How Does a Twitter Hashtag Hype a COVID-19 Conspiracy Theory?

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Abstract: We analyzed the trend of high frequency words under a Twitter hashtag #5G: Coronavirus as well as the sentiments behind based on the collected 3,136 tweets which filled the gap in studies concerning how conspiracy spread. Figuring out the mechanism, we found the contexts driven by the conspiracy appear to be negative as a whole, and new topics overflow into the unsolved tangle, by which we propose two succinct solutions to tackle the issue: explain the obscure events ASAP and avoid direct engagement with conspiracy theory discourse.

Keywords: Covid-19, conspiracy theory, social media, hashtag

1.   Introduction

The digitalization of news through social media has made it more available to receive information about current affairs. A vast number of us, especially the youth, rely on platforms such as Twitter to get informed about what is happening around the world ver, what we've witnessed is the fact that misinformation is now more rampant than ever, especially during the virally expanding crisis where people tend to believe in whatever concerning the issue [1-4]. Focusing on today, we are standing right at the post-pandemic era, where a bunch of COVID-19 conspiracy theories on social media have led to an unexpected infodemic, wreaking havoc of trust missing, faith losing and lives dying. Therefore, finding out the mechanism "how does a conspiracy theory spread" is the prerequisite of tackling the issues mentioned and thus our main focus [5-7].

Before diving into the plan of our research, we've narrowed the mechanism of conspiracy's spread down into three layers of questions: (1) what was the entity that created the conspiracy at the beginning and what were the incentives? (2) by what media and how did it approach receivers? (3) why did some receivers buy in the conspiracy? According to our study on previous studies, numerous researches had been focused on the first and third questions and the second question is less touched upon which leaves the gap for us to study [4,8,9]. Moreover, we learnt that emotion is accounted as extremely crucial to the conspiracy spreading dynamic and emotions are mostly embodied in words on social media, where the more searching and subtle sub-question "how wordings on social media drive a conspiracy viral" is readily left to us to solve [10].

With the employment of trend map, scraping and sentiment analyzing as methods, we searched the hashtag #5G Coronavirus which tops the list of popular COVID related conspiracies and collected 3,136 tweets under the hashtag from the social media Twitter. After the analysis with our two main focuses which are "high-frequency words" and "sentiment of these words", we concluded two pieces of findings from the dynamic: (A) users with positive sentiment (opposed to, or neutral towards, conspiracy theories) were more focused on using neutral language and displaying lighter emotional intensity, while users with negative sentiment (conspiracy proponents) were more inclined to use relatively extreme language and display extreme negative sentiment which makes the overall emotional state of the discussion under the hashtag 5Gcoronavirus negative; (B) new high-frequency words emerged with new discussion topics in conspiracy's each ascending period [11]. In addition, two possible solutions to eliminate conspiracies by combing our findings and previous studies are proposed at the end of the essay, summarized by two concise slogans: explain the events and avoid conflicts.

2.   Literature Review

This part will bring two layers of proof on the importance and rationality of our research: 1. Conspiracy theory is overall detrimental though proven to yield some positive effects; 2. Similar studies on the spreading of conspiracy theory are insufficient in tackling the problem.

2.1.   In Terms of the Importance of Our Selection on This Topic

Reason1. Conspiracy theory related to COVID-19 has done more harm than good. According to two stated potential benefits that believing in conspiracy theories might lead to a feeling of shared community and a sense of control, the fact is that such misinformation not only haven't united people but teared the whole society apart with the backlash of xenophobia, populism and even anarchism [12]. The society's whole atmosphere has been infested with such insecurity that it needs to be saved. We firmly believe that placing our focus on this topic is the right choice.

Reason2. The unprecedented globalized use of social media has made it easier for misinformation to spread, where people are more likely to be exposed to false sources. The previous studies had been deployed in a relatively less-connected society, but nowadays we are unprecedentedly more interactive on digital platforms. The new mode of using hashtag, people's frequency of checking the social media, citizen's attitudes towards different stakeholders including government, scientists, local communities and foreigners and so on, are what we deemed as undoubtedly new and challenging when facing the same term "conspiracy theory" even though the psychological mechanism of detecting dangerous coalition appears to be a theoretically fixed rule.

2.2.   In Terms of the Insufficiency of Current Studies in Tackling the Problem

A certain number of studies have indicated emotions have something to do with the spread of conspiracy theory, but also the negative emotions especially 'anger' can be a catalyst to spawn conspiracy theory regarding cognitively changing or challenging people's understanding towards current happening, or practically inciting people to commit certain actions, for instance, rejecting vaccination or practicing protest [13]. It is indeed a huge success in identifying the internal drive which can further be utilized to potentially regulate people's behaviors, but the question now is "when to intervene?". As a result, our target of collecting and analyzing the trend of one conspiracy's dawning, rising, peaking and declining appears to be uniquely important.

3.   Methodology

Data gathering is the initial step of research. In this study, WDRA software is utilized to collect the data within the rise, peak, decline and bottom for later analysis. Regarding the study's methodology, we initially searched the term 5G Coronavirus in Google trends. Figure 1 below shows the trend map for the appearance of 5G Coronavirus on Google Trends where the periods involving peaks of the term's volume were what we targeted.

Further, we searched Twitter for the periods when the appearance of the term 5G coronavirus went highest, declined, and increased. These periods included January 24th, 2021 to January 30th, 2021, March 28th, 2021 to April 3rd, 2021, and May 2nd, 2021 to May 8th, 2021. Further, between January 3rd, 2021 to January 23rd, 2021, January 30th to February 13th, March 14th to March 27th as well as April 25th to May 22nd, and July 25th to August 2nd, 2021, the appearance of the term 5G coronavirus declined on Google trends. Notably, between April 3rd to May 1st, July 11th to July 31st, August 22nd to September 19th, 2021, 5G Coronavirus' appearance on Google trends was highest and thus considered the rise period. During these periods, we searched the query 5G Coronavirus and found 3,136 tweets.

The results were downloaded by utilizing WDRA software, a type of software for data scraping. Thereafter, we imported these data into the SentiStrength software to analyze the tweets for finding out the mass sentiment (negativity and positivity as two indicators) as well as the sentiment that account for the majority.

Finally, we returned to the initial Excel data to filter out tweets affiliated with the greatest percentage of the sentiment using Voyant, a text mining software to get visual outcomes of the tweets employed phrases and frame network between words and phrases in every aspect of sentiment.

Figure 1: Trend Map for the Appearance of 5G Coronavirus on Google Trends (Source: Google Trends).

4.   Data Analysis

The peak period is defined as the busiest period and the data gathered from Twitter during these periods where 5G Coronavirus appeared in 566 tweets shows that people used the hashtag to contribute to, ridicule, or dispel the discussion on the topic thereby raising the hashtag to newer heights and increasing its visibility on Google trends and subsequently Twitter. According to Ellwood, at the beginning of January 2020, a conspiracy theory linking the 5G mobile network's launch to COVID-19's emergence took off on Twitter [14]. It is during this period that the current study found the most prevalent appearance of 5G Coronavirus on Google trends and Twitter. Therefore, the reason for the peak of this term on Twitter is that 5G and the pandemic conspiracy belief became an especially trending talking point on Twitter as seen in the gathered data.

The decline period refers to the period when something is slumping. During the collection period, we gathered 258 tweets related to the term 5G Coronavirus on Twitter, which shows a significant

deterioration from the peak period when it appeared the most on the platform. During these decline periods, Twitter users expressed support and criticism of the connection between 5G and Coronavirus. However, the decline in the appearance of the term can be attributed to efforts that were introduced to counter false and misinformation on Twitter following its outbreak in early January.

The rising period starts at the end of the decline period. During the rise periods, we collected data and noticed that the term 5G Coronavirus appeared 368 times. The reason for the rise in 5G Coronavirus' appearance is a surge in users' propaganda and anti-propaganda accounts that spread information related to the link between 5G and the pandemic. Further, it is during this rising period that notwithstanding an absence of scientific evidence, this 5G Conspiracy theory propagated and spread quickly on Twitter and had severe ramifications, resulting in cell phone towers burning in different parts of the world. Thus, considering the ramifications of the conspiracy theory especially the burning of 5G network masts, the term 5G Coronavirus trended on Twitter hence the rise in its appearance on Google trends.

Also, after gathering the data, we carried out a sentiment analysis to examine Twitter users' general attitude towards the 5G Coronavirus Conspiracy theory. According to Liu & Zhang, sentiment analysis constitutes an approach of employing a computer program to examine sentiments that a text presents [15]. Following the first analysis step, we sorted the gathered tweets in an Excel sheet in accordance with negative emotions and sentiments' value. Thereafter, we advanced to the following stage of sentiment analysis. According to Liu et al., the emotional analysis process is also known as text mining since it aims at mining opinions and sentiments from data and information within texts [16]. The tweets with positive as well as negative sentiments that we had filtered using Excelled were processed utilizing Voyant (see Table 1). Thereafter, the outcome was shown by WordCloud as well as the semantic link to demonstrate how the 5G Coronavirus hashtag hype a COVID-19 conspiracy theory. Table 1 below shows the sample tweets depicting levels of the sentiment of 5G Coronavirus tweets.

Table 1: Examples of how to determine the degree of negativity or positivity of a word.

Level of Sentiment	Sample Tweet
Extremely negative	5G robots are battling the coronavirus in China.
Negative	My whole family group still thinks that coronavirus has come because of 5G radiation
Neutral	RETRACTED: 5G Technology and induction of coronavirus in skin cells This article was retracted, so we can't even read what the study said.
Positive	No link between 5G technology and spread of. It has come to notice of (DoT) Ministry of Communications- several misleading messages are being circulated on social media platforms that the second wave of coronavirus has been caused by the testing of the 5G mobile towers.
Extremely positive	The claim that 5G trials or networks are causing coronavirus in India is "false" and without any scientific basis, an official release said.

5.   Findings

In the following section, we present the findings of our data analysis. The initial part was sentiment analysis. Using the WDRA software along with data rectification, we obtained a total of 1,191 valid tweet data. As exhibited in Figure 2 below, every tweet's sentiment score comprises two different elements: negative and positive, for example, (-1, 1). Because 1 and -1 represent neutrality respectively, we predominantly analyze the percentages from -2 to -5 as well as from +2 to +5 in this section. In the figure below, we noted that the proportion of users' tweets with negative sentiments was 58.68% of the sum total, which was less than the sum total of positive tweets (87.60%). It is also worth noting that the negative sentiments were clustered in the -2 and -4, which depicts a lighter level of negative sentiments, with 25.62% and 8.26% separately. Comparably, the main aspects of positive sentiment are at a modest percentage of 2 (11.57%) as well as 3 (0.83%) whilst only fewer numbers, 0.00% and 8.26% of very positive and negative sentiments appeared in users' tweets. Overall, the gathered tweet data largely conveyed a negative attitude towards 5G Coronavirus and expressed with massive attitude.

Raw Labels		1	2	3	4	Grand Total
-4	8.26%	87.60%	11.57%	0.83%	0.00%	
-3	7.44%	12.40%	23.43%	8.79%	46.45%	
-2	25.62%	0.00%	51.40%	11.97%	23.11%	
-1	58.68%	0.00%	13.60%	78.41%	30.44%	
Grand Total	100%					100%

Figure 2:The percentage of negative and positive words in varying degrees.

To further examine the users' concerns and interests behind every sentiment, we employed text mining and analysis with Voyant Tools in the following step.

Figure 3: Words occurring in the collected data.

			Term	Count	Trend
⊞	☐	1	5g	123	
⊞	☐	2	coronavirus	103	
⊞	☐	3	false	26	
⊞	☐	4	spread	24	
⊞	☐	5	testing	22	
⊞	☐	6	towers	22	
⊞	☐	7	india	20	
⊞	☐	8	technology	19	
⊞	☐	9	covid	16	

Figure 4: Top nine most frequently occurring words in the data collected.

According to word frequency and WordCloud form (see Figure 3 and Figure 4 above) the top 4 words and phrases appearing most commonly and frequently in gathered tweets associated with negative and positive sentiments were 5G, Coronavirus, false, and spread. Further, to make sense out of these phrases and words within the context, we analyzed the phrases link joined by higher frequency words independently. As per the analysis, 5G was strongly linked with Coronavirus (see Figure 5 below). From the text of the tweets, most of the Twitter platform users expressed and conveyed their support for the connection between 5G and Coronavirus. This suggests that a good number of individuals did believe in the conspiracy's accuracy during the peak periods that the term 5G coronavirus appeared on Google Trends and Twitter. However, it is also worth noting that during the period when 5G Coronavirus appeared on Google Trends, a group of individuals expressed their lack of support for the relationship between the 5G network and coronavirus. This shows how some individuals were actively castigating the conspiracy theory. For instance, one user Tweeted "5G Coronavirus conspiracy is false".
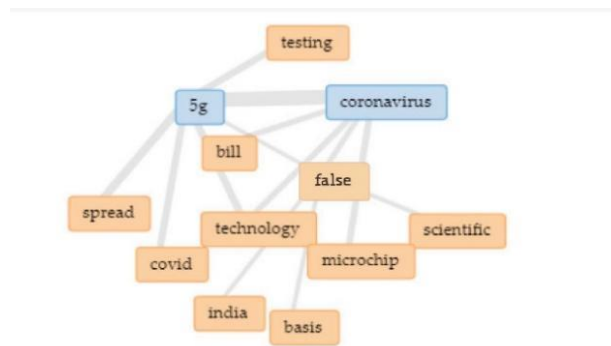

Figure 5: Links between high frequency words in the collected data.

Finally, we carried out text mining for the tweets to discover what was the main information in the tweets holding individual users' sentiments. The most prevalent words within the texts after 5G and Coronavirus were false appearing 26 times (see Figure 4 above). These are positive tweets criticizing the conspiracy theory around COVID-19.

6. Summary

From our research, Twitter users generally used the platform to counter the hype around the COVID-19 conspiracy theory. Despite this, comparatively a majority of them used the hashtag 5G Coronavirus to hype and publicize the COVID-19 conspiracy theory. This notwithstanding, our research focused on users' hype of the COVID-19 conspiracy theory on Twitter using the hashtag 5G Coronavirus. Users' positive sentiment was largely reflected by their criticism and denouncement of the COVID-19 conspiracy especially the link between the 5G network and the pandemic.

Contrastingly, users' negative criticism on the subject of COVID-19 conspiracy theory was conveyed largely on their support of the coronavirus conspiracy theory especially the positive link between 5G and COVID-19.

Further, it is worth noting despite individuals' negative and positive sentiments towards the topic on the COVID-19 conspiracy theory, Google trends revealed that the 5G Coronavirus hashtag appeared most between January 24th, 2021 and January 30th, 2021, March 28th, 2021, and April 3rd, 2021 as well as between May 2nd, 2021 and May 8th, 2021. Considering that almost as many users' tweets were opposed to the 5G conspiracy theory as were approving of it, we infer from our study that users who tweeted opposed to the conspiracy theory were unwittingly and unknowingly exacerbating the hype and discussion and thereby driving the 5G Coronavirus topic and talking point into trending status. In conclusion, when users of Twitter joined the discourse to support, ridicule, dispel or even piggyback on the 5G Coronavirus hashtag, the subject was raised to newer heights and also had heightened visibility, which explains the peak and fall in the identified durations. The deterioration in the appearance of 5G Coronavirus is attributable to efforts that were introduced to counter false and misinformation on Twitter following its outbreak in early January.

7.   Discussion

Many prior studies have repeatedly demonstrated that people's trust in conspiracy theories can have a direct negative impact on the effectiveness of government policies [17,18]. For example, Earnshaw's 2016 study confirmed that knowledge of Ebola was not directly related to people's support for quarantine policies, while conspiracy beliefs were negatively associated with support for quarantine policies; Earnshaw's 2020 study also showed that participants who believed in one or more conspiracies about COVID-19 reported being nearly four times less likely to be vaccinated when SARS-CoV-2 vaccine when it became available [19-20]. Belief in COVID-19-related conspiracy theories can alter people's decisions and behaviors, thereby affecting society as a whole and national governance of the epidemic. Today, when searching for "#5Gcoronavirus" on Twitter, users can see "Know the facts" bolded at the top, followed by the official CDC website, but does it really work? Wood demonstrated in his 2015 study that calling something a conspiracy theory did not have any effect on people's perceptions of it, so when public opinion is influenced by a conspiracy theory, simply notifying and clarifying it with an orange exclamation mark and "Stay informed" under the tweet that contains a conspiracy theory may not directly interfere with the trust in the conspiracy theory [21]. Finding the proper solution to the conspiracy theory issue has become a priority. Based on our research, we have concluded two solutions to effectively control the development of conspiracy theories [22].

7.1.   Solution One: Explain the Events

When analyzing the high-frequency words in the rising period, as stated in the conclusion, we found that new high-frequency words emerged with new topics of discussion in each rising period (e.g., power, technology, India, etc.). In almost every case, it was the emergence of a new topic that made the conspiracy discussion rise, and people's lack of knowledge about the new occurrence contributed a lot to the overall development of the conspiracy theory [23]. In other words, when an event occurs for which people are not fully aware of the reason, new conspiracy topics tend to emerge at a rapid pace (e.g., from April 25 to May 8, after the UK began removing 5G base stations, the number of discussions rose and the high frequency word "tower" appeared). This phenomenon can be explained by people's perceived lack of control over events around them. Kim's research in 2021 suggests that a major reason for the spread of and trust in conspiracy theories is to give an account of events they cannot explain, thus increasing their perceived sense of control over what is going on around them

[24]. And this phenomenon emerged very quickly in our study. It does not take much time for new events to ferment before new conspiracy speculation sends conspiracy theory discussion skyrocketing.

After searching, we also found that Zollo's study showed that when the volume of discussion about conspiracy theories rises, both pro-conspiracy and pro-science (anti-conspiracy) users become increasingly negative, with conspiracy advocates being particularly negative [10]. Meanwhile, Prooijen showed in his study that conspiracy theories are emotional and that irrational negative emotions lead people to believe in conspiracy theories [25]. This is because people in negative emotions will be more inclined to act in search of meaning and reason for events [26]. Our findings show that users who advocate conspiracy theories and make statements carrying negative emotions exhibit more extreme negative emotions, while among those who oppose conspiracy theories there are almost no extreme positive statements. Those extreme negative sentiments, on the other hand, tend to influence more people in the group consisting of hashtags, thus making more users likely to believe in conspiracy theories.

Trust in conspiracy theories, negative sentiment, and conspiracy theory discussion volume interact with each other on social media: discussion volume leads to negative sentiment, and negative sentiment influences more people's sentiment while making more users likely to believe in conspiracy theories. In summary, we believe that the control of conspiracy theories is centered on controlling the volume of discussion, and here, according to our findings, the focus is on providing reasonable explanations for new events, and the explanations need to be communicated in a timely manner in order to increase people's sense of control over what is going on around them [27,28].

7.2.   Solution Two: Avoid Conflicts

When analyzing the high-frequency words in the rising periods, we also found that the word "false", which represents the anti-conspiracy side of the argument, was used only second in frequency to the words "5G" and "Coronavirus", which were the topics of discussion. ". This means that while the influence of conspiracy theories is increasing along with the volume of discussion, it is not just the proponents of conspiracy theories who are spreading information and exporting ideas unilaterally. On the contrary, the number of users speaking against conspiracy theories is not at all less than that of conspiracy theory supporters. This also means that the rise in conspiracy theory dissemination is not due to the absence of opposing voices; rather, it is the conflict created by the coexistence of opposing and supportive voices that increases the volume of discussion, and that the speech against conspiracy theories indirectly expands the influence of conspiracy theories [29].

Does the presence of anti-conspiracy rhetoric under hashtag also contribute to the elimination of conspiracy theory discussion? We have two hypotheses before analyzing the data: one, it is the presence of anti-conspiracy theories with more advocates under hashtag that causes more users to discard conspiracy theories, thus leading to a decline in discussion. If this hypothesis is correct, then we need to see one or more words in the high frequency words in the declining period that were not in the rising period. Two, is that there is not a strong anti-conspiracy theory force emerging under hashtag, and topic discussion gradually declines as people lose interest in the topic. After analyzing the high frequency words in the decline period, we found that the high frequency words in the decline period are almost the same as in the rise period, except that the frequency of each word is gradually declining. Therefore, hypothesis 2 is more reasonable. Together with the second conclusion from the analysis of high-frequency words in the rising period, we believe that when controlling the volume and influence of conspiracy theories under hashtag, the official authorities cannot try to correct people's opinions by citing opposing opinions in such a group where conspiracy theories are the topic of discussion - this would not only be ineffective in correcting people's opinions. It would not only be ineffective in correcting people's perceptions, but it would also result in an increase in the volume and influence of conspiracy theories [30]. When responding to, explaining, or refuting conspiracy

theories, all such conspiracy opposing messages should be posted as far as possible outside of conspiracy discussion forums.

By analyzing data on sentiment and high-frequency words, our study makes observations about the governance of conspiracy theories in terms of "timely explanations for new events. More importantly, we identify a widespread misconception that the tactics used to dispel conspiracy theories should not be placed where they are discussed, but rather should avoid direct conflict with conspiracy proponents, so that conspiracy theories can be successfully extinguished while avoiding another increase in conspiracy discussion and dissemination.

8.   Conclusion

In our study, we analyzed the overall emotional state of people under the 5GCoronavirus hashtag and the similarities and differences in the high frequency words appearing in the discussion as it rises, peaks, and declines. We found that under this hashtag, users with positive sentiment (opposed to, or neutral towards, conspiracy theories) were more focused on using neutral language and displaying lighter emotional intensity, while users with negative sentiment (conspiracy proponents) were more inclined to use relatively extreme language and display extreme negative sentiment. This makes the overall emotional state of the discussion under the hashtag 5Gcoronavirus negative. In the analysis of high-frequency words, we found that in the four ascending periods (March 17 to March 20, April 4 to April 17, April 25 to May 8, and September 26 to October 16), new high-frequency words emerged with new discussion topics in each ascending period (e.g., power, technology, India, etc.) and the high-frequency words Also "5G", "Coronavirus" and "false". In the declining period we analyzed, there was no difference between the high frequency words and the rising period, but each word was used less frequently as the volume of discussion declined.

8.1.   Limitations and Future Research

The small sample size used in this study affects the accuracy of the results to a degree, and makes it impossible to separate the rising period from the declining period when analyzing emotional factors.

There are potential errors in the study regarding the " emotion" factor, i.e., the ambiguity of the target of emotion expressions. For example, it was imprecise to identify whether the negative emotions in the speech were directed at conspiracy theories or policies.

This study only analyzed the state of conspiracy theories in a single channel of textual communication in social media, and future research needs to focus on other communication media besides text, such as how videos and links to articles affect people's perceptions or emotions about conspiracy theories.

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