

## **Bridging polarised Twitter discussions: the interactions of the users in the middle**

### **Abstract**

*Purpose:* The purpose of the paper is to analyse the interactions of bridging users in Twitter discussions about vaccination.

*Approach:* Conversational threads were collected through filtering the Twitter stream using keywords and the most active participants in the conversations. Following data collection and anonymisation of tweets and user profiles, a retweet network was created to find users bridging the main clusters. Four conversations were selected, ranging from 456 to 1,983 tweets long, and then analysed through content analysis.

*Findings:* Although different opinions met in the discussions, consensus was rarely built. Many sub-threads involved insults and criticism, and participants seemed not interested in shifting their positions. However, examples of reasoned discussions were also found.

*Originality:* The study analyses conversations on Twitter which is rarely studied. The focus on the interactions of bridging users adds to the uniqueness of the paper.

*Keywords:* Twitter discussions, Twitter conversations, controversies, argumentation, polarisation, vaccination.

### **1 Introduction**

Polarisation is an important aspect of digital communication tools. When a topic is polarised, like-minded prefer to talk to each other, rather than with opposition groups (Sunstein, 2009). In theory, it makes sense to believe that online environments increase polarisation with the effects of recommender systems, and the option to build its own filters through following chosen users on the platform. It is not so straightforward though. Dahlgren *et al.* (2019) found that people who seek out news leaning one way tend to increase their own leaning, but also concluded that people who use online news frequently seek news from both sides of the ideological spectrum. Similar findings were made by Matuszewski and Szabó (2019). It seems as citizens are exposed to a variety of sources online but the effect of this can also increase polarisation (Bail *et al.*, 2018).

In this paper, Twitter conversations about vaccination are investigated with a focus on the users that act as bridges between groups of like-minded. The issue with Twitter in this regard is related to its affordances. The followership model makes content visible to a user's followers, but any public tweet is also searchable. With the character limit at 280, users who want to spark a reaction need to write clear, short messages expressing a distinct opinion. Vaccination has shown polarising

tendencies on the web and on Twitter (e.g. Ninkov and Vaughan, 2017; Radzikowski *et al.*, 2016). On the controversy surrounding the link between vaccine and autism, Jang *et al.* (2019) studied information flows across different online platforms, finding that Twitter “drives news agendas”. If so, understanding the dynamics of communication on this topic on Twitter is important.

The underlying idea is that people bridging groups of like-minded in polarised topics might have the skill to or interest in discussing with people from both sides of the issue. If being exposed to content from the other side of the spectrum as well as content from like-minded contribute to reinforcing existing beliefs, a bridging participant might be able to help other participants come to consensus. If that happens, we can learn important lessons about strategies to deal with polarisation. From a network representing communication within a polarised issue, opposing sides can be found as clusters separated from each other (Marres, 2015). The users in-between the clusters are potential bridges within the issue. The potential impact of being strategically positioned in a network is highlighted by van Schalkwyk *et al.* (2019). This includes being exposed to different viewpoints (Burt, 2004) and being able to diffuse messages across different parts of the network (Rogers, 2003). Translated to the chosen setting, a bridging user should be exposed to different viewpoints and being able to redistribute content within as well as between clusters. With this in mind, the purpose of this paper is to identify bridging users and analyse their interactions in discussions, as well as to outline the characteristics of the discussions. The following questions will be addressed:

- What is the nature of the discussions the bridging users participate in?
- What characterise those users who contribute to a less polarised conversation?
- How do other users respond to their tweets?

By using a set of hashtags and keywords that both sides of the topic are likely to follow and use, a wide spectrum of opinions is believed to be captured in the dataset. In the first step of the study, network analysis is used to map and identify issues and possible controversies. An issue involves distinct clusters of people that are tied together through links representing communication (Marres, 2015; Venturini *et al.*, 2018). The clusters are connected through bridges; if people are more inclined to follow and communicate with like-minded, the bridges between the clusters are likely to be thinner and the number of users bridging the clusters small. In the second step, the conversations as they unfold around actors in bridging positions are in focus.

The paper takes a digital methods perspective, which means that the activity of a platform must be studied with the affordances of the platform in mind (e.g. Venturini *et al.*, 2018). Based on what Twitter allows a researcher to do, the study is limited to how polarisation is visible and how discussions unfold within a given topic on Twitter. It does not aim to understand the discussions about vaccination at a more general level, although there are some aspects of the conversation dynamics that might be transferrable to other platforms.

## **2 Theoretical background**

### **2.1 Polarisation and bridging in networked settings**

The connections between people in a setting such as this is the focus of social network analysis (e.g. Wasserman and Faust, 1994). Communication network analysis is similar, but focused on communicative exchanges. In communication networks, the degree of homophily and heterophily measures to what extent content is similar within the network and its sub-clusters (Rogers, 2003). On Twitter, two main types of networks can be studied; followership and communication. The former is made up through users following other users and thus being exposed to their content. The latter can be created through retweet or reply connections, showing who redistributes or replies to whom.

An effect of this is polarisation which in turn makes it less likely for people to agree (e.g. Sunstein, 2009). If the topic is polarised, content redistributed through retweets on Twitter would be less diverse within a group, but it can also traverse to other groups through the bridges. Returning to the introduction of this text, there are positions that are more strategic than others for specific purposes, such as bridging between different groups. Betweenness centrality is a measurement of how often a shortest path passed through an actor in a network, meaning that the actor is between many other actors (Wasserman and Faust, 1994). Translating this to communication, an actor with high betweenness has the potential to control the communication flow (Freeman, 1979). Hence, the bridge is similar to a gatekeeper, who has the power to decide which items to filter forward in a chain or network (Shoemaker and Vos, 2009; DeJuliis, 2015). However, applying this to Twitter requires some considerations. Firstly, the underlying followership graph is costly to analyse from a data collection perspective. Secondly, information can be accessed through the search function.

It is here assumed that users tend to redistribute content they agree with, even though that is not always true. Sometimes one would want to highlight opposing viewpoints for example (Guerra *et al.*, 2017), and not all retweets signal agreement (Tufekci, 2014). Given that a number of previous studies have indicated on retweet networks being clustered around groups of like-minded (Cossard *et al.*, 2020; Dyagilev and Yom-Tov, 2014; Lorentzen, 2014; Stewart *et al.*, 2018), it makes sense to use such a network as basis for identifying bridges between groups of like-minded. With this though, we can only see the communicative relations that do exist within the network, and not the users' strategic positions from which they can possibly control the information flow.

### **2.2 Conversations, argumentation and controversy**

In computer mediated conversations, interactions are different than their face-to-face counterparts, with exchanges often being multiple and overlapping (Herring, 1999). The way these exchanges play out are influenced by the affordances of the platforms, including users finding new ways to address others, redistributing or tagging content (Herring and Androutopoulos, 2015). With the character limit on Twitter, at the time of the study 280 excluding any mentions, hashtags or URLs,

users sometimes chain messages together as self-replies to build arguments. This affects the turn-taking of a conversation where one post can be seen as a turn unit (Herring and Androutsopoulos, 2015). If it is not obvious that the argument spans multiple chained tweets, then other users might reply before seeing the argument as a whole.

On Twitter, we can distinguish between different levels of conversation, the usage of a hashtag at a macro-level and the micro-level tree structure of tweets and replies (e.g. Magnani *et al.*, 2012). As a conversation involves interaction, the macro-level usage of a hashtag is not a conversation per se, but rather an aggregated stream of tweets tied to a topic. The interactions within a set of hashtagged tweets on the other hand can be seen as some kind of conversation with its different modes of communication. Here, we differ from the interaction where tweets are redistributed as retweets and tree structures of tweets and replies. The latter has more similarities with a face-to-face conversation in that utterances are replied to, commented, and questioned.

The interactions are viewed from the perspective of argumentation theory and controversy studies. Argumentation is based on a viewpoint on an issue attempting to convince opponents of its acceptability, using arguments to justify or refute propositions while assuming that the counterpart has an interest in evaluating the arguments in a reasonable way (van Eemeren and Grootendorst, 2004).

One may question whether social media affords this, given the reasoning above. A different take on communication is presented by Dascal (2008), who differs between discussion, controversy and dispute. Where the discussion aims for discovering truth through proof, the aim in controversies and disputes are persuasion through argument and victory using strategic scheme, respectively. Discussions and disputes end in solution in the first case, and dissolution in the second, following a dichotomising strategy. In controversy, the strategy is de-dichotomising, to reach a resolution. Hence, in a controversy, the participants aim to reach a resolution through the use of arguments, by convincing the other part. In a dispute, however, the aim is to “win” the debate without reaching a solution, and maintaining positions. The dispute is then different from the discussion, which may result in opinion change. In a dispute, there is no search for an objective truth, but rather enforcing one’s own truth upon the opponent.

### **3 Literature review**

There are many examples of studies on Twitter communication. This review section is focused on polarisation, vaccination and conversation dynamics on the platform. Polarisation has been studied in numerous articles, of which a selected sample is highlighted here. An interesting finding was made in Guerra *et al.* (2017), where antagonising groups seemed to retweet each other more than other groups. However, as the authors highlighted this finding, a retweet graph also shows clustering tendencies, indicating that intra-group retweeting is more common than inter-group retweeting. In a study by Stewart *et al.* (2018) where Russian troll accounts on Twitter were investigated, a retweet

graph indicated on clear polarisation between left and right-leaning users. Through an analysis of discussions about the Dakota Access pipeline, Smith and van Ierland (2018) highlighted a lack of a middle ground, suggesting that if it existed, the debate could be made less aggressive. Among their main findings was an amplified polarisation, as indicated by the most influential tweets. In Yardi and boyd's article (2010) on abortion issues, sensible discussions were rarely found as different viewpoints met. On a similar note, participants talked about rather than with each other in the exchanges studied by Bruns and Highfield (2013) and Mascaro and Goggins (2015), with the latter also concluding that many replies were not intended for continued discussion.

Regarding vaccination related topics on Twitter, Radzikowski *et al.* (2016) analysed tweets following a measles outbreak in 2015. A topical analysis based on word frequencies identified what most often was tweeted about, finding the topic being partisan. They drew parallels between levels of retweets and activism. van Schalkwyk *et al.* (2019) focused their study on anti-vaccination and autism and found distinct clusters in a co-tweet network, where a link was created between two users if they had shared the same research article. Three anti-vaccination clusters were tightly connected both regarding inter-connectedness as well as intra-connectedness, whereas the pro-science cluster had few connections with two clusters and was more connected to one anti-vaccination cluster. The study also found examples of bridging users with connections to other clusters. Sanawi *et al.* (2017) applied network analysis to identify potential influencers in communication networks drawn from the #vaccination hashtag. Among the central users, a media actor and a celebrity situated in one end of the network were found to be able to influence opinions, and a homeopathy promoter attracted anti-vaccination users at the opposite end. Broniatowski *et al.* (2018) focused their analysis on bots and Russian trolls, finding that anti-vaccine content was produced by other accounts than those that were very likely bots. They called for participation by health practitioners to counter anti-vaccine content. In an Italian study, Cossard *et al.* (2020) found a retweet network mainly clustered into advocates and sceptics. Looking closer at the interchanges between the networks, it was found that the sceptics were much more connected with each-other than the other main group. Also, some hashtags were much more frequently used by the sceptics, such as those representing freedom of choice. Official sources were prominent in an analysis of swine flu discussions, in which a small minority of anti-vaccination users was vocal (McNeill *et al.*, 2016). Contrary to other studies on related topics, a retweet graph showed no indication of polarisation. Finally, in a webometric link analysis performed by Ninkov and Vaughan (2017), sources linked to by the pro-vaccine community on Twitter had a higher PageRank and were deemed being of higher quality given a qualitative content analysis. Sources seemed to be more spread from the pro-vaccine community and more centralised in the anti-vaccine group. The findings also imply that the topic is polarised with little middle ground.

A problem with these studies, and many other hashtag or user based studies, is that only fragments of conversations are collected (D'heer *et al.*, 2017; Lorentzen and Nolin, 2017). So far,

little attention has been given to Twitter discussions. The few examples include political discussions related to events and campaigns (Lorentzen, 2016; Nelimarkka *et al.*, 2020), activism (Housley *et al.*, 2018), and discussions emanating from references to research papers (Nelhans and Lorentzen, 2016). Nelimarkka *et al.* (2020) found a large percentage of tweets expressing opinions and very little agreeing and disagreeing. In comparison, Lorentzen (2016) found that many tweets included an opinion, but agreements and disagreements were also common, with the latter more frequent. The study drew the conclusions that reasoned discussions were rare, with many replies not inviting further discussion. Similarly, quite a few replies in the threads analysed by Housley *et al.* (2018) were categorised as unengaged. The analysis also showed that discussions deviated from the topics in sub-conversations. In the study of academic discussions, the references were most often used for promoting articles or as arguments (Nelhans and Lorentzen, 2016). In concluding this section, we can see that conversation-based studies are not common. While there are many examples of polarisation studies and research on vaccination on Twitter, little is known about how people discuss in general and on this topic specifically. Given this, it is relevant to analyse the potential for a middle ground in conversational thread by focusing on users that hold bridging positions in the retweet network.

## 4 Method

### 4.1 Data collection

Data collection was made using the method proposed by D'heer *et al.* (2017) and Lorentzen and Nolin (2017), who both outlined how to collect conversations using the Streaming API as opposed to only focusing on tweets matching keywords or users. To be able to find conversations about vaccination, a static filter of keywords and hashtags were used, including *vaccination*, *anti-vaccination*, *antibiotic resistance*, *immunisation*, *protective immunity* and variations of these. Alongside the keywords, a dynamic set of the currently 2,000 most active users derived from the dataset comprised a second filter. Through this combination, tweets matching the keyword set and tweets replying to collected tweets were captured.

Data collection was started on November 19 2018 and ended one week later. Tweets that were replied to by tweets in the database but not collected were then identified and downloaded if they were still available through the API. If they were replying to tweets not in the database, those tweets were subsequently looked up. The final dataset comprised 302,434 tweets, of which 91,406 were replies. When data collection was finished, threads were inferred from the reply metadata accompanying replying tweets. All participants in threads with at least 100 tweets were looked up in the Twitter API for profile analysis. After these steps, all user IDs and usernames were replaced by a numerical ID so that the material were anonymised before analysis. The user profiles were categorised using a semi-automatic method which is described by Ekström (2019). While several categories were

identified, the focus is here on academic users, including students, graduated, educators and other faculty members.

## 4.2 Data selection and analysis

As previous studies have found clustering tendencies in retweet networks in polarised topics, the selection of bridging users takes off from such a network. The network (Fig 1) consists of 2,003 users who share 4,668 connections, where a connection represents one user retweeting the other user in a directed graph. The network is filtered so that only the users with at least ten connections are visible, but the same clustering tendencies can be seen with more than 10,000 nodes. The structure is partly mirrored with the structure of the retweet network in Cossard *et al.* (2020), in which 19,193 nodes were clustered into two large opposing groups and one distinct smaller group in between. The left cluster seems to be more inclined to anti-vaccination opinions whereas the other parts of the network are pro-vaccination oriented, a conclusion drawn from the hashtags used by the users within each cluster. Similar to van Schalkwyk *et al.* (2019), the anti-vaccine cluster is denser than the other clusters, however in this network there are far more participants that belong to pro-vaccination groups.

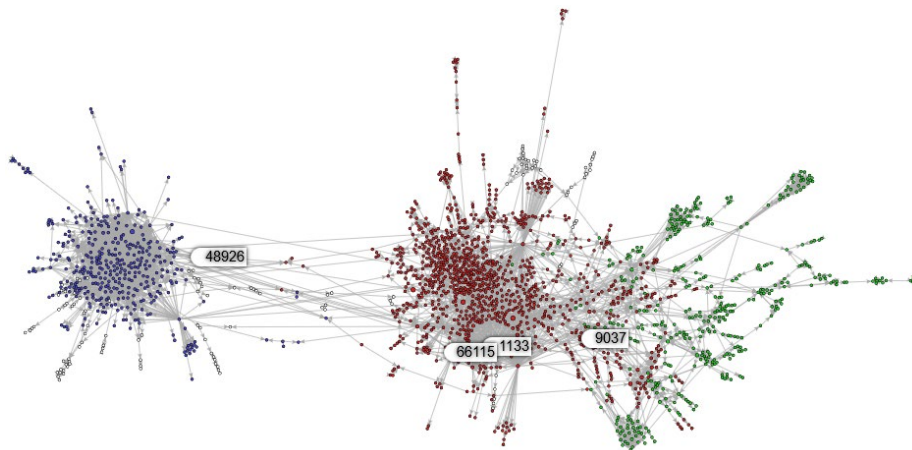


Figure 1. A retweet network with bridging users labelled. Three main clusters can be identified: blue, red, green. The four bridges with highest betweenness scores are labelled.

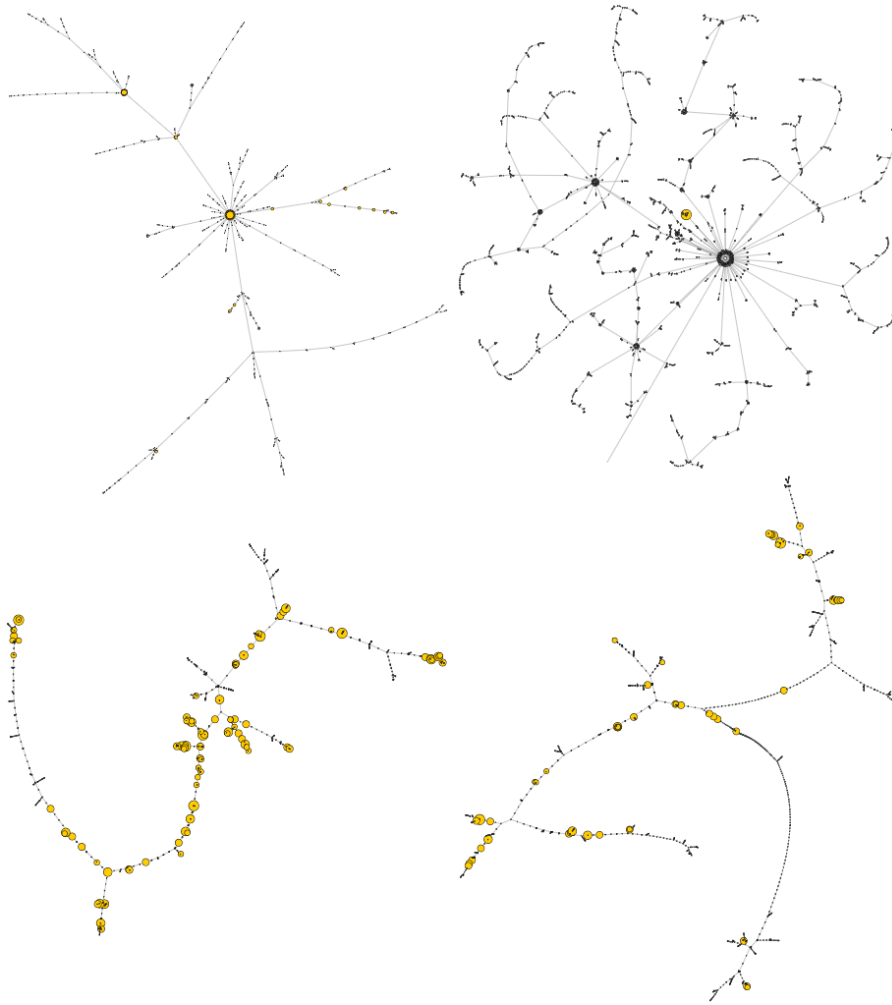
The eight potential bridges (Table I) make up a stratified selection of participants, primarily based on the network metric betweenness centrality. With only four users with high betweenness participating in the threads, the selection was expanded with four other users, all situated between the pro- and anti-vaccination groups. The bridging users make use of different tweeting practices with three of them being far more active than the others. 1133 is the most connected user with the highest betweenness score having 98 retweet connections, of which 79 are outgoing, meaning that 1133 retweets content from 79 other users. This user is also the most frequent participant in the discussions, with 383 tweets posted in threads. 66115 is similar to 1133 but less active. Their retweet connections are mostly made up of users in the central parts of the network. 48926 has the second highest

betweenness score, but is the least active in the discussions of these eight. The user is situated close to the anti-vaccination cluster to the left and acts as a bridge to the pro-vaccination cluster in the middle, retweeting content from the latter to the former. Similarly, the more active 6930 retweets content from the anti-vaccination cluster into the pro-vaccination cluster. At the right side of the network, 9037 acts similarly as 48926, but is more active in the threads. The other three users have a betweenness score of 0, but are situated between the left and the centre clusters. One of these, 301388, is heavily involved in discussions, contributing with 133 tweets.

[INSERT TABLE I ABOUT HERE]

97 conversational threads consisted of at least 100 tweets. From these, four threads were chosen based on the bridging users' participation. The threads have different structural characteristics (Fig. 2), with Thread B having a very complex structure. From a few hubs the discussions bifurcate into branches that in turn evolve into sub-branches. In this thread, only one of the selected users participates. Looking at length and participation, Thread A is the shortest with 456 tweets posted by 145 users. B is the longest of the threads with 1,983 tweets and involving 727 users. C and D are more similar in length (779 and 993 tweets respectively) and number of participants (75 and 78). D is considerably slower than the others, with four tweets posted per hour as compared to between 14 and 20 in the other threads. C and D both involve very active bridging users. Topic-wise, similarities with the top ten topics in Radzikowski *et al.* (2016) can be seen, for example flu, HPV, polio, health freedom and autism.





*Figure 2. The chosen threads. Top left: A, top right: B, bottom left: C, bottom right: D. Tweets sent by bridging users are coloured and oversized.*

While special interest is given to the bridging users, the entire discussions as they unfolded were analysed. The thread analysis was done through the concepts outlined in the theoretical background above. Specifically, the emphasis lies on different ways of ending a debate and argumentation aspects, focusing on the parts where the bridging users participated, and the immediate reaction to their tweets. As science is a very important aspect of the vaccination topic, the analysis is also centred on to what extent and how academic users participate in the discussions. 106 academics participated in the threads, 11% of the 962 participants.

## **5 Analysis of the threads**

The eight bridges have different sets of characteristics. Two users occupy strategic positions between sub-networks, but their participation is limited to a few tweets with little reaction. 48926 and 6930 retweet content from other groups into their closest group. Both of them can hence be seen as gatekeepers in this setting. Especially 48926 has a potential reach across the whole network, which entails that its retweets may spread to a large audience. 1133, 9037 and 66115 are more active in the discussions and contribute to a less polarised conversation. While all three of them have retweet

connections from the pro-vaccination cluster, they interact with non-like-minded in the discussions. A third type is represented by 301388, who is mainly retweeted by the pro-vaccination cluster, but has a critical stance towards vaccines in the threads. Finally, 12423 and 149448 are retweeted by users from the two main clusters, but their participation is limited to a few tweets.

Thread A is dominated by an attempt to equate anti-vaccination opinions with hate-speech. Anti-vaccination opinions and connecting vaccination to autism is a main feature of the discussion, as is freedom and human rights, which might indicate that some participants believe that freedom is more important than vaccination, similar to the sceptics community usage of such hashtags in the study by Cossard *et al.* (2020). Parts of the thread deal with racism and religion and other parts are about big pharma. Measles and polio appear as examples of diseases vaccines are supposed to prevent.

Four bridging users participate in this thread. It starts with a reference to a tweet later deleted, posted by 149448. The reactions to the tweet suggest that it takes an anti-vaccination position and attempts to use victimisation and hate-speech to build sympathy. Some angry responses follow the start tweet, but also support. This part of the thread is dominated by topics such as anti-vaccination and autism. The discussion is heated with two sides attacking each other. 301388 enters the discussion by taking the side of the thread starter, agreeing that parents who do not vaccinate their children are victimised. The branch gets more into a reasoned discussion but then falls back into the same style and is eventually abandoned. The thread evolves in another direction as the starter builds an own sub-thread by chaining a couple of tweets together. The first reply, in which the starter tries to clarify the stance and apologise, bifurcates in two directions. One reply to this explains how the unvaccinated replier got shingles and then a brain disease, which is met with scepticism by another user who insinuates that these were caused by vaccines. This user is then blocked by a few participants who talk about him/her. The other main branch consists of tweets disagreeing with what they are replies to, and although participants try to build their arguments, the branch is abandoned without positions moved.

The second reply bifurcates into many directions and the discussions take off again, as a participant claims that there is no evidence for that vaccines decrease measles. This part of the discussion is more centred on whether hate-speech could be the same as having anti-vaccination opinions. Here, people talk about the other side by using terms such as *vaxxers* and *anti-vaxxers*. 1133 enters the conversation, trying to correct 149448 with an apology that 1133 thinks would be more appropriate. In this branch, pro-vaccination opinions are dominant, and these users are in complete consensus. However, further down the branch a vaccine sceptic enters the discussion with 1133, trying to claim that vaccines cause more harm than good. The branch divides into two smaller branches in which both these users have a reasoned discussion without arriving at consensus. In another branch emanating from the chain by the thread starter, 6930 participates with a few tweets with little response.

Generally, the anti-vaccination stance seems to centre on examples of vaccine injury, and academics attempt to clarify that it is better to save many people with vaccines. These attempts are not replied to in this thread. A claim that polio is caused by vaccines is disputed by an academic, pointing out that the source is a YouTube video and backing up the argument with references to other sources. Again, this reply is not answered.

Thread B is different in that it involves many different topics or sub-topics. As this thread is the longest and most complex with regards to the structure, this is perhaps not surprising. The thread starts with an academic chaining tweets together telling a story about what happened to child with cancer being exposed to measles. Most of the replies to these chained tweets are to the first (220 replies) and last (59) tweets, with only a few replies to the other tweets. This is an example of the potential consequence of not making it obvious that the argument spans over several tweets. Of the bridging users, the only participant is 48926 who takes part in a branch that starts with a reply to the first tweet in the chain by the thread starter. The reply by 48926 implies that vaccines cause brain damage. 48926 is then ridiculed by some users whereas others respond with arguments, one of them referring to research articles. A user calling the tweet by 48926 for nonsense is replied to by two anti-vaccine users, one of them referring to videos in which a doctor says that we know nothing about vaccines. Most of the participants categorised as academics take a pro-vaccine stance, although a few in this category post anti-vaccination and vaccine sceptic content. Most of these tweets are not replied to, but a few of them spark discussions, as one user hints that vaccines cause autism and claims that the study showing this link is valid. Other exchanges involve theories about the connection between vaccines and cancer, based on non-academic sources.

Aspects related to school, children, parents and consent are prominent in thread C. A main topic for the thread is about informed consent when it comes to vaccination of school children. 1133 is participating in almost every segment of thread C, apart from the start of the thread in which academics argue in favour of vaccination in schools. Three other bridging users are involved in the overall discussion. The thread develops in different directions where the first one focuses on informed consent, with anti-vaccination users arguing that children must agree to vaccination whereas the opposing opinion centres around that they are too young to understand the benefits. The branch ends as an echo chamber where anti-vaccination people are talked-about alongside anecdotes about how the participants tried to avoid the needle as children, involving 66115 who agrees with 1133. In another direction, the discussion is focused on vaccination in schools. This part of the thread is dominated by the opinion that parents should decide about their children's vaccination. The thread bifurcates when a user who claims he/she has been selling vaccines to schools building an argument on an article, however, 1133 argues that the argumentation and the article do not match. Another part of the discussion is about solutions to make it more likely for children to take the vaccine. Much of the thread is dominated by these two participants. 1133 argues reasonably and without attacking other

participants, which contributes to a more sensible discussion, a style mirrored by the less active bridging user 9037. The salesperson does however use a more aggressive language but is constantly argued against. However, after the discussion turns into a discussion about the discussion, the tone becomes aggressive as 1133 continues with scientific arguments and the salesperson takes a free-will stance. 301388 sides with the salesperson but receives no reactions to his/her tweets. The other bridging users support 1133 at various parts of the thread. Beside 1133, other academics participate in the thread too. Their interactions follow a similar pattern as in A.

In the final example, science is an important aspect alongside conspiracy, with a separate discussion about mutations. Thread D involves six of the eight bridging users, and again, 1133 is very active. The discussion does not start within the topic of vaccination but is rather about drugs. It eventually develops into a discussion about vaccines in which academics point to scientific data that are contested by opponents. 66115 is the first bridging user to enter the conversation with a tweet disputing an anti-vaccine claim. The mutation branch is dominated by two academics arguing with each other, where one starts with a tweet about evolution and the other argues that the former has misunderstood the process. After quite a few exchanges this branch is abandoned. The same two users are then engaged in another exchange about appendices. In other parts of the thread, academics argue mainly with each other.

The conspiracy part emanated from a tweet by an academic stating that pro-vaccine people know the limits of science and those against vaccine are affected by cognitive bias. The discussion is then on the topic of autism, where defendants of the connection point to anecdotal evidence as opposed to what they call “big pharma-gov studies”. 1133 starts participating with a source-type related question. An academic’s reply suggests that anti-vaccine users are often requesting sources, but constantly dismiss the sources given, or change the goalposts. Examples of such practices can be seen elsewhere in this thread, where sources are requested, but the one providing the source is then asked to point out specifically where in the source the facts can be found. This part of the thread eventually evolves into a discussion about anti-vaccination people, dominated by academics. Another branch evolves into mudslinging. There is a shorter discussion about chemistry, most notably about aluminium in vaccines.

A short discussion starts when 1133 responds to a tweet referring to an academic source by claiming that the person behind the text, an opinion piece, has had multiple articles rejected, and asks for evidence. An academic, also posting anti-vaccine opinions in B, replies with links to white supremacy web sites, and following a few replies to this tweet the discussion ends. Then, in another branch, anti-vaccine participants mock opponents by saying they are brainwashed. Most branches only involve a few tweets on the topic and then deteriorate to meta-discussion and mocking.

Especially one user, 12352, categorised as academic (although in one tweet in the thread the user hints at this might be a parody account), is arguing against vaccination, and with the help of 301388, also against 1133. The potential parody account is one of the most frequent tweeter in the thread with 64 tweets, but attracts little interest from academics. Finally, 1133 responds with suggesting that evidence shown does not match the arguments. There is little substance in large parts of the thread, but at the later stages 12352 supports an anti-vaccine claim linked to by another user, and again, 1133 responds by refuting the claim. 12352 suggests that 1133 should read a study, and then 1133 points to a scientist, which results in a few insulting tweets and the discussion is abandoned.

6930 enters with a tweet that argues against that big pharma sponsors medical schools, a point 12423 agrees with, but there are no replies to these tweets. In another branch close to this, 301388 insists that it is the case that big pharma supports medical schools. 301388 then tries to side with the connection between cancer and HPV vaccine, which is disputed by a reply which indicates that the cancer patients were not vaccinated. An interesting argument is seen when someone requests a citation, which according to a user supporting the connection is a diversion tactics.

Some patterns are recurring. Governmental and non-governmental sources are linked to in three of the threads. In all threads, both academic and non-academic sources are used as arguments or evidence. Quite a few times a source is referred to, and then follows a dispute about how the other side did not bother to read the entire content or did not understand it. Academic sources are mainly used for pro-vaccination arguments, although a few vaccine-sceptic participants made use of these too. Anti-vaccine participants are more often relying on non-academic content from blogs, websites and YouTube. These sources are typically not commented on by opponents, but sometimes they are ridiculed or met with academic sources as arguments. Big pharma is a target for anti-vaccine participants. Those arguments are contested by pro-vaccine participants, with many of these showing a neutral stance towards the industry.

Both sides attempt to argue for their positions but there are no concrete examples of viewpoints being shifted. While different opinions meet in the discussions, the participants rarely arrive at any kind of consensus. Rather, the basic motivation for participating seems to come from a need to express opinions.

## **6 Discussion and conclusions**

When Twitter changed its information model so that mentions, URLs and hashtags no longer counted as part of the content, it started facilitating conversations more easily. If many users are tagged into the conversations, more users can participate. The underlying idea behind the study was that bridging users might help other participants arrive at consensus in polarised discussions. After studying four conversational threads and a total of more than 4,000 tweets, little evidence of

consensus was found. Discussions often ended in closure due to disagreement and abandonment as participants lose their interest. Consensus building happened typically in echo chamber like branches. Seemingly, Twitter is not a platform used by people to evaluate their own positions. Also, in many parts of the threads, the discussions deviated from the topic, or developed into other topics, and quite a few times ended up in personal criticism and insults. Similarities between these findings and previous research include lack of consensus building (Lorentzen, 2016), unengaged replies and deviations from the topic (Housley *et al.*, 2018), participants talking about each other using mentions of their usernames (Bruns and Highfield, 2013; Mascaro and Goggins, 2015), and academic sources used as arguments (Nelhans and Lorentzen, 2016).

Of the users with higher betweenness centrality, participants 48926 and 1133 stand out in different ways. Both were categorised as academics but situated in different clusters of the retweet network. 48926 is placed in the outskirts of the anti-vaccination dominated cluster and from its position could be thought of someone who could potentially act as a bridge between opinions. However, this user only participated with a few tweets in one thread, showing little interest in building consensus. In the retweet network, 48926 has a reach that spans across large parts of the whole graph and is thus able to spread information to all major clusters. This seemingly strategic position, which 6930 also occupies, did not prove to be an indicator of bridging in the threads. 1133 on the other hand, situated in the pro-vaccination cluster, is very active in the discussions, consistently tweeting factually, using a formal tone and responding with arguments without being aggressive. The strategy is a good example of combating messages as suggested by Broniatowski *et al.* (2018). Even so, it did not seem to create the middle ground that has been identified as lacking in vaccination discussions (Ninkov and Vaughan, 2017) and elsewhere (Smith and van Ierland, 2018). However, the discussions 1133 and similar users such as 9037 and 66115 take part in are less aggressive than the exchanges involving other bridging users. Based on these results, we may understand Twitter as a dispute-oriented arena with traces of reasoned discussions where bridging users participate. The participants that contributed more to depolarisation were not found between the main clusters, but could be identified through their participation in discussions, where they interacted with users from both opposing groups.

## **6.1 Implications**

Twitter has moved to include content from other accounts than the user follows, based on different signals (Twitter, 2020). If users have less power over their timelines they have less influence what they are exposed to. The question is then if the signals strengthen or weaken polarisation. If it is the latter, then the next question is what people do with information they do not agree with. Within the realms of digital methods, we can study this through their information practices in retweeting, quoting and replying. Their interactions suggest that they redistribute tweets from like-minded far more often than non-like-minded and that based on the discussions, the participants are not open for

changing their opinions. Digital methods seek to study the activity given the affordances of the platform (Venturini *et al.*, 2018). Nelimarkka *et al.* (2020) stressed the importance of also considering the practices on the platform. With this follows that argumentation theory needs to be adapted to affordances of Twitter and how people interact on the platform. If depolarisation is desired, then we need to focus on the exchanges where different perspectives meet on a larger scale over several domains or topics. Housley *et al.* (2018) developed a typology that can be built on for a quantitative approach. Using this with a focus on the debate-dispute related aspects from a computer mediated communication perspective, more knowledge about how to bridge polarised topics can be gained. If conversational threads are collected, attention can be turned to the users that interact with different groups. The retweet network could be a reasonable vantage point for identifying opposing groups, although an analysis of the content the users produce is needed. In this study, a few users expressed opinions contrary to the main stance in their network cluster.

While the two users with strategic gatekeeping positions in the retweet network did not participate in the conversations to a meaningful extent, they still have the possibility of spreading content into different sub-clusters. Further analysis of their retweets, and the reaction by other participants is recommended. For participants who strive for a more sensible discussion, a more formal and neutral tone seems to contribute to this end. This type of participation does not seem to move positions of the users interacted with, but it might help winning support from other participants in the threads, and passive readers. It might also encourage other like-minded users to participate.

## **6.2 Limitations**

Even though previous research with different methods point to the same lack of consensus building as this study, it is important to point out that this data collection was limited to a short time-span and one topic. Twitter is event-driven and respond to what is happening at the time. This entails that sub-topics, polarisation and discussion characteristics may differ from one time period to another. Another limitation is the number of threads studied. The four threads were chosen based on the participation of eight potential bridging users. If network metrics are used to identify users to focus on, then bridging users could be compared to, for example, actors that are central within the clusters. A different set of users would very likely result in another set of threads to analyse. These threads, all of them of substantial length, included 4,000 of the more than 300,000 tweets in the dataset. Analysing a larger number of threads of different lengths would increase the knowledge about Twitter conversations. Further investigations into how academic and non-academic sources are used in the discussions, as hyperlinks as well as embedded media, are also recommended. From an academic point of view, it is interesting to study how the sources are used and discussed.

Despite these limitations, the study has provided insights into the conversation dynamics. With little attention given to conversational threads in Twitter research, more studies of the

conversations are needed, both qualitative and quantitative. Finally, following the COVID-19 outbreak, it would be interesting to see if and how the conversation dynamics have shifted within the topic.

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