Original Paper

Misinformation Regarding 5G and COVID-19 and the Psychological Mechanism Behind Them

Yufan Chen[1*]

[1] Brooks School, North Andover, USA

[*] Yufan Chen, Brooks School, North Andover, USA

1. Introduction

In late 2019, the COVID-19 pandemic started to spread around the world (Fauci, Lane, & Redfield, 2020). Along with the virus, misinformation about the pandemic started to spread as well. Rumors regarding the usefulness of masks, conspiracy theories regarding the legitimacy and origin of the virus, and the astonishing amount of fake news about the virus posted online every day are extremely hard to distinguish from factual news reports (Mian & Khan, 2020; Brennan, Simon, Howard, & Nielson, 2020). One example of this alarming phenomenon is the conspiracy theory that links the pandemic to 5G, which is in the early stages of being commercialized (Shafi et al., 2017). This conspiracy theory claims that 5G and the radiation it causes disrupted the natural magnetic field of the earth, and started this pandemic (Geary, 2020). Though it might look like an absurd concept, the "5G causes Corona" conspiracy theory has gained an extremely large following, and the effect of that is clear on and off the internet, as multiple 5G antennas have been vandalized all over the world by mobs claiming they are the means of spreading the coronavirus (Reichert, 2020). The fabrication and spreading of misinformation regarding 5G and its link to the coronavirus are largely connected with the multiple psychological mechanisms and manipulation of sources.

2. Background

2.1 5G and anti-5G Sites

5G is the fifth generation of cellular connection standard that was commercialized in 2019. It is a network that provides internet connections to cell phones and other connected devices within its service area by emitting a radio wave to the antennas in the device that could reach a higher bandwidth than previous generations of cellular networks (Shafi et al., 2017). Rumors and conspiracy theories regarding 5G have existed long before the pandemic struck. These conspiracy theories, or rumors that

question the legitimacy of certain current issue, deduce with little to no evidence that 5G leads to different diseases. 5GCrisis.com, one of the most vocal Anti-5G websites, was registered in early 2019 by its parent company, Grassroots Environmental Education Inc., which has been spreading rumors against cell phones since its founding in 2000. Manhattanneighbors.org, registered in 2014, is another anti-5G website and one of the first websites to publish misinformation that directly links 5G to the COVID-19 pandemic (Manhattan Neighbors, 2020). These websites and their authors, knowingly or unknowingly, use psychological mechanisms to spread the misinformation, including motivated reasoning, asymmetry of knowledge, manipulating social media algorithms as well as cognitive reflection skills.

2.2 Motivated Reasoning and Asymmetry of Knowledge

Motivated reasoning refers to the phenomenon in which one uses emotionally, logically or other biased reasoning to make judgments or decisions rather than basing it on the information presented (Slothuus & Vreese, 2010). In other words, readers will interpret these articles in a way so that it suits their own opinion, instead of judging it objectively with the information given. These websites also take advantage of the asymmetry of knowledge and difference in expertise between the writers and the readers to help the spreading their rumor. Asymmetry of knowledge and difference in expertise refers to the gap in the level of knowledge between the writer and the reader in a given subject, which makes a reader believe the website is a reliable source, instead of questioning its legitimacy (Lorenz-Spreen, Lewandowsky, Sunstein, & Hertwig, 2020; Clarkson, Jacobsen, & Batcheller, 2007).

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2.4 Social Media

Social media platforms are a rather new phenomenum, but they are a big catalyst for misinformation. Two ways social media platforms help the spreading of misinformation is the rumor cascading effect and source monitoring. When one reads something on social media, they can choose to share it with their followers, and their followers can choose to do the same. This reposting cycle is known as the rumor cascading effect, and it increases the speed of the spread of misinformation (Lorenz-Spreen, Lewandowsky, Sunstein, & Hertwig, 2020). Source monitoring, on the other hand, refers to the tendency for readers to remember solely the content of an article or other forms of media, and ignores

or misremembers the source of said media (Dywan & Jacoby, 1990). This leads to the spreader of the rumor could pass the rumor off to the next person as a claim from a reliable source, instead of being an unreliable social media post.

2.5 Cognitive Reflection and Pseudo Profound Hogwash

Cognitive reflection skills are one's ability to override a "gut" reaction and reflect further based on the evidence presented (Frederick, 2005). These skills can often be tested with a cognitive reflection test, and lower CRT scores have often been linked with the fact that a reader can be easily misguided by misinformation and pseudo profound hogwash, which is another common tactic used by conspiracy theory sites (Pennycook & Rand, 2019). Pseudo profound hogwash refers to articles that seem to be extremely scientific and profound, but actually has no real meaning or is made up. According to Pennycook, one's receptivity to pseudo-profound hogwash can be closely linked to one's likeliness to assume new information as true (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015). Conversely, by intentionally creating a large amount of pseudo-profound hogwash, readers with lower cognitive reflection skills would be more likely to assume the information as the truth.

3. Misinformation and the Psychological Mechanisms behind the Spreading of Misinformation

3.1 Rumors Regarding 5G and Brain Cancer Risks

Before the pandemic, these websites posted rumors that link 5G to various health issues, such as brain cancer. These websites would quote certain scientific studies, cherry pick them and changing the context so it would fit their narrative (5Gcrisis.com, 2019). One study frequently quoted by these sites is a 1996 study by Dr. Henry Lai and Dr. Narendra Singh, "Magnetic-field-induced DNA strand breaks in brain cells of the rat." This study was conducted by exposing rats to acutely continuous radiofrequency electromagnetic radiation for 2 hours. The magnetic field explosion was a simulation of cell phone signals (Lai & Singh, 1996); however, the experiment was set up at a different frequency than a typical 1996 cellphone, and the amplitude is 3 times as strong as the legally allowed amount of radiation by the Federal Trade Commission. More importantly, the 2-hour continuous exposure simulates someone holding a cell phone that is on an active call next to their head for 2 hours straight, not using a smartphone with a wireless connection of any kind. These issues are all mentioned and acknowledged by Lai and Singh in their paper (Lai & Singh, 1996), however, the 5G Crisis site does not address any of these core differences between this study's results and their claim that 5G causes health issues. In fact, the website glosses over the actual content of the paper, only incorrectly paraphrases the paper's results as showing "biological damage from exposure to wireless radiation" was possible (5Gcrisis.com, 2019). Moreover, the only mentions of 5G in their "sciences" page are theoretical papers written before 5G technology was completely developed. Inconsistency between narratives is also a common issue with these websites. One of the website's biggest endorsers, Dana Ashlie, said in her YouTube video that she thinks cell phones themselves are safe, and the only harmful part of a cell phone is the wireless connection (Ashlie, 2019), which is directly against the research the

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website and herself uses to back up that claim (Lai & Singh, 1996).

3.2 Rumors Regarding 5G and Pandemics Including the Coronavirus

When the corona virