol consumption
2. **The Daily Mail Online was also a key influencer with a smaller impact on the conversation than the Independent** - Like the Independent, content of posts are articles summarising new research findings related to the effects of alcohol consumption. Responses were similar to those comments from Independent readers – positive when behaviours are reinforced and sceptical or dismissive when it suggests changing behaviours.

There were outlying influencers that generated content that got social media users' attention - but fell short of making wider network connections



Who is this outlying influencer

- Editor for Buzzfeed news, based in the UK, posting on their twitter feed

What are these influencers doing and saying

- Posting content about research finding and other content related to the topic alcohol, alcoholism, and mental health

A small number of other outlying influencers generated content - but like the example above did not make wider network connections with other communities, creating a one-off response that was disconnected from the broader conversation

Within this community …

1. **A user posted media content about UK politics and politicians** - in one instance they posted video content related to alcoholism – this post generated 1,884 retweets, 3,570 likes, and 39 comment
2. **A video clip from Channel 4 news showing Nicola Blackwood's, former MP for Oxford West and Abington, and former Chair of the Science and Technology Select Committee, reaction to another MP's story about his father's alcoholism**. This sparked conversations about alcoholism and the role politicians play in influencing views – this type of post/event presents an opportunity for building networks. Despite the number of retweets, likes and comments, this post does not link up with other communities in the network.
3. **Emotional stories and videos present opportunities to interest and engage users** – however in this case there was no link made to the wider research and conversation online about alcohol – meaning this was a missed opportunity to make research more personal

We qualitatively explored the content of the conversation landscape to identify key trends and themes

Here we present key trends and themes regarding **the ways in which social media users talked about and assessed the veracity of alcohol research** and information online

This provides us with **an understanding of the ways in which social media users react to scientific information online** – and provides some insight and **lessons for the ways in which scientists can improve engagement** with the public online

Key conversational trends in the landscape included:

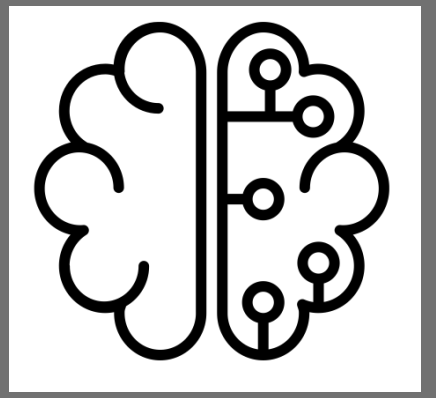
- **Trend #1: Social media users typically included alcohol guidance in with broader online discussions about healthy lifestyles** - although these posts were not typically linked to research and evidence, they demonstrated users' consideration of alcohol consumption guidelines within other lifestyle attitudes and behaviours

- **Trend #2: A key trend was positive posting about new scientific evidence that reinforced users' own views and behaviour regarding alcohol consumption** – particularly when universities or medical journals were sources - social media users shared content and engaged with evidence that reinforced their views and current behaviours and did not tend to question the source of the research. However these types of posts may relate to these community members' wider values. However this changed when they suspected research was commissioned by those with a vested interest, users were distrustful of alcohol research they saw as biased. Users did not trust research by the alcohol industry because they saw them as self-interested and became distrustful of scientists and their research when they suspected it was sponsored by industry, suggesting that it is important for scientists to be clear and transparent about the funding of their work.

Key conversational trends in the landscape included:

- **Trend #3: Users were frustrated when they perceived scientific evidence about alcohol as contradictory - becoming dismissive and sceptical as a result -** the communication of what appears to be contradictory advice and evidence about alcohol intake can reduce trust in science and scientific research on the topic and health advice more widely. Along with dismissive responses - users expressed suspicion about reports being misleading or biased when they saw advice as contradictory. Users were distrustful of scientific research which seemed to promote alcohol in contradiction to other health guidance they were familiar with – when they suspected it was sponsored by the alcohol industry.

- **Trend #4: When new scientific evidence suggested a reduction in consumption behaviour - users tended to share frustrated, annoyed, and dismissive posts** – they were less likely to engage with this topic and scientific findings when they challenged their current behaviours. Research suggesting this needs to do more to actively engage the public as they are less receptive.



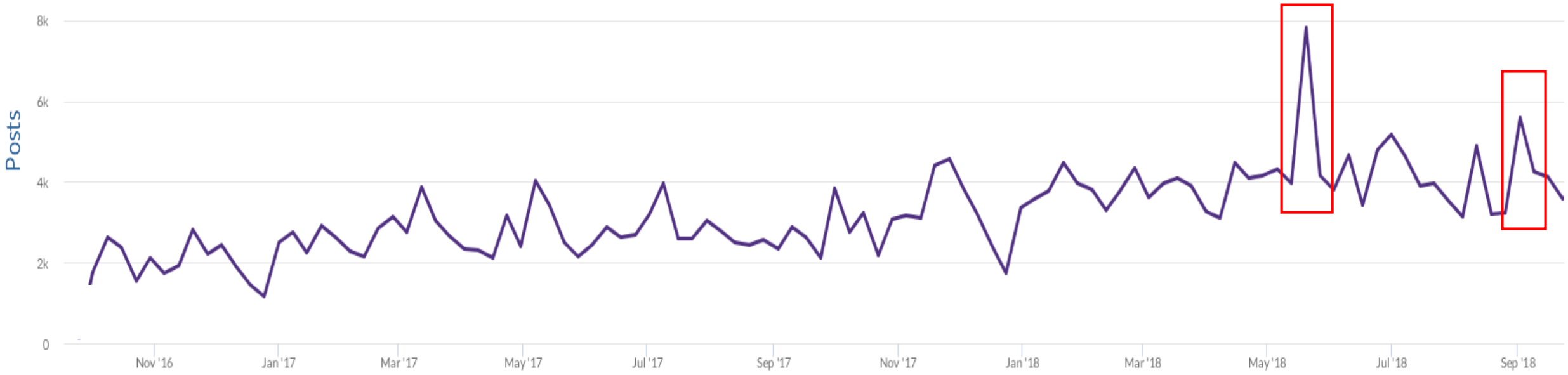
3.
Wave 2: Attitudes to the use of artificial intelligence in healthcare

Research Insight	Implication
There has been steady growth in conversation volumes about this topic over the last two years. However, this growth has been driven by individual posts with relatively little engagement with them. Spikes tended to be driven by new developments in the sector and government announcements about public support for healthcare AI.	**This is a growing area of work promoting the technology but at the moment social media is not the place for interaction among players in the field and the wider public**. However, when government makes announcements about new developments, this generates interest among various organisations in the field.
The conversation landscape was dominated by healthcare and technology sector professionals and there was low engagement with their technical discussions. Currently technical language used by professionals seemed to be a barrier to public engagement with some of their posts. Greater public engagement was driven by posts about concerns and implications of the introduction of AI into healthcare.	**To engage the public in these conversations,** it is important to use accessible language and to provide relevant and tangible examples – to explain how AI works and what the benefits and risks are for the public.
Online debate about this topic was polarised – companies and government were promoting AI while healthcare professionals were providing a critical voice about lack of consultation, validation, and transparency.	**Currently posts and comments about this topic tend to take either positive or negative view points**, and there is space online for more mediating voices and more nuanced discussion, particularly about how to address risks.

Research Insight	Implication
On social media, the key benefits, presented mainly by technology companies and government, of the use of AI in healthcare are seen to be that it saves the NHS money; improves the speed and accuracy of diagnosis; increases opportunities for greater patient control, and improves reach and accessibility of healthcare. These posts tend to receive low engagement from the public.	Currently, there is low public engagement with the promotion of the benefits of these technologies. More accessible language and using more relevant, tangible examples could help to engage the public in these discussions, allowing them to contribute.
The key risks and concerns raised about the use of AI in healthcare were scepticism about the NHS's capacity and ability to implement new technologies effectively; risks to patient safety and lack of clarity about liability issues; concerns about lack of transparency about algorithms and data sharing and use practices; and the lack of development of regulatory and ethical processes	**Interest groups and some members of the public have identified a range of concerns about the technologies.** There is a desire, among the public, for regulation and interest groups want to see greater transparency from government and companies that are promoting the use of AI in healthcare.
Tensions are present in these conversations between the healthcare and technology sector, and highlight the healthcare sector's concern that the technology sector are not doing enough to address potential risks before new developments are introduced.	**Awareness of these cultural differences between the healthcare and tech sectors** could help to mediate and develop more nuanced conversations in this space.

The last two years have seen steady growth in conversation about the use of AI in healthcare on social media - in 2017 posts typically fluctuated between 2,000- 4,000 per week which rose to typically 4,000 – 5,000 per week in 2018

In the last eight months there have been two notable spikes in conversation – mainly due to an increase in individual posts on the topic, with relatively low further engagement with these through retweets, likes and comments



Spikes in volumes were generated by government announcements of support for use of new AI technology applications in healthcare and the introduction of the AI and Data Grand Challenge, as part of the Industrial Strategy

Analysis of conversations across the spikes found that:

- **The most significant spike concerned the Prime Minister's announcement of the AI Grand Challenge and introduction of free WiFi in GP surgeries to allow use of health apps there.** In May 2018, despite the spike in the number of posts on the topic from news and government related sites, there was relatively low engagement from the general public on these social media posts; no comments, and a small number of retweets and likes.
- **A later spike concerned developments in the area such as announcements about reports on how the UK can use AI and new AI partnerships being launched in the UK.** In September 2018, despite the spike in the number of posts on the topic, mainly from interested parties posting on Twitter, there was relatively low engagement from the general public; no comments, and low number of retweets and likes.

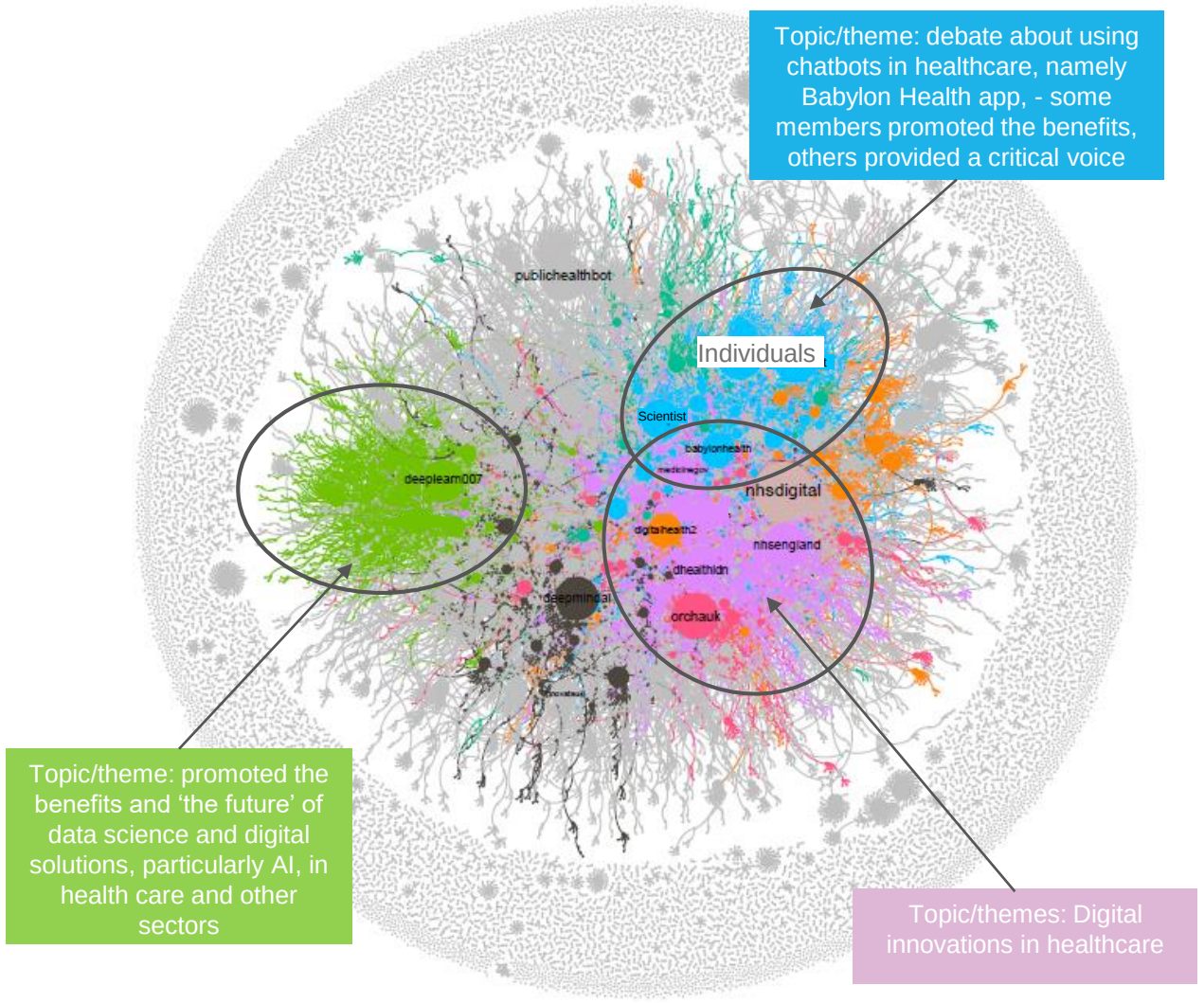
We created a network map of social media posts about the use of AI, big data, and algorithms in healthcare to explore the conversation landscape

At the centre of this conversation landscape was a clustering of **professionals,** made up of **3 dominant communities**

There were three main topics of conversation:

- Data analyst/data analytic companies talked about the use of big data and AI diagnostic tools;
- Health services and digital experts talked about digital solutions for healthcare;
- Independent healthcare professionals and the wider public talked about AI, specifically about use of chatbots/apps for medical diagnosis, and about healthcare in the digital age.

Overall, many connections can be seen between the main communities, more so between the health service and digital experts community and the independent healthcare professionals and wider public community. News outlets, government regulators, and public health advocacy groups less commonly featured as key influencers in this landscape.



In this community, data analysts and data analytics companies primarily communicated and built networks amongst themselves with limited connections to the other dominant communities

Community members

- Data analysts and business consultants: individual data analysts/scientists, software developers and companies offering data analytics and digital innovations (e.g. SAS software, PwC, IPFC Online)
- Some experts post independently and others as a representative of their company

Conversation focus

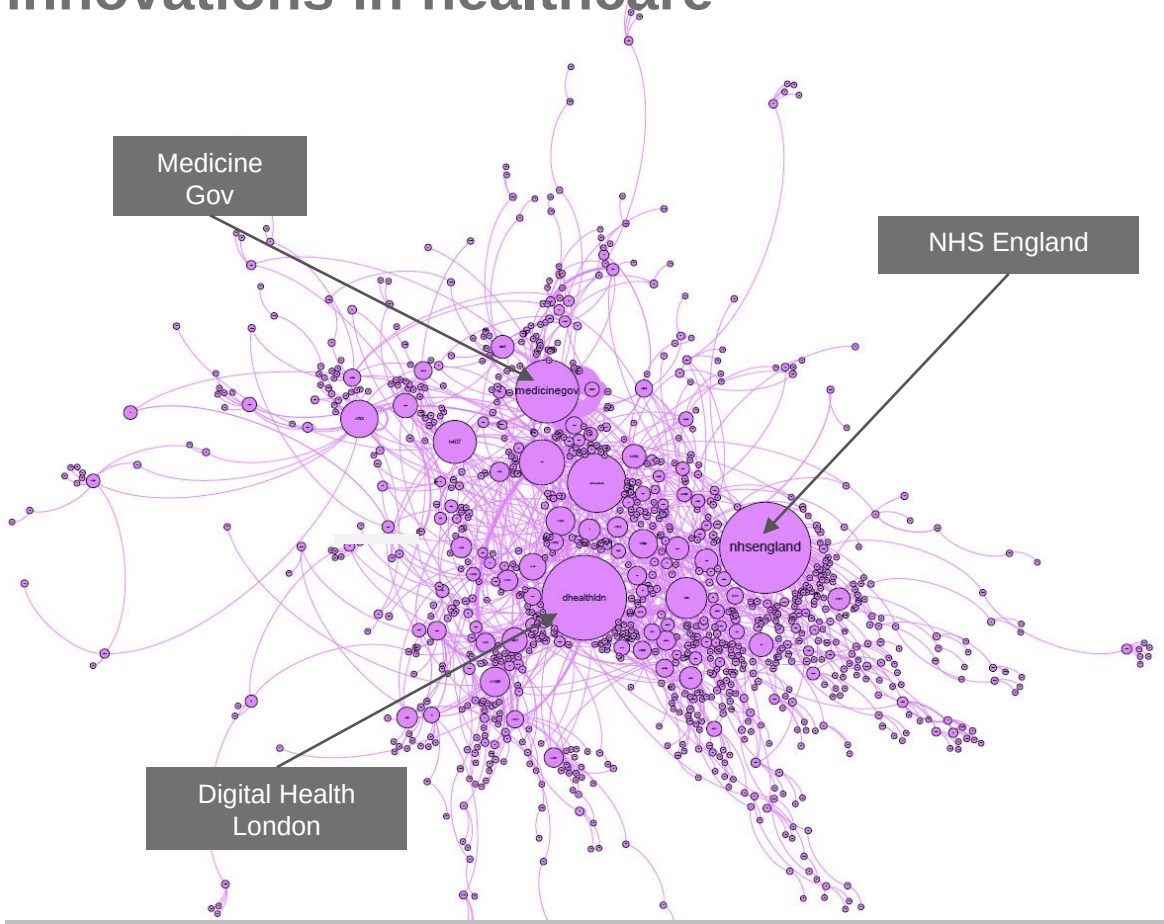
- Posts mainly about the benefits and 'the future' of data science and digital solutions, particularly AI, in the healthcare sector
- Posting about upcoming conferences, launch of new technologies and/or use of technologies in a new sector

There was low engagement with the wider public within this community, meaning the expert information and discussion occurring here was not being engaged with by the general public

Within this community …

- **Data analysts and representatives of data analytics companies use Twitter to communicate the benefits of the use of AI in healthcare.** Content mainly focused on: promoting the role of IT in healthcare; sharing articles and reports that highlight benefits of AI in healthcare; and upcoming conferences and introduction of new technologies. There was limited impact with little to no comments on posts and retweets and hashtags often refer to one another in the community.

In this community, healthcare institutions, digital companies working in the healthcare sector, and their intermediaries used Twitter to raise awareness about innovations in healthcare



Community members

- IT companies (small and large) working in the healthcare sector, healthcare institutions (NHS), and intermediaries supporting digital solution campaigns, and IT news publication (e.g. NHS England, Digital Health London, Medicinegov, Computerweekly)

Conversation focus

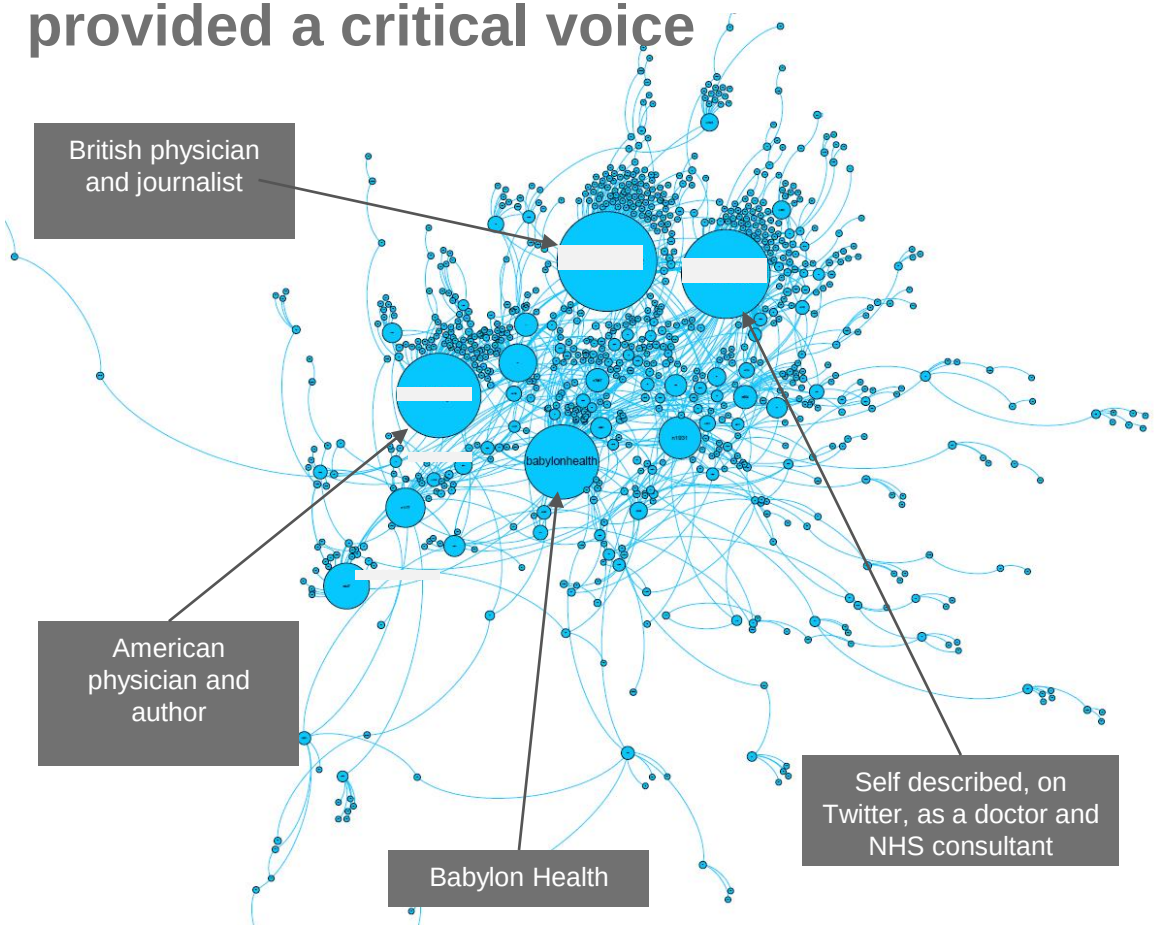
- Raising awareness and posing questions about innovations in health and posting about opportunities to engage in online debate about these innovations
- Discussions about the future of IT in healthcare systems

Posts are technical / academic and obscure the topic for the wider public, or assumes that they are aware of the implications; the groundwork hasn't been sufficiently laid for the public to engage with this material

Within this community …

- **Posts in this community attempted to spark debate and/or provide opportunities to discuss and learn more about healthcare in the digital age - but these posts generated low engagement.** Typical posts in the community focused on raising awareness and posing questions about tech innovations in healthcare or providing links to online debates and events that highlight the future of IT in healthcare systems (virtual expos/conferences as well as real life events). There was little impact associated with these tweets, there were low numbers of retweets and likes, and typically limited comments. Re-tweets were mainly among professionals, in healthcare and/or technology companies.

This community formed around the debate about using chatbots, namely Babylon Health app, in healthcare - some members promoted the benefits, while others provided a critical voice



Community members

- Healthcare professionals (a public facing British physician and journalist), an MP, interested members of the public (one self described as a doctor and NHS consultant), and a health service provider

Conversation focus

- Benefits of use of AI – cost savings, efficiency and speed, improved accuracy and greater control
- Critical voice about use of AI - expressed the need for transparency in data sharing practices, providing published evidence of validation, further validation prior to public release, and further period of consultation with the public

Professionals, providers and the public were more likely to engage in this debate about AI in healthcare than other topics, because the topic is more tangible and relatable to people's lives rather than abstract and technically focused

Within this community …

- There was discussion in this community about the implementation and implications of AI in healthcare. An example included Babylon Health posted about their AI tool passing the Royal College of GP's exam. The tone of this post was positive and excited - stated the value of the AI and it's ability to match and potentially exceed accuracy of 'real-life doctor'. Typical responses showed an overall scepticism – some called for peer review, published evidence, and further validation and fewer responses weighed the pros and cons.
- In another example a doctor who was a critical voice and key influencer in this community engaged healthcare professionals and the wider public in debate about the use of AI in Healthcare. His posts discussed things such as the use of chatbots. Much of the discussion, seen in the comments, was about the potential risks of technologies being launched without rigorous validation.
- Compared with other communities that focused solely on the benefits, this community discussed the negative implications and sparked more conversation among social media users – both healthcare professionals and the wider public.

We qualitatively explored the content of the conversation landscape to identify key trends and themes

This section presents key trends and themes regarding **the ways in which social media users talked about the use of big data, algorithms and AI in healthcare**

This provided us with insight into what social media users saw as being the key benefits and concerns/risks of the application of this new technology in this sector

Benefits:

- Savings for the NHS and healthcare more widely
- Increased speed and accuracy of diagnosis
- Greater patient control over health records, diagnosis and treatment
- Increased reach and access to healthcare

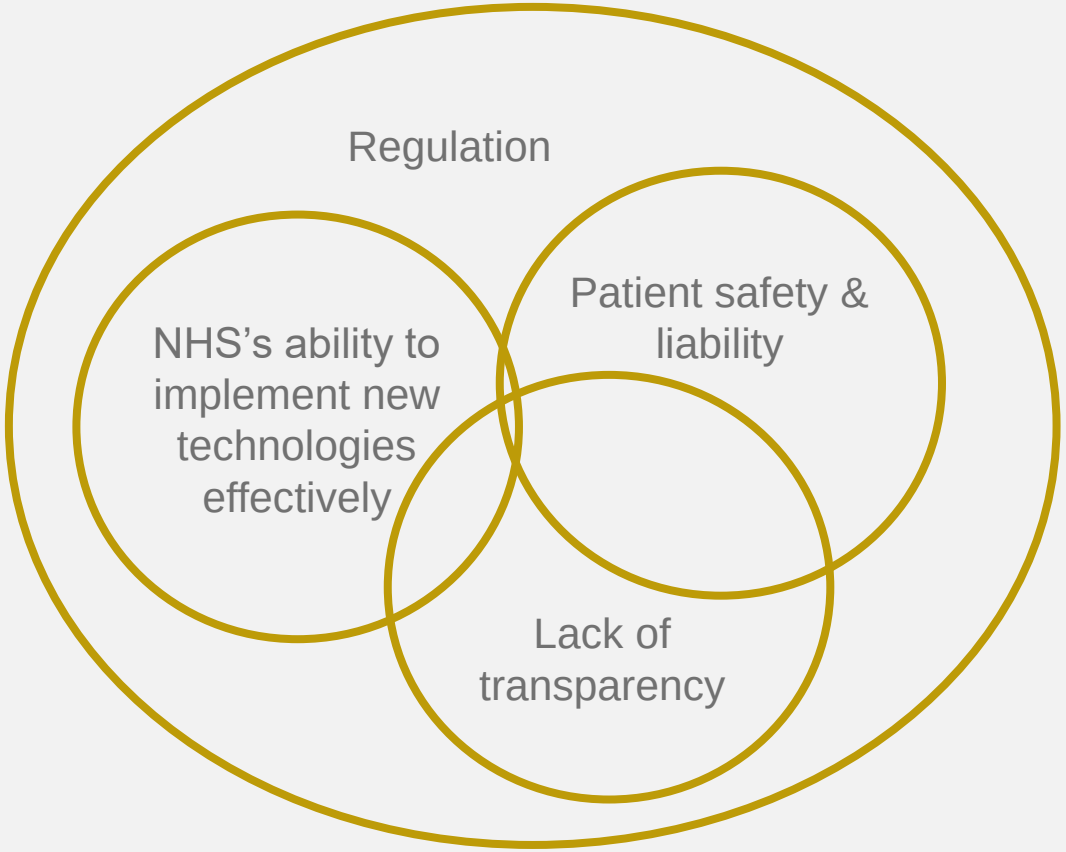
Concerns/risks:

- Lack of confidence in the NHS' ability to implement new technologies
- Patient safety and liability for unintended consequences
- Lack of transparency and regulation of algorithms, and data sharing and data usage practices

Within the conversation landscape, the benefits of the use of AI in healthcare were seen to be:

- **Benefit #1: Reduction of costs was emphasised as a key benefit of the use of AI in healthcare, particularly for the NHS –** while some companies posted regularly on Twitter about the benefits of healthcare AI, they did not engage the wider public
- **Benefit #2: Improved accuracy and speed of diagnosis were emphasised as key benefits of the use of AI in healthcare -** this topic generated limited engagement with the public, mainly retweets and likes among sector professionals
- **Benefit #3: Greater patient control over health records, diagnosis and treatment were raised as benefits of AI, and IT systems more widely, in healthcare –** the NHS was promoting the use of health tech and attempting to engage professionals and the public but with little success – engagement through retweets was among professionals
- **Benefit #4: Increased reach and improved access to healthcare were also raised as benefits of the use of AI and wider IT systems –** posts by companies generated low engagement in general and no engagement with the public – illustrated by the lack of comments for them.

Meanwhile four key concerns about the use of AI in healthcare emerged – these themes overlapped and were discussed in parallel



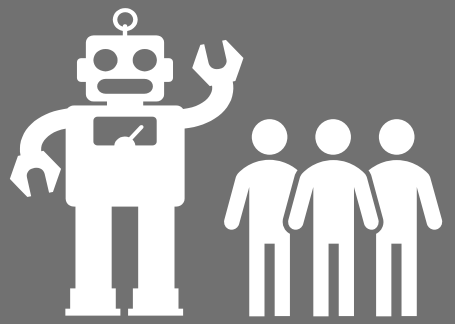
These are presented in turn in this section, but were commonly overlapping in conversation threads within the landscape

Within the conversation landscape, the risks and concerns about the use of AI in healthcare were seen to be:

- **Concern #1: Social media users voiced concern about the NHS' capacity and ability to implement new digital technologies effectively** – users were more likely to engage when concerned about use of public funds, especially when current IT systems and basic infrastructure is not working. Previous experiences of poor NHS implementation of IT systems led to some critics, mainly healthcare professionals, expressing scepticism about NHS' ability to implement more advanced technologies in healthcare
- **Concern #2: Users voiced concern about patient safety due to the risk of misdiagnosis** - reactions to potential for misdiagnosis led to conversations about patient safety and the need for further validation, clinical trials and published evidence – there was less mention about who would be liable for unintended consequences. The issue of patient safety drove further conversations about not only validation but the need for regulation of AI devices – calling for them to be treated the same as other medical devices.
- **Concern #3: Lack of transparency around the development of algorithms and data sharing practices was a key concern among healthcare professionals.** Posts about transparency of algorithms reveals a conversation among healthcare professionals about new digital technologies not facing the same level of scrutiny as other healthcare/medical device. Professionals and wider public express concern when patient data is shared without knowledge and consent – additionally there is concern about how data is going to be used and by whom.
- **Concern #4: There was a theme running through online conversations about the need for establishing regulatory and ethical processes for healthcare AI.**

Overall, key conversational themes in the landscape included:

- **Online debate about the use of AI in healthcare was polarised** – technology companies, with a vested interest, and government supported digital programmes were focused on promoting the benefits of AI in healthcare. **Meanwhile, others in the healthcare space provided challenge** and called for more consultation, transparency and further validation when introducing new AI healthcare applications. **The content posted by these two sides was polarised and there was a lack of dialogue between them**, with industry focussed on promoting the benefits and not engaging with critique from healthcare professionals.
- **Social Media Analysis identified a trend that the healthcare sector** - which is characterised as being risk averse - is concerned that the tech sector is not doing robust enough testing of its AI products. When it came to thinking about introducing new health technologies, the healthcare sector seemed to tend to be risk averse – and focused on rigorous validation cycles. Meanwhile, the technology sector tended to be more willing to take risks and introduce technologies for public use earlier, in order to get to market sooner and speed up development and refinement through iteration.
- **Concerns in the online debate were driven by the wider context of the UK government's support of AI technology being rolled out in the NHS, without acknowledging potential risks.**



4.
Wave 3: Attitudes to the use of robotics technology in the labour market

Research Insight	Implication
Over the last two years, conversation on robots has grown on social media. The conversation landscape is nascent and diffuse. Communities are in an early stage of development and no single community yet dominates the landscape. The topic has captured the media's imagination, and online news media is currently a key influencer and stronger initiator of conversation, and therefore is influencing the shape of the debate in this online space.	As the landscape is in its infancy, and users are looking for information about this topic and answers to queries and concerns, **this is a ripe moment for scientists to step into this space and participate** to contribute reliable information and a point of view to the debate. We know from Wave 1 that the public wants to hear more from academics and scientists in public debates about social implications of new technologies.
Fear of job losses as a result of automation was a key theme for the public in this conversation landscape. The public are concerned about the range of industries at risk and what the future holds for those workers who are affected. We are beginning to see Universal Basic Income activists stepping into this space online.	**As above, there could be a role for academics and scientists to step into this space with a point of view**, alongside political activists and tech companies who are presenting solutions from their own vantage points.
Entertaining and humorous posts captured attention and the fascination of social media users – for example those involving cats and pole dancing robots.	**Using humour and entertainment (notably visually) can be hooks to engage the public** about more serious issues and with the implications of technological developments.

In the last two years online conversation on this topic fluctuated between 2,500 and 8,000 posts per week, with three notable spikes

Between November 2017 and April 2018 there were two notable spikes in conversation – one in December 2017 reached 7,313 and one March 2018 reached 8,592 posts. In February 2017 there was a smaller spike that reached 6,444 posts.

Spikes in volume were typically related to social media posts and online news articles about the use of robotics technology for certain jobs and the potential for humans to be replaced by robots in the workforce

Analysis of conversations across the spikes found that:

- **The most significant spike concerned a post on Twitter in December 2017 of a video showing a robot simulating pole dancing.** This post received high levels of involvement from social media users (unusually high levels of engagement compared to other posts on the topic) - 103,237 retweets; 190,082 likes; 2,900 comments. Responses illustrate the range of views expressed in response to this including; fear of humans being replaced; discomfort with money being used for this; and fascination.
- **The spike in March 2018 concerned several news article about robotics technology being used in various workplaces, in HR, and fast food.** Links to several news articles (BBC, Guardian, the Sun) were posted on social media in the first week of March. There was higher engagement with posts about robotics being used in hiring processes and users questioned whether robots could do this in a non-discriminatory way. Responses to an Observer article on the topic show social media user's concern that robots may embed structural inequalities.
- **In February 2017, a smaller but notable spike concerned various posts about robots replacing jobs in the public sector – including the NHS and civil service roles.** There were low levels of engagement through retweets and likes but moderate level of involvement through comments. Responses illustrated mixed views, ranging from excitement about robots doing a better job than humans to concerns about unemployment and humans becoming irrelevant.

We created a network map of social media posts about the use of robotics in the labour market to explore the conversation landscape

This conversation landscape was nascent, diffuse and not clearly dominated by a community, with communities in an early stage of development. It appears to be a topic of interest for people, but not yet organized into an ongoing conversation or broader communities of interest.

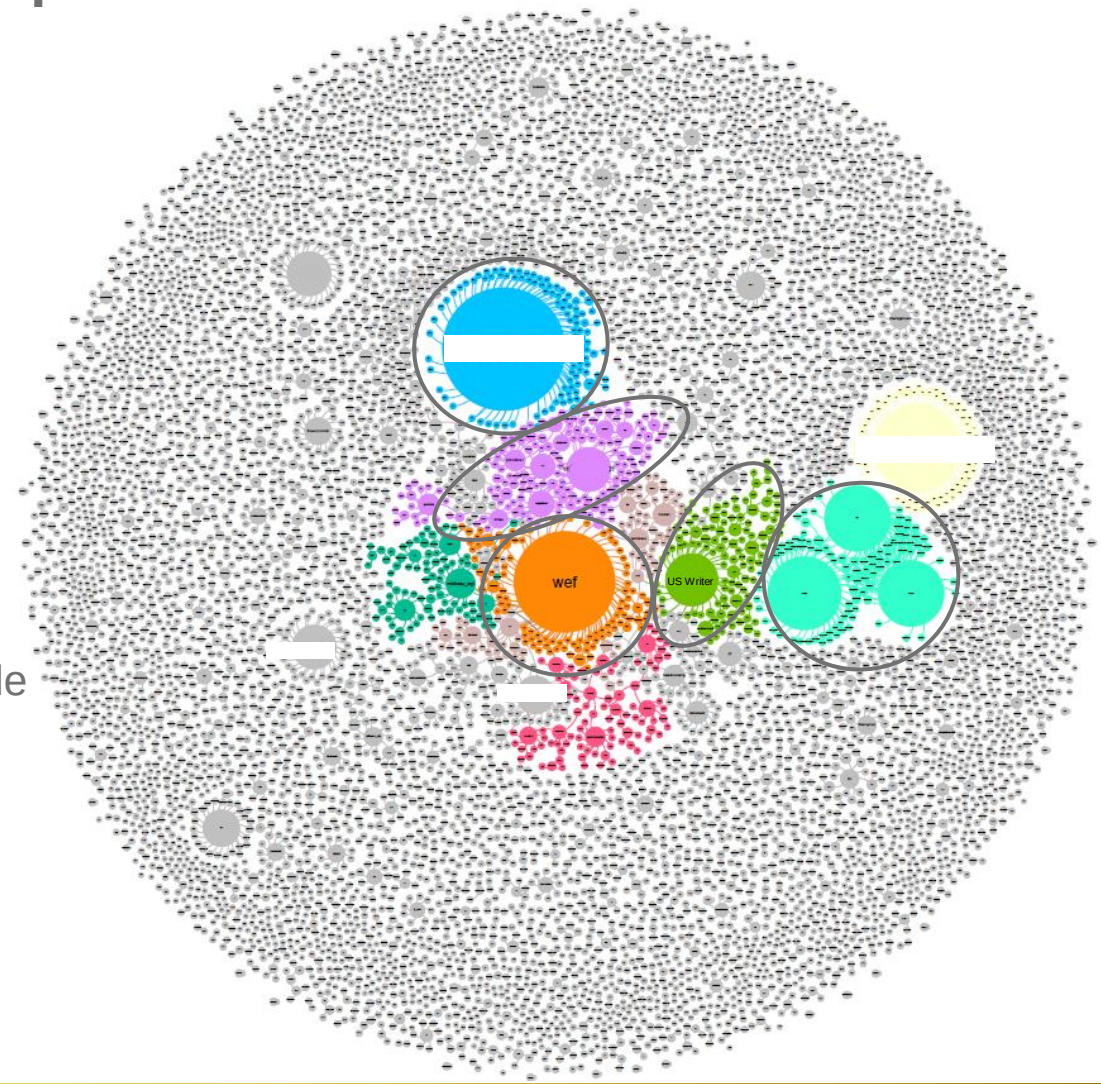
Although the landscape largely comprised of singular posts and there were limited connections between communities, there were three main topics seen across the landscape:

- Fears of humans being replaced by robots in the workforce
- Universal Basic Income as a solution to job losses
- Shifting labour markets bringing new jobs and requiring new skills

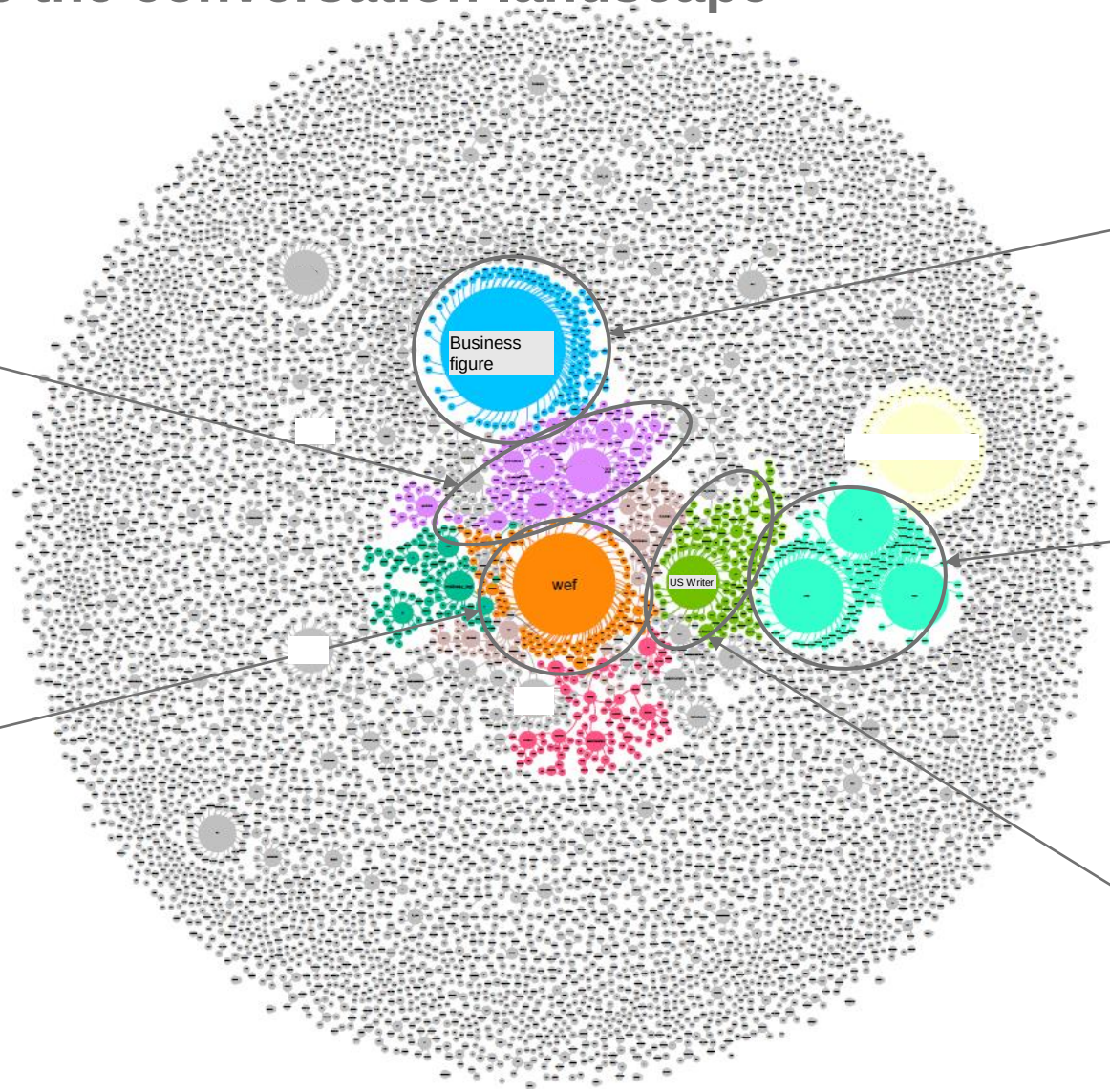
News outlets featured as key influencers in each community and made up 32.2% of the sources of content on social media.

The UK government was less commonly featured as a key influencer in this landscape than others.

Several key influencers from the digital and business community were also present in the previous wave 2 topic of AI in healthcare.



We created a network map of social media posts about the use of robotics in the labour market to explore the conversation landscape



Topic/theme: promoted the benefits of robotics in the labour market - engaging mainly amongst themselves

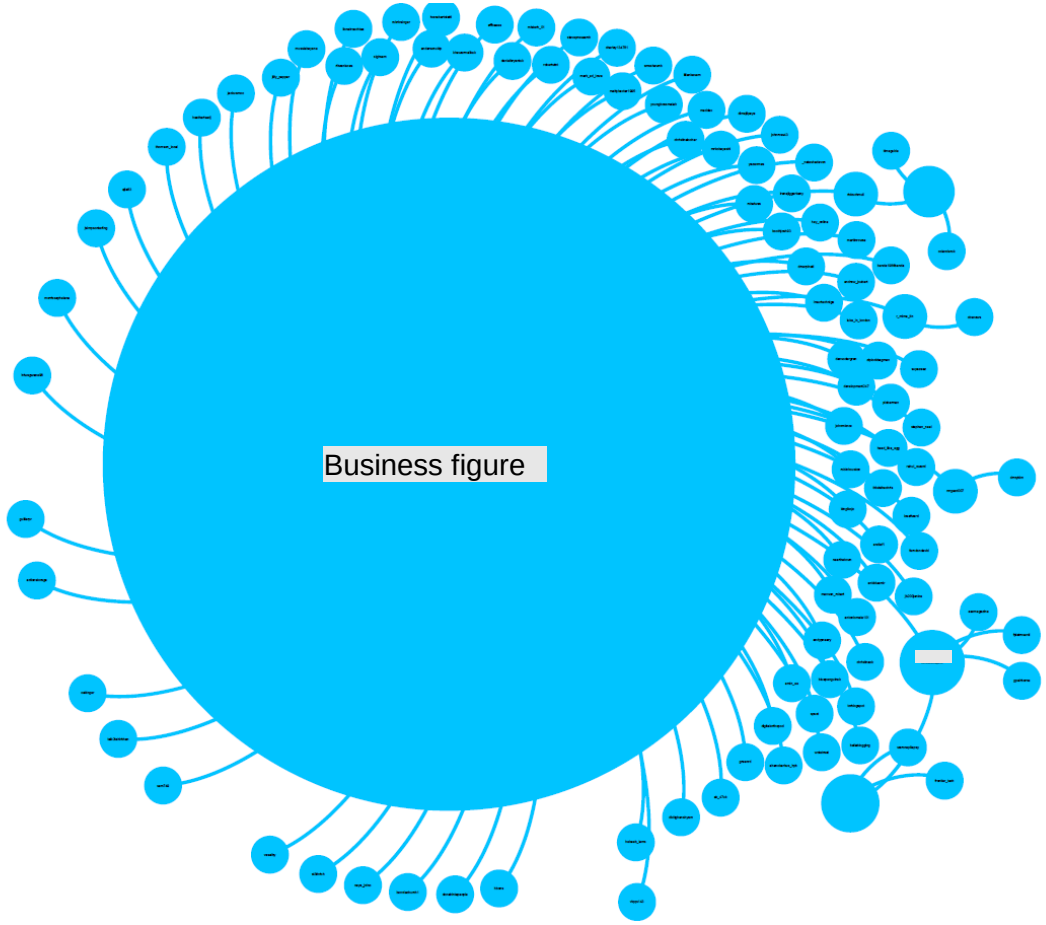
Topic/theme: shared content about how robotics is already in use

Topic/theme: loss of jobs and whether new types of jobs would be available to replace the jobs done by robots

Topic/theme: impacts and challenges that society faces due to greater reliance on robotics

Topic/theme: future of work - concerns about loss of jobs and an economic base for society and how to prepare for this

This community primarily used Twitter to share content about how robotics is already in use [1]



Community members

- Key influencer self described as a Digital Evangelist and works for software company
- Other, less dominant, community members are news outlets (People's Daily in China) and individuals (self described as technologists and analysts)

Conversation focus

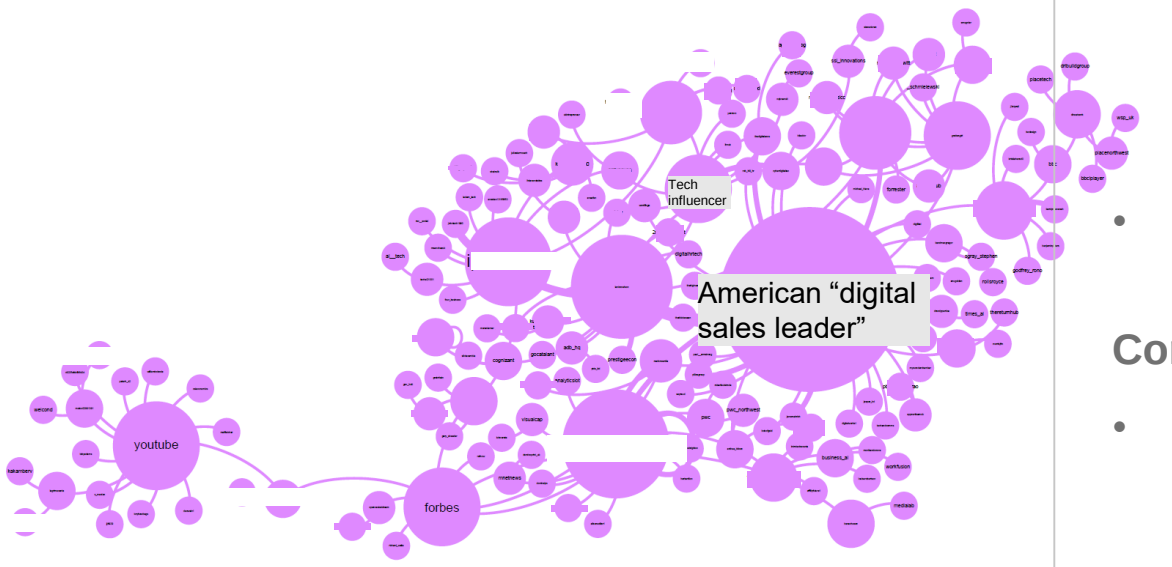
- Sharing videos, images and reports of robotic technology being used in various settings in China and the US for sorting and delivering parcels; moving goods within a warehouse; manufacturing; and in supermarkets

This community is isolated from the other communities in this landscape and not engaging with critiques, however the main influencer received high levels of involvement from social media users

Within this community …

- **This community primarily used Twitter to share content about how robotic technology is already in use.** The content mainly focused on videos of robots doing jobs such as sorting parcels, scanning shelves, moving goods, and working on an assembly line. This community was balanced in showing potential uses while also acknowledging concerns about jobs. Typical responses were a combination of enthusiasm for the technology and mentions of human workforce being replaced. Posts showing large factories using robots generated a lot of involvement, by showing robots in action, at this scale, engages people's imagination and got them discussing how this might impact society.

In this community, digital experts, digital businesses and the wider business community promoted the benefits of robotics in the labour market - engaging mainly amongst themselves



Community members

- Digital experts and the wider business community: individual data analysts, business consultants, chief digital officers, digital innovation companies, and business publications (e.g. PwC, IPFC Online, Forbes, Insight Brief)
- Some experts posted independently and others as a representative of their company or organisation

Conversation focus

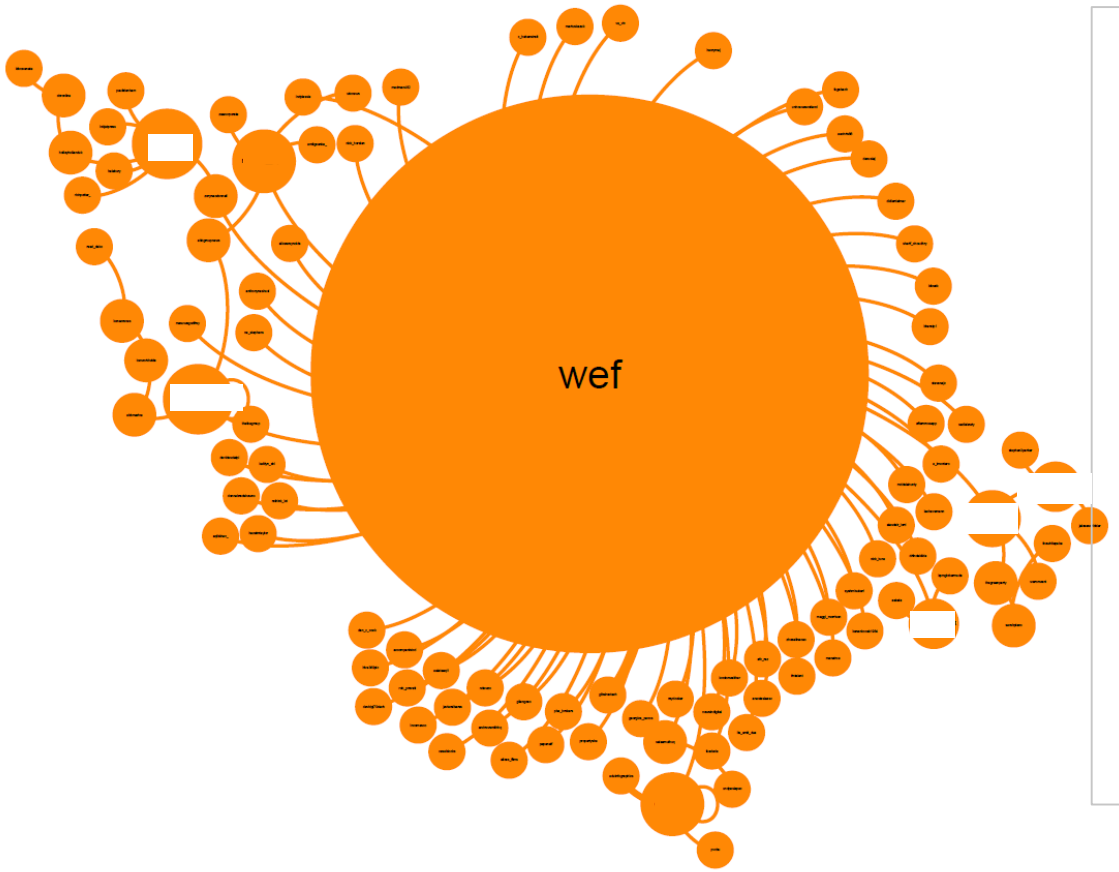
- Benefits of using robot technology, such as increased productivity, efficiency, and yields in manufacturing and creation of new and different jobs (referred to as Future of Work)
- OECD defines Future of Work as the effect of globalisation, technological progress and demographic change on labour markets, namely the quantity and quality of jobs that will be available in future

Digital and business experts promoting benefits is a similar finding to Wave 2 topic of AI healthcare, with some of the same experts present in this community

Within this community …

- **Digital experts, digital businesses and the wider business community use Twitter to promote the benefits of robotics, including AI, in the labour market.** Examples of typical posts from digital experts and wider business community included an article from Forbes business magazine posted a link to the second article from a four part story about a man whose work shifted from working on a factory floor to being a factory robot tester, and a Business Management Consultant posted links to article about predictions of job growth in certain sectors by 7% in the US over the next decade. There was relatively low levels of engagement and little to no involvement through comments.

However in this community, the conversation was about the impacts and challenges that society faces due to greater reliance on robotics



Community members

- World Economic Forum (WEF) - a non-profit organisation for public-private cooperation; Tech Republic – an online trade publication and social community for IT professionals; London Economic – an independent news publication; ABB group news – online news for a multinational digital company.

Conversation focus

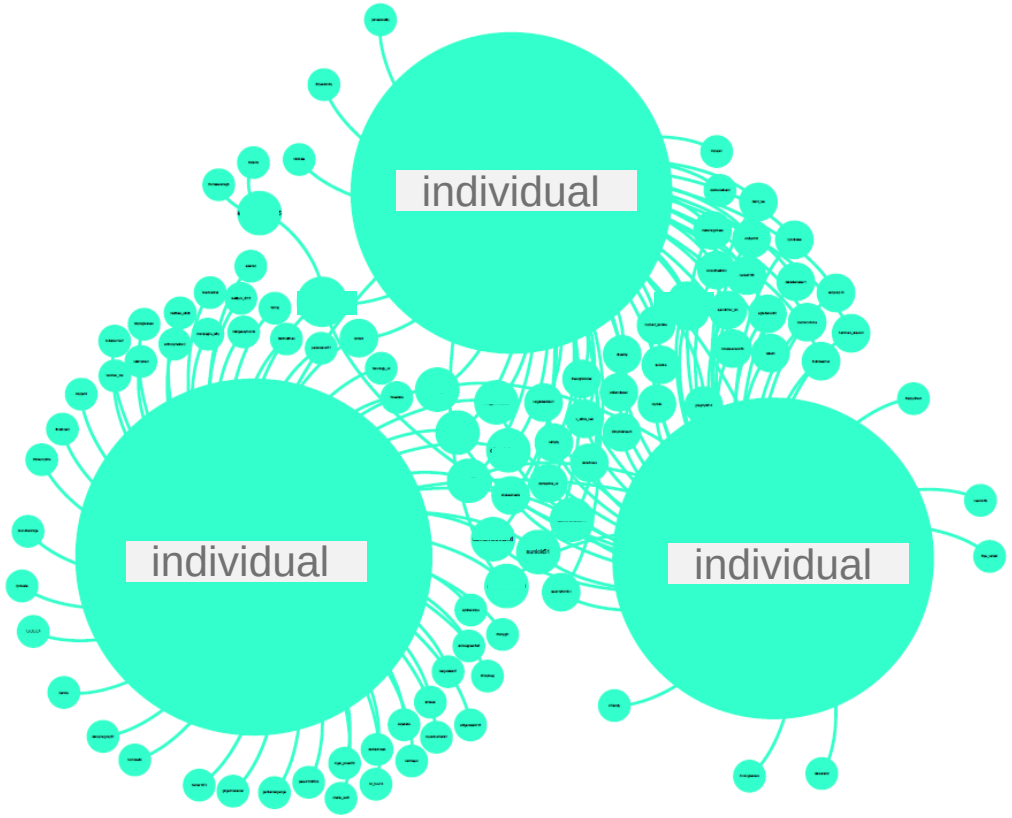
- Impact of automation and robotic technology on the future of the human workforce – specifically loss of jobs in manufacturing leading to the need for humans to prepare for different types of jobs going forward
- How to prepare society for jobs that will be available in future through re-training schemes and further education

A key influencer in this community and across all other communities is the WEF, whose posts tend to represent interest of both the business focused communities and the activism focused communities - providing an opportunity to engage in conversation about this topic

Within this community …

- **Posts in this community tended to be about industrial jobs being replaced by robots and the challenge of preparing for new and different types of jobs.** Content mainly focused on: Industrial jobs, such as warehouse and manufacturing jobs, being replaced worldwide; the impact that increased use of robotics will have on the workforce in these industries; and consideration of potential solutions; robot tax and education/training for new types of jobs. There were moderate levels of engagement, limited involvement through comments.

This community also raised concerns about loss of jobs and doubt about whether new types of jobs would be available to replace automated jobs [1]



Community members

- Individuals – public users with accounts localised in the UK, posting in a personal capacity
- Community members tend to post between others in the community

Conversation focus

- Questioned whether new types of jobs would come into existence to replace the number of jobs that will be automated
- Concern that robots will be more productive and cheaper, leaving humans unable to compete in the labour market

This community of public users rather than academics, activists or experts have expressed concerns about not being able to find work if jobs are replaced by robotics, which is an important point to address going forward.

Within this community …

- **This community also raised concerns about loss of jobs and doubt about whether new types of jobs would be available to replace automated jobs.** Posts tended to receive low volumes of engagement and appear to communicate only with each other but raise an important point. Content focused on: effects of automation on the economy; jobs being replaced by automation and AI; raised doubt about new types of jobs being created; and robots are an unfair competition for humans. There were very low levels of engagement – posts tended to have few likes, no retweets and no comments.

This community was focussed on the future of work – mostly concerns about job losses, loss of an economic base for society, and how to prepare for this

Community members

- Individual activists, political campaigns, entrepreneurs and politicians, news outlets (e.g. an activist and advocate for Basic Income in US; LabourUBI – campaign for UK Labour party to adopt basic income; a US entrepreneur and 2020 presidential candidate; The Guardian news)

Conversation focus

- Advocating for the implementation of universal basic income, in general and specifically as a solution to loss of jobs due to automation, AI and robotic technology

This community shows social media was being used as a space for activism on this topic

Within this community …

- **Posts in this community tended to support implementation of a universal basic income as a solution to job losses due to automation, AI and robots.** Content mainly focused on: advocated for basic income as a means to combat negative social and economic impact of job losses; automation will allow people more “free time” and potential “decouple income from work”; and suggested basic income as a solution to more jobs being automated. There were moderate levels of engagement through retweets and likes and some involvement through comments.
- **The topic of basic income generated some conversations among social media users about purpose of life without work** and concerns about changes to society due to increased us of robotics.

We qualitatively explored the content of the conversation landscape to identify key trends and themes

This section presents key trends and themes regarding **the ways in which social media users talked about the use of robotic technology in the labour market**

This provided us with insight into how social media users are discussing this topic. At this point in time the discussion is nascent and posts are scattered across social media users with the topic being mentioned once or twice. Particular groups of interest are starting to form around certain arguments, but for the moment there are no groups that dominate and structure the overall discussion.

The topic itself invites interest but it is not yet immediate enough for most people, and especially those on Twitter, to have a clear viewpoint on it and so are looking to examples from other countries, where automation is already being applied to understand what it might mean for the future.

Key conversational trends in the landscape included:

- **Trend #1: News media was an important initiator and influencer in this landscape - conversations and communities were commonly driven by news posts.** Typical posts from news outlets focused on the risk to the human workforce being replaced with robotics. This topic appears to have caught the imagination of the news media and they will likely continue to drive these conversations and influence the tone of the conversation, unless the science community start to participate.
- **Trend #2: A key trend in this conversation landscape was of social media user's expressing fears of job losses.** Responses to a post from People's Daily China illustrate social media user's fears about loss of jobs leading to instability of the economic base and about how wealth will be distributed. The post generated discussion among social media users – excitement about robotic technology as well as concern about what it means for the future of work, stability of economic base and distribution of wealth. Meanwhile an article from The Economist about workers needing to choose between being replaced by a robot or being treated like one received high levels of engagement – it sparked debate among social media users about options for dealing with the potential of being replaced by robots, and basic income was mentioned as an option.

Key conversational trends in the landscape included:

- **Trend #3: Technology and business experts attempted to allay users' fear of being replaced, by re-framing the discussion** to one about the potential for creating jobs that require new skills and humans working alongside robots.
- **Trend #4: Business experts, political activists and a US politician used Twitter in an attempt to allay users' fear of being replaced by advocating for Universal Basic Income**. Responses to posts typically indicate scepticism and concern about wealth distribution.
- **Trend #5: There was an international dimension to the online conversation about the use of robotics technology which presented global benefits and challenges**. Key posts demonstrate that this not a UK only topic of interest and there is potential to learn from other countries that are further along in implementation of robotic technology

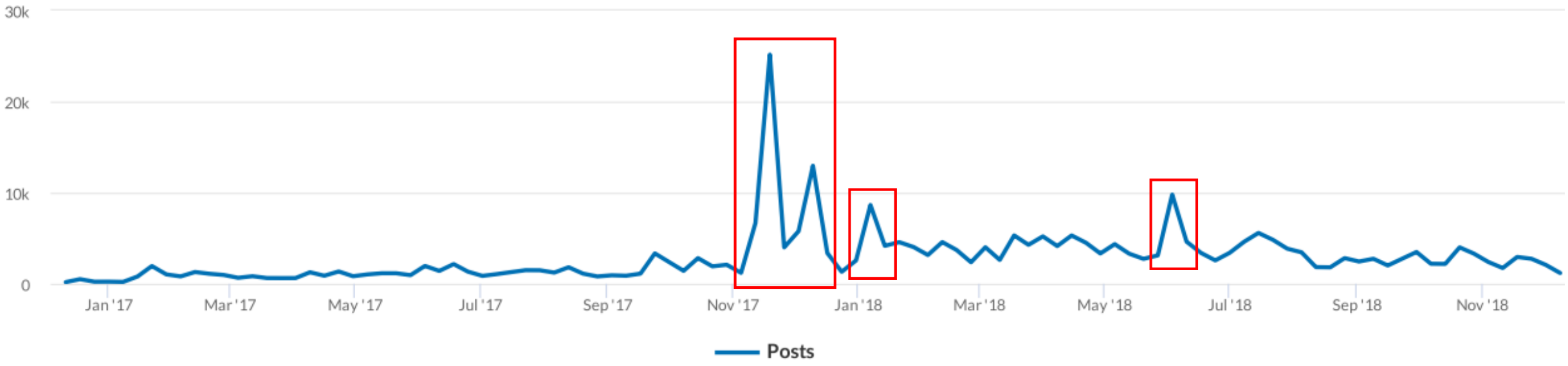
5.
Wave 4: Attitudes to ocean plastic pollution

Research Insight	Implication
There was an increase in social media posts about ocean plastics between Nov 2017- Jan 2018, driven by the release of Blue Planet II. Before this, the conversation was limited to posts among environmental interest groups.	**TV programmes and media events** provide opportunities to produce and share engaging visual material which can be shared and engaged with by social media users, to, for example, raise awareness of an issue or topic.
This landscape was highly interconnected and users were **motivated by their increased awareness** and discussed a range of solutions, including individual action, new products, taxes, legislation, and business action.	**Events, such as Blue Planet II, created a moment of increased awareness** among social media users and motivated them to consider their own behaviour and seek ways to change it. Social media is a space where people can come together and dynamically suggest and share solutions to problems.
Social media users also wanted to know who was responsible for causing the problem of plastic pollution in the oceans.	People can use social media as a place to **find answers and explanations from other social media users and influencers.**

Research Insight	Implication
Material from Blue Planet II engaged social media users because the emotional story and use of **visual material illustrated the negative impact** of peoples' plastic use, revealing consequences they were not previously fully aware of. The programme and visual material that was shared online told **an emotional story** which engaged users.	**Visual material and emotional stories** about plastics were more engaging than posts about reports and statistics which we saw in other dialogue waves. Greater use of emotional stories, images and videos about risks and issues associated with scientific developments, rather than statistics and reports, could help to engage the public with science topics.
Social media users placed high levels of trust in **David Attenborough's** views about ocean plastics and his credibility helped to drive conversation about this topic.	Attenborough is a good example of a trusted scientific expert, being seen as a **passionate specialist who is not acting out of self interest or personally profiting** from his work (similarly found in wave 1 of the dialogue). This is an important finding for those looking to understand the types of people who make good messengers for scientific information for the public and the characteristics that drive trust.

The online conversation about ocean plastics spiked in November 2017 from 2000 to 25,000 posts per week, following the release of the BBC's Blue Planet II

Before these spikes, the online conversation primarily focused on the effects of plastic on oceans among various environmental interest groups, specifically marine conservation groups.



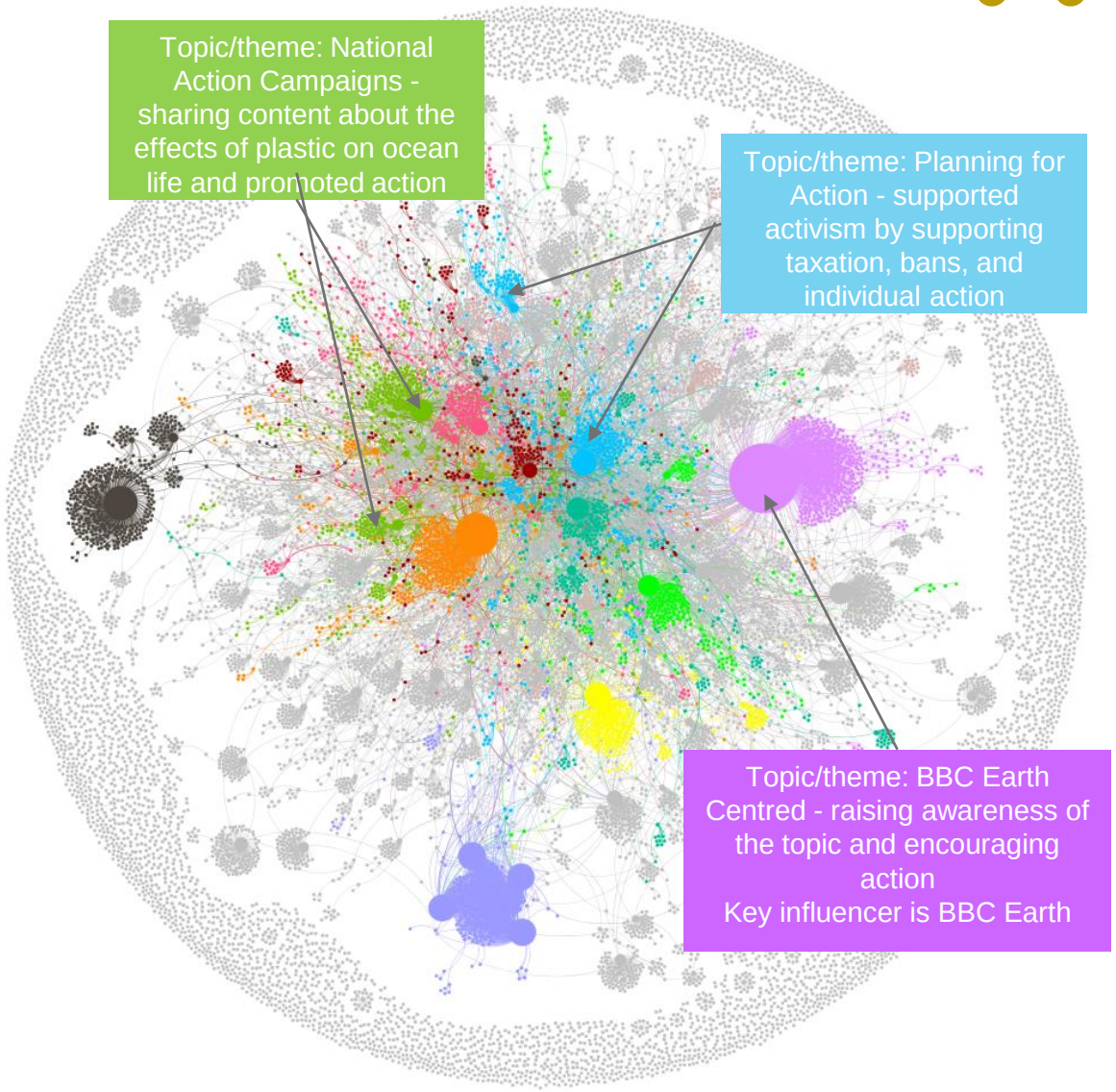
The main November 2017 spike was followed by smaller spikes in December and early January and June 2018 – but the baseline was also elevated and remained so after the airing of Blue Planet II

Analysis of conversations across the spikes found that:

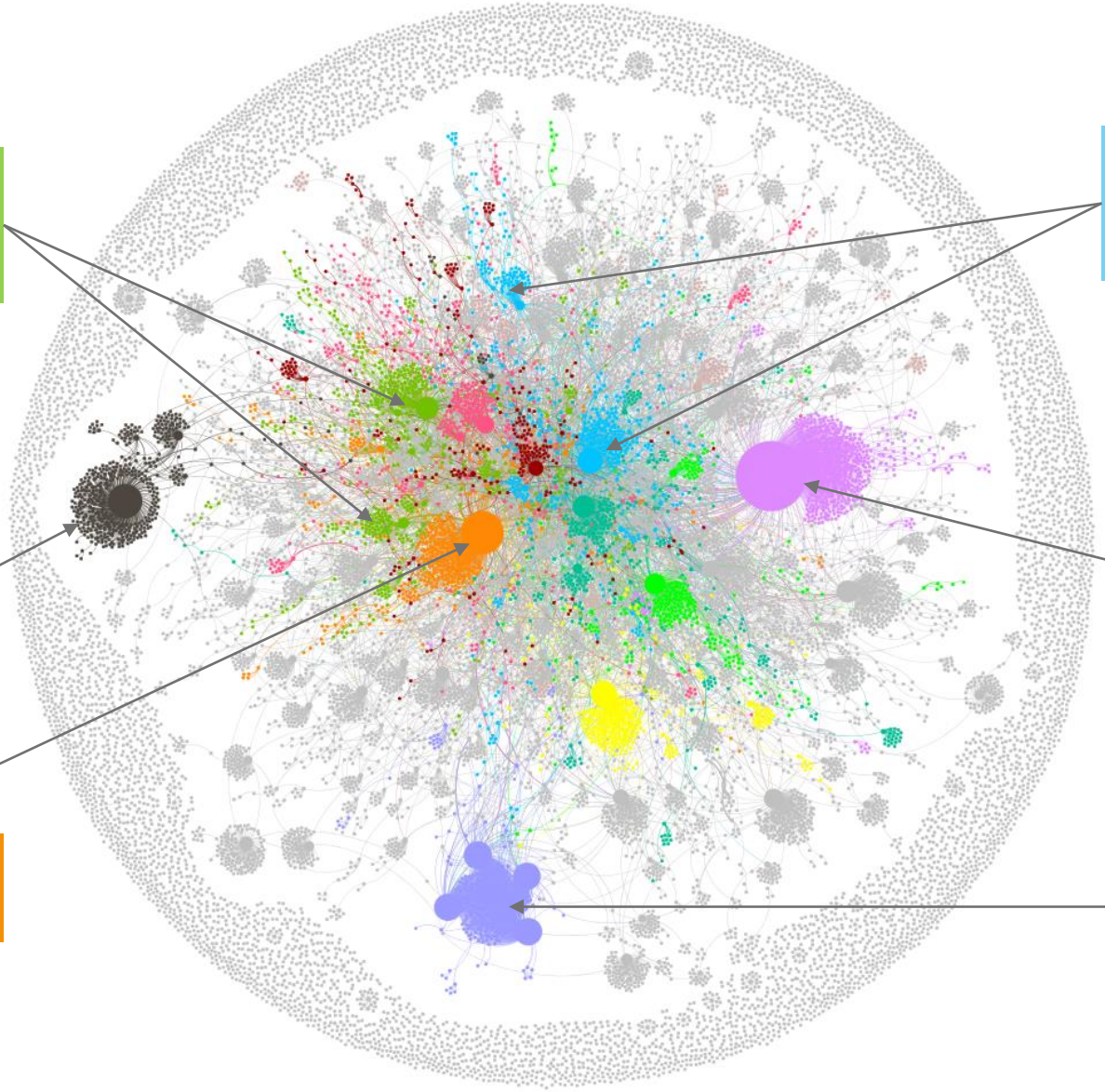
- **The November 2017 spike was driven by an episode of BBC Earth's Blue Planet II series, which showed emotional footage of the effects of plastic on marine life.** An example of a BBC One post at the time of this spike showing a dying whale received high levels of engagement: 6,878 retweets, 16,493 likes, 302 comments. Typical responses illustrate social media users' upset at seeing the effects of plastic on marine life and a desire to see action and solutions. Other posts similar to this one, from BBC Earth, contributed to the volume of this spike. Powerful emotional images shown in the Blue Planet II episode sparked online conversation about who is responsible and what kind of action should and can be taken by consumers, governments, and businesses.
- **December 2017 saw a smaller, yet notable spike (13,914 posts) in response to the final episode of Blue Planet II, that highlighted human impact on the oceans.** An Instagram post from the Natural History Museum that received high levels of engagement. Post was about action the museum is taking to curb plastic usage and made reference to the Blue Planet II series (6,299 likes and 247 comments). Typical responses further illustrated shock, sadness and desire for action.
- **January 2018 saw a smaller, yet notable spike (11,722 posts)** – some of which concerned taking action to reduce ocean plastic for the new year
- **June 2018 saw a smaller but notable spike of posts related to World Oceans/ Environment Day.**

We created a network map of social media posts about ocean plastics to explore the conversation landscape

- This conversation landscape consisted of several discrete clusters, widely inter-connected, and not clearly dominated by any single community. BBC Earth was a key influencer across communities in generating conversation and interactions on this topic (i.e. largest node in size in the BBC Earth centred community). However, it is more influential in discussions in the environmentalist communities (Planning for Action and National Action Campaigns) than the discussions in other communities.
- While communities in this landscape are highly inter-connected, they are disparate. Different organisations are activating their networks, on a smaller and more fragmented scale. Relatedly, no one has yet created an overarching movement or narrative that unifies everyone together to take action (i.e. a hashtag or movement that many groups are plugging into and linking up around).
- The conversation was mainly driven by events, such as the release of a TV series or an annual environmental protection day. Social media users seized on Blue Planet II to communicate, share, and get the topic on the agenda of discussion and to promote action by individuals, governments, and business.



The network map is made up of key communities that formed around particular topics and themes



Topic/theme: sharing content about the effects of plastic on ocean life and promoted action

Topic/theme: supported activism by supporting taxation, bans, and individual action

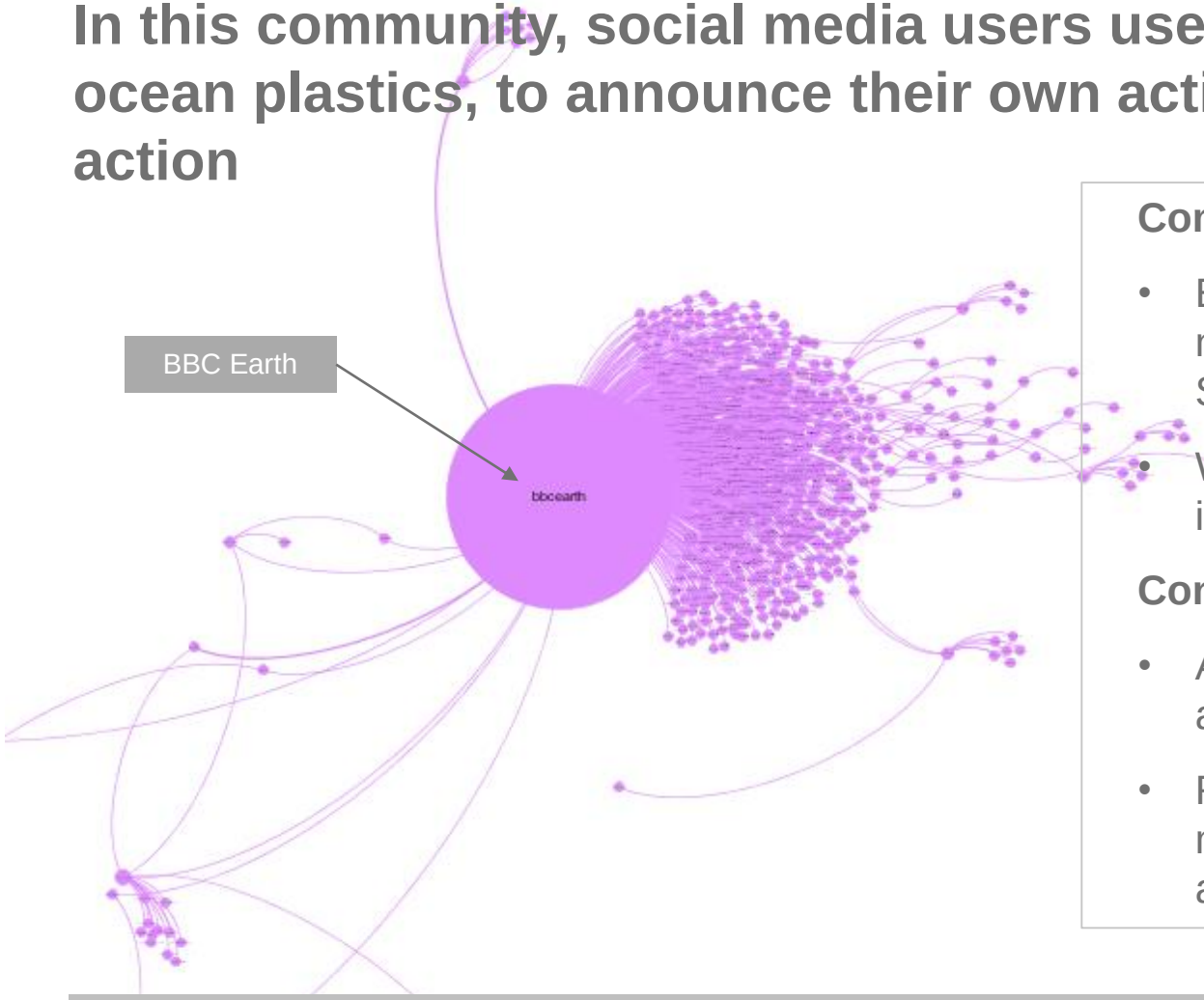
Topic/theme: promoted eco-friendly products as a solution to plastic pollution of the oceans

Topic/theme: raising awareness of the topic and encouraging action

Topic/theme: posts by Sky Ocean Rescue

Topic/theme: promoted a specific local action to ban plastic straws in cinemas

In this community, social media users used Twitter to express awareness of ocean plastics, to announce their own action, and encourage others to take action



Community members

- Environmental interest groups and documentarians focused on natural history (e.g. BBC Earth, Whale and Dolphin Conservation Society).
- Well known British DJ and musician, and a UK politician, feature in this community.

Conversation focus

- Announcing personal action, behaviour change, and increased awareness about the topic as a result of watching Blue Planet II;
- Raising public awareness of the extent of the effects of plastic on marine life and ocean shores and encouraging the public to take action.

The conversation in this community was primarily related to Blue Planet II and a coordinated effort to harness star power and federate environmental groups to engage the wider public around the importance of the issue. The community seems to target a broader umbrella than other groups, which seem to target already engaged consumers.

This community, although similar to the previous community, used Twitter to campaign for solutions rather than focusing on individual actions

Community members

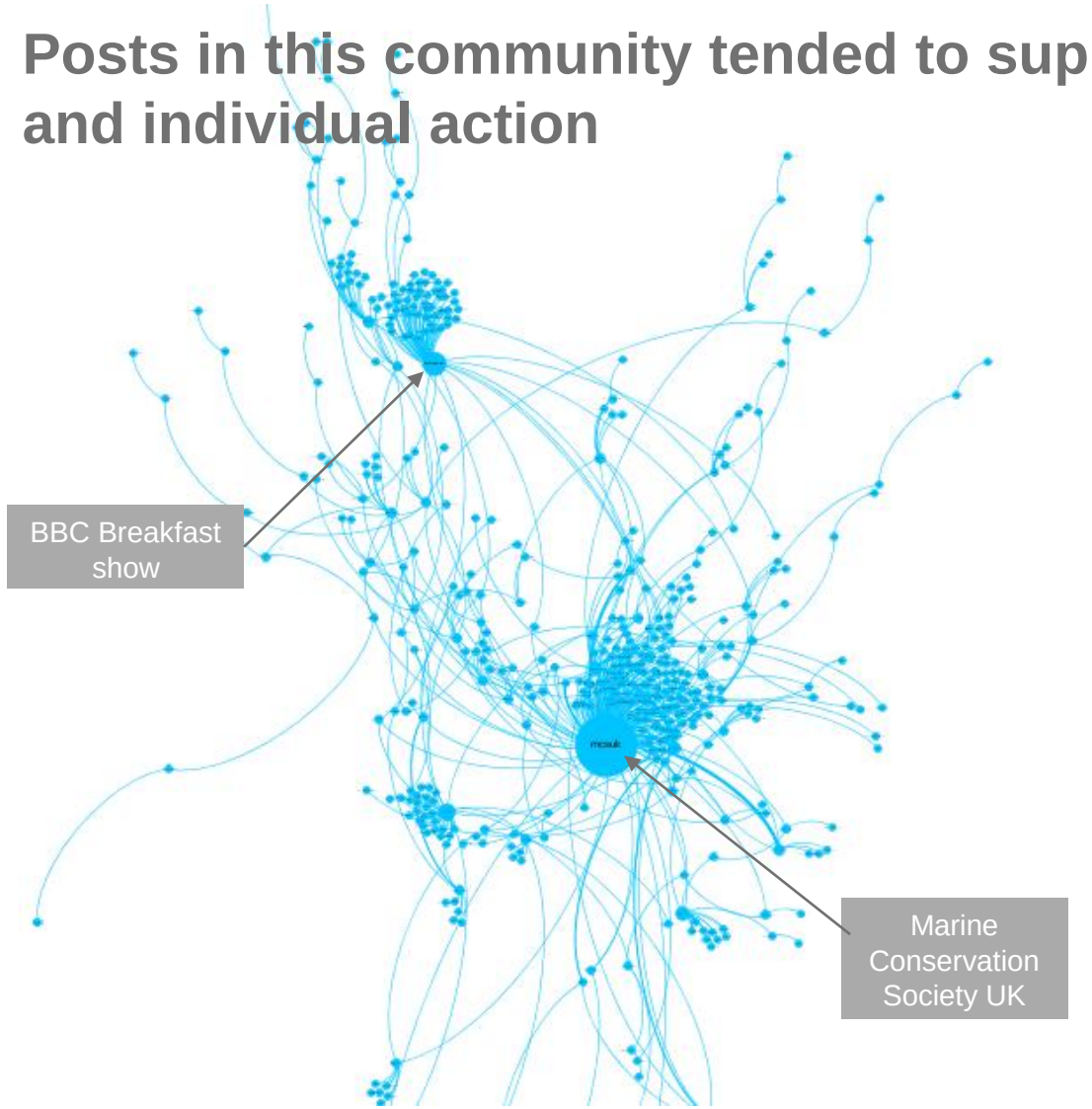
- Large and small organisations/foundations campaigning for solutions to the issue of plastics pollution in oceans (Surfers Against Sewage - SAS, New Plastic Economy, Plastic Pollutes Campaign).
- Sky News also featured in the community.

Conversation focus

- Raised awareness about the topic through videos, images, and statistics.
- Provided ways to take action through petitions, volunteering, global partnership between charities.
- Calls to action for businesses, governments and individuals.

The conversations in this community are primarily about taking action and continuing to raise awareness. Social media users used Twitter as a way to promote action, both online and in real life.

Posts in this community tended to support activism by supporting taxation, bans, and individual action



Community members

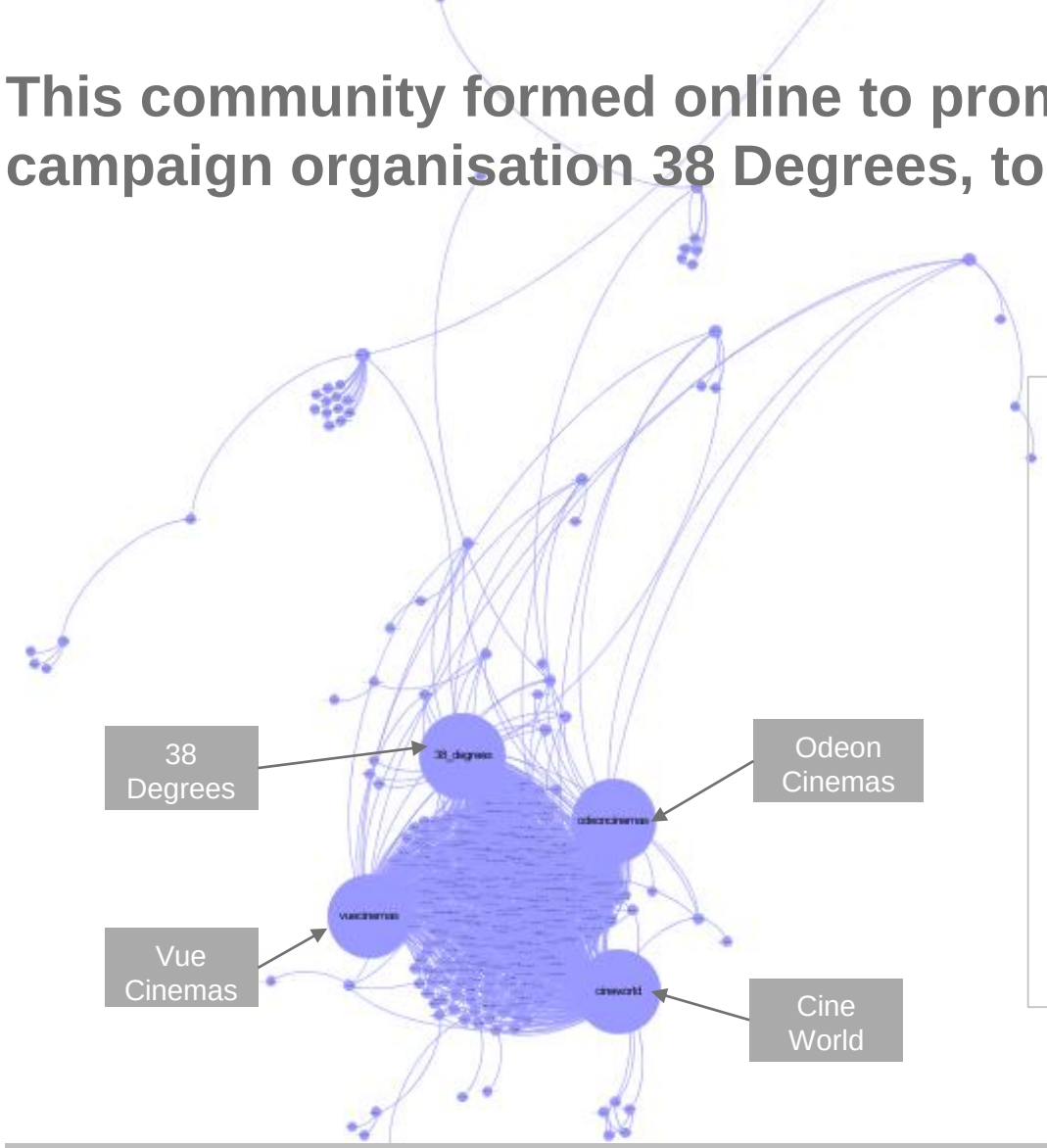
- Individuals, international and national organisations that are focused solely on protecting oceans and marine life (i.e. Marine Conservation Society, Oceana, Conservation Officer);
- BBC Breakfast show featured in this community because of connections/links shared with the above organisations.

Conversation focus

- Advocating for conservation of oceans and marine life through bans on plastic and taxation;
- Encouraging action from others.

This community shows social media was being used as a space for activism on this topic, with this community forming around the more specific ideas of tax and legislative solutions

This community formed online to promote a specific local action, led by campaign organisation 38 Degrees, to ban plastics straws in cinemas in UK [1]



Community members

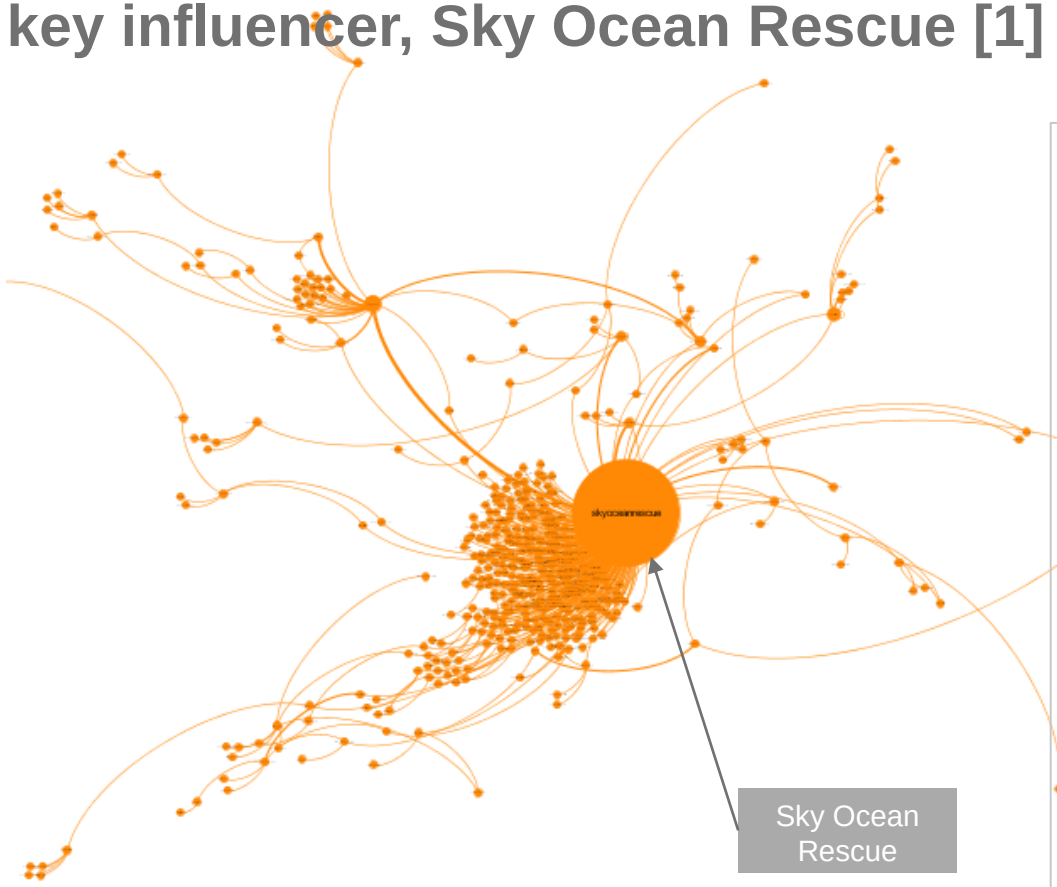
- Key influencer in this community is a campaign organiser, 38 degrees
- Individuals posting their own opinions and interests

Conversation focus

- Individuals posted their support of 38 Degrees campaign to ban plastic straws at cinemas in the UK

This community was a relative outlier with limited impact on the online conversation; limited connections with other communities in the landscape despite sharing a similar focus and interest

This community formed around, and commonly shared, one Twitter post from a key influencer, Sky Ocean Rescue [1]



Community members

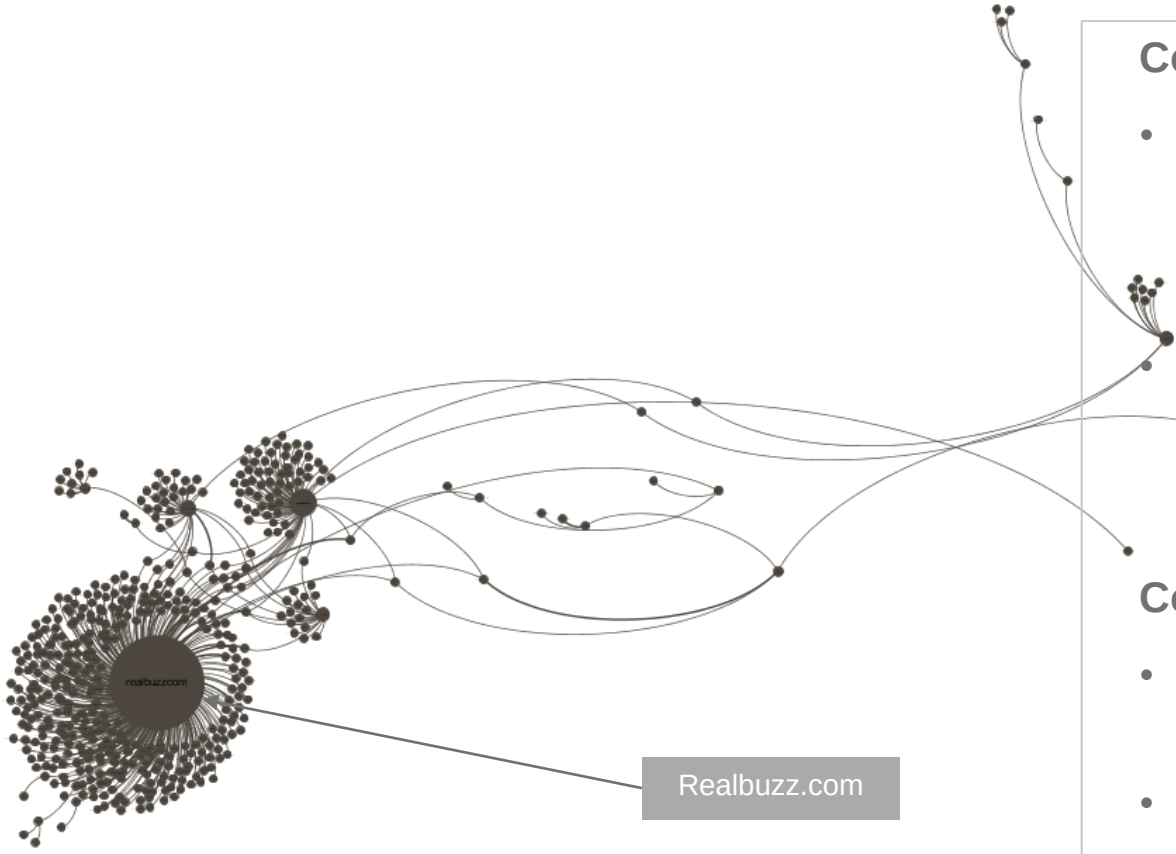
- Mixture of individuals, with accounts located in the UK, posting in a personal capacity, a campaign from a news outlet (Sky Ocean Rescue) and a UK government organisation (The Marine Management Organisation – the MMO).
- Key influencer in this community was Sky Ocean Rescue, a campaign launched by Sky news on 24th January 2017, that aims to spotlight the issue of ocean health and find solutions.

Conversation focus

- Mainly focused on sharing and commenting on Sky Ocean Rescue's post of a clip of David Attenborough referring to the effect of ocean plastic as "heart breaking."
- Other posts, included calls to action by individuals, government and businesses.

Discussion in this community tended to be around one post that drove individuals with a vested interest in the issue, and ocean protection campaigns and organisations to share information and suggest action.

This outlier community used Twitter to promote eco-friendly products as a solution to plastic pollution of the oceans [1]



Community members

- Forums and websites that typically promote products and share advice about healthy living, cosmetics, and parenting (i.e. Ren Skincare, Mumsnet, Realbuzz). In this instance the products were in support of reduction of plastic use.

This community made limited connections with other communities, because the posts were product related and usual followers did not belong to environmental and marine interest groups that make up the other communities.

Conversation focus

- Announced competitions to win eco-friendly products or products whose sales go towards plastic reduction in oceans.
- Comments were primarily about the products, retweets and likes were to enter the competition and get others to enter.

Social media users in this community typically shared content about products and provided advice; and in this instance they were promoting eco friendly products in response to recent concerns about plastic pollution

We qualitatively explored the content of the conversation landscape to identify key trends and themes

This section presents key trends and themes present throughout the whole social media landscape for ocean plastics; and were found across all communities. However, several trends, such as expressing shock and a desire for action were more dominate within certain communities, such as the BBC Earth Centred and Planning for Action communities.

This provided us with insight into how social media users are discussing this topic. At this point in time the discussion is wide spread and posts are scattered across the communities that make up the landscape. Particular groups of interest have formed around certain aspects of the conversation, forming numerous connections among one another.

Key conversational trends in the landscape included:

- **Trend #1: Social media users expressed shock and disgust after seeing visual images of the effects of plastic pollution on marine life.** A key image with high levels of engagement and comments that illustrate social media users' emotional response to seeing effects of plastic on marine life that they were not previously aware of, in particular the image of a whale carrying a dead calf. Seeing images of the consequences of their plastic consumption led to reactions from commentators characterised by shock, shame, guilt, and sadness.
- **Trend #2: Social media users questioned who is responsible and to blame for the effects of ocean plastic pollution.** Responses suggested that social media users are unsure, both about who is responsible for plastics being in the ocean and who is responsible for taking action against this.
- **Trend #3: Social media users widely expressed desire for government and business to take action and do something about the issue.** While social media users acknowledged the need for individual action, they seem confused about whose fault it is that the problem of plastic pollution in oceans has happened - but they are clear it is the government, businesses and individuals who now need to take action to fix the problem.
- **Trend #4a: However social media users also talked about how individuals could take action, primarily by making more eco friendly consumer choices.** The main form of individual action users suggested was making more eco friendly consumer choices, which they seemed to take pride in.
- **Trend #4b: The conversation about eco friendly consumer choices was focused on new, replacement products rather than reduction, reuse and recycling.** Within the limited discussion about reduction, reuse and recycling, there was still an emphasis on businesses making changes, which would limit individual's options and force lifestyle change.

We qualitatively explored the content of the conversation landscape to identify what types of post on this topic get traction on social media – with the aim that these lessons could be transferred to other similar scientific topics

In this section we examine what gets traction on social media, using this topic as an example of a scientific issue that government and experts might want to communicate with the public about, aiming for the lessons to be transferable.

Social media data was analysed qualitatively to identify key themes, trends and to explore what the key characteristics were of influential users and posts.

Spikes on this topic were event led and driven mainly by Blue Planet II. Therefore large volumes of the conversation were driven by a small selection of key posts and therefore some examples are repeated from previous sections. Other events, such as New Years day and World Environment days also contributed to spikes in conversation.

Trend #1a: A celebrity champion, such as David Attenborough who is a trusted expert, can help to raise awareness, advance a cause and engage users

Specialist knowledge

Devotion of one's time/life to a particular field of research, area of work and having a particular skill set and a lot of knowledge on a particular subject.

Passion and conviction

Having an emotional connection and drive to be involved with a particular subject or area of interest

Having a point of view and being personally invested

Easily identifiable opinion and way of considering an issue/topic. Invested in making a difference and willing to spend personal time to advocate for and raise awareness of an issue/topic.

Acting selflessly – not motivated by personal profit or power

Acting with compassion and altruistic intentions, without self interest in mind. The issue or topic is the primary focus.

This reflects findings from Wave 1, that the public trusts experts who are seen be passionate and acting selflessly, and appreciate experts who provide the public with a point of view.

Other key conversational trends in the landscape included:

- **Trend #1b: Celebrity champions and social media personalities can also help to advance a cause – by promoting action locally.** These types of social media influencer can demonstrate passion and personal investment in the topic; and get engagement, however engagement tends to be on a surface level where influencers lack additional characteristics that gets the public more deeply engaged, such as specialist knowledge.
- **Trend #1c: Celebrity champions and social media personalities can also help to advance a cause – by promoting associated products.** However, where the environmental angle was ancillary to product promotion, engagement about the topic was surface level. This type of celebrity champion was not able to deeply engage the public, because they lack specialist knowledge, point of view is not conveyed, passion is not apparent and they stand to gain.
- **Trend #2: The Blue Planet II series was a national event that helped to raise awareness, advance a cause and engage users by telling an emotional story.** Telling an emotional story gives momentum to the topic and drove social media users to share their experience, thoughts and feelings about it. It drew a larger public in and got them to care and want to engage.
- **Trend #3: Use of visual material, rather than statistics and reports, brings the issue to life; it allowed the public to see direct impact of their behaviour.** Visual material was more immediate and impactful than perhaps statistics and reports would have been – and allowed users to quickly share content that had an effect on them.
- **Trend #4: Tapping into World/national days and annual / seasonal events was an effective way to drive online conversations about this topic**. Annual events are standard vectors for increasing conversation on social media and get traction as users are keen to share content to raise an issue, promote action and/or promote new products as a solution at this moment.

6
Appendices

Wave 1: Overview of methodology

Data collected via:

NETBASE™
ENTERPRISE SOCIAL ANALYTICS

Query development

Involved devising a list of key terms related to 3 topic layers:

= Alcohol

= Attitudes towards alcohol

= Research/scientific findings

The query was refined by including/excluding terms that generated relevant/irrelevant data

Data cleaning

Data was extracted on 01/10/18, covering 27 months from 10/07/16 to 01/10/18

Data cleaning involved analysis to filter out irrelevant authors/posts.

Sources of data from Netbase after cleaning included:

= 93% Twitter

= 1.1% Instagram

= 1% Forums and blogs

Network Visualisation

Using 10% of the clean dataset, we exported the Twitter data to perform a network map analysis to visualise the relationships between different accounts.

In the network map, we applied a statistical algorithm to identify "communities" of users that interacted more with each other than with other accounts, to help us interpret who the important groups and actors in the conversation are.

Analysis

Using quantitative analysis, the network visualisation, and qualitative analysis a deep dive was carried out to further study:

= Volumes - including spikes and what generated them

= Communities and influencers

= Interactions and relationships

= Key posts

= Key themes

Wave 1: ‘Alcohol’ query terms

Key terms	Secondary key terms	
Alcohol	consumption	recommendation
Booze	consum*	recommend*
Drink* NEAR/3 alcohol	addiction	"drink tank"
alcoholism	units	"designated driver"
alcoholic*	"good for"	"drinking game"
"alcohol dependen*"	"bad for"	know NEAR/3 limit
"alcohol abuse"	health	"get drunk"
alcoholi*	"mental health"	"get wasted"
teetotal	homelessness	sozzled
sober	withdrawal	"middle aged drinking"
""on the wagon""	intoxication	pint
""off the wagon""	poisoning	"know your limits"
onthewagon	maximum	pregnan*
offthewagon	"too much"	trollied
"alcohol free"	guidance	bladdered
"alcohol depression"~5	healthy	"got wrecked"
	rehab	paralytic
	treatment	wasted
	detox	hammered
	"side effects""	
	nannystate/ "Nanny State" AND NOT Brewdog	

Wave 1: ‘Alcohol’ query terms continued

Standalone key words	Key terms	Exclusions
alcoholism	beer	win
alcohol dependence	wine	competition
"alcoholics anonymous"	spirits [within 5 words of] drink	cider vinegar
"al-anon"	cider	thegentlerebel_
addaction	lager	suthrn_belle
adfam	vodka	tinyrebelbrewco
nacoa	voddy	
"SMART recovery""	prosecco	
drinkaware	whisky	
#alcoholawareness	whiskey	
#mupsaveslives	rum	
#dryjanuary	brandy	
#addictionrecovery	absinthe	
#alcoholfree	sambuca	
""drink driving""	gin	
""drink drivers""	sherry	
""drink driver""	red wine	
""dui""	Jagerbomb	
""booze problem""		
breathalise*		
"adrian chiles"		
"drinkers like me"		

Wave 1: ‘Alcohol attitudes’ query terms

Included Terms			
decide	concern	unreliable	actual
choose	worried	valid	accurate
choice	bothered	honest	credible
"how to know"	lifestyle	dishonest	refute
how much	confusing	legit*	Ignore
"nanny state" (NOT brewdog)	"always change"	trust*	sceptical
killjoy	myth		scepticism
"don't care"	mythbuster	trustworthy	Respect
youonlyliveonce	"as much as I like"	suspicious	"have faith in"
YOLO	"do what I want"	believe in	change
moderate	"doesn't matter"	believe	changing
moderation	fake	truth	
control	doubt	true	
"my life"	reliable	fact	
mylife	rely on	factual	
safe	reliable	lie	
"how much is too much"	real	dodgy	

Wave 1: ‘Research’ query terms

Included Terms	
research	(kidney AND disease)
science	(heart AND disease)
scientific	cirrhosis
study	studies
statistics	"research findings"
figures	university
published	"politicians"
article	"parliament"
findings	""nhs figures""
#research	guidelines
analysis	"NHS England"
scientist	"GP NEAR/3 advice"
expert	"media NEAR/3 alcohol OR drink*"
proof	"tabloid NEAR/3 alcohol OR drink*"
evidence	"journalist NEAR/3 alcohol OR drink*"
cancer NEAR/3 alcohol OR drink*	"news NEAR/3 alcohol OR drink*"
(liver AND disease)	

Wave 2: Overview of methodology

Data collected via:

NETBASE™
ENTERPRISE SOCIAL ANALYTICS

Query development

Involved devising a list of key terms related to:

= Artificial intelligence

= Big data

= Healthcare, medicine and diagnosis

The query was refined by including/excluding terms that generated relevant/irrelevant data

Data cleaning

Data was extracted on 14/10/18, covering 27 months from 25/09/16 to 14/10/18

Data cleaning involved analysis to filter out irrelevant authors/posts.

Sources of data from Netbase after cleaning included:

= 97.1% Twitter

= 0.4% Instagram

= 2.5% Forums and blogs

Network Visualisation

Using 10% of the clean dataset (see slide 8 for further explanation), we exported the Twitter data to perform a network map analysis to visualise the relationships between different accounts.

In the network map, we applied a statistical algorithm to identify communities of users that interacted more with each other than with other accounts, to help us interpret who the important groups and actors in this conversation landscape are.

Analysis

Using quantitative analysis, the network visualisation, and qualitative analysis a deep dive was carried out to further study:

= Volumes - including spikes and what generated them

= Communities and influencers

= Interactions and relationships

= Key posts

= Key themes

Wave 2: Query terms

Primary	Secondary		Standalone terms	Exclude	
AI	Medical	depression	NHS app	"sent from my"	
Artificial Intelligence	Medicine	addiction	"health app" NEAR/3	"TSR App"	
patient data	health	suicide	NHS Digital	dailym.ai	
big data	health care system	NHS	"medical app" NEAR/3	alternate-source-bot:reddit.com	
"data sharing" NEAR/5	mentalhealth	BUPA	"diagnosis app" NEAR/3	@workwithai	
				"ai diseases"	Referring to autoimmune diseases
data breach	mental health	Nuffield		"ai disease"	Referring to autoimmune diseases
data science	mentalhealthawareness	woebot		helenbevan	Tweets advertising a virtual conference
Wearable	symptoms	deepmind		takethatdarwin	Unrelated joke
Bot	sick	babylonhealth		lucyxiv	Unrelated joke
cyberdoct	prescribe	InnerEye		hiyalauren	Unrelated joke
Chatbot	prescription	HeartFlow		rochelletrose	Unrelated tweet
Virtual	pain	Life Engine.AI		everton	unrelated promotion of thei virtual mascot for sick children
data security	"human doct" NEAR/3	disease			
Machine learning	"human GP" NEAR/3	heart disease			
Deep learning	diagnosis	cancer			
health tech	diagnose	illness			
smartphones	diagnosed	ill			
		"chronic pain" NEAR/3			
		self-diagnosis			

Wave 3: Overview of methodology

Data collected via:

NETBASE™
ENTERPRISE SOCIAL ANALYTICS

Query development

Involved devising a list of key terms related to:

= Robotics

= Labour market

The query was refined by including/excluding terms that generated relevant/irrelevant data

Data cleaning

Data was extracted on 14/11/18, covering 27 months from 1/10/16 to 14/11/18

Data cleaning involved analysis to filter out irrelevant authors/posts.

Sources of data from Netbase after cleaning included:

= 56.9% Twitter

= 32.2% News

= 6.8.5% Blogs

= 3.4% Forums

Network Visualisation

Using 10% of the clean dataset, we exported the Twitter data to perform a network map analysis to visualise the relationships between different accounts.

In the network map, we applied a statistical algorithm to identify communities of users that interacted more with each other than with other accounts, to help us interpret who the important groups and actors in this conversation landscape are.

Analysis

Using quantitative analysis, the network visualisation, and qualitative analysis a deep dive was carried out to further study:

= Volumes - including spikes

= Communities and influencers

= Interactions and relationships

= Key themes

Throughout, **engagement** refers to posts that receive likes and retweets; **involvement** refers to comments in addition to retweet and likes

Wave 3: Query terms

Primary
robot
automation
automated

Secondary
labour market
labor market
labourmarket
labormarket
workforce
technological disruption
warehouse
productivity
efficiency
workers
staff
employees
jobs
employment
industry
manufacturing
wages
profit
earnings
impact
"job lost" NEAR/5
"job lose" NEAR/5
"jobs created" NEAR/5
"job creation" NEAR/5
"self service" NEAR/3
"click collect" NEAR/5
"self checkout" NEAR/5

Standalone terms
4 day week
universal basic income
basic income

Exclude
Happy News Robot
porn
#hiring

Wave 4: Overview of methodology

Data collected via:

NETBASE™
ENTERPRISE SOCIAL ANALYTICS

Query development

Involved devising a list of key terms related to:

= Ocean plastic

= Plastic and Blue Planet

The query was refined by including/excluding terms that generated relevant/irrelevant data

Data cleaning

Data was extracted on 11.01.19, covering 27 months from January 2017 to January 2019

Data cleaning involved analysis to filter out irrelevant authors/posts.

Sources of data from Netbase after cleaning included:

= 97.9% Twitter

= 1.5% News

= 0.3% Instagram

Network Visualisation

Using 10% of the clean dataset, we exported the Twitter data to perform a network map analysis to visualise the relationships between different accounts.

In the network map, we applied a statistical algorithm to identify communities of users that interacted more with each other than with other accounts, to help us interpret who the important groups and actors in this conversation landscape are.

Analysis

Using quantitative analysis, the network visualisation, and qualitative analysis a deep dive was carried out to further study:

= Volumes - including spikes

= Communities and influencers

= Interactions and relationships

= Key themes

Throughout, **engagement** refers to posts that receive likes and retweets; **involvement** refers to comments in addition to retweet and likes

Wave 4: Query terms

Primary	Secondary
ocean plastic	plastic AND marine life
oceans plastic	plastic AND marine wildlife
ocean's plastic	plastic AND marine sea life
ocean plastics	plastic AND marine habitat
#oceanplastic	plastic AND marine environment
#OceanPlastic	plastic AND marine ecosystem
"plastic ocean" NEAR/10	plastic AND marine animals
"plastic sea" NEAR/10	plastic AND marine birds
"plastic seas" NEAR/10	plastic AND marine mammals
"plastic beach" NEAR/10	plastic AND sea creatures
"plastic coast" NEAR/10	plastic AND coral reef
"plastic single-use" NEAR/10	plastic AND Blue Planet
"plastic throw-away" NEAR/10	plastic AND Blue Planet2
"Ocean Cleanup" NEAR/10	plastic AND BluePlanet
	plastic AND BluePlanet2
	plastic AND David Attenborough
	plastic AND Davidattenborough
	plastic AND fishing net
	plastic AND fishing gear
	plastic AND fishing equipment
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic water" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic fish" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic whale" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic turtle" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic reef" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic dolphin" NEAR/10
	(pollution, issue, harm, impact, effect, threat, problem) AND "plastic seabird" NEAR/10
	(ocean, sea) AND plastic straw
	(ocean, sea) AND plastic straws

Wave 4: Query terms

Secondary continued

(ocean, sea) AND plastic waste
(ocean, sea) AND plastic bag
(ocean, sea) AND plastic bags
(ocean, sea) AND plastic beverage bottles
(ocean, sea) AND plastic beverage bottle
(ocean, sea) AND plastic bottles
(ocean, sea) AND plastic cutlery
(ocean, sea) AND plastic bottle
(ocean, sea) AND plastic trash
(ocean, sea) AND plastic garbage
(ocean, sea) AND plastic rubbish
(ocean, sea) AND plastic debris
(ocean, sea) AND plastic litter
(ocean, sea) AND plastic material
(ocean, sea) AND plastic particles
(ocean, sea) AND plastic polution
(ocean, sea) AND plastic pollution
(ocean, sea) AND plastic product
(ocean, sea) AND plastic products
(ocean, sea) AND "plastic awareness" NEAR/10
(ocean, sea) AND plastic bag pollution
(ocean, sea) AND plastic crisis
(ocean, sea) AND plastic cleanup
(ocean, sea) AND plastic clean up
(ocean, sea) AND plastic clean-up
(ocean, sea) AND plastic packaging
(ocean, sea) AND single use plastic
(ocean, sea) AND throw away plastic
(ocean, sea) AND single-use plastics
(ocean, sea) AND throw-away plastics
(ocean, sea) AND single-use plastic
(ocean, sea) AND throw-away plastic
(ocean, sea) AND six pack ring

Excluded

Plastic Ono Band
barbie
plastic surgeon
plastic surgery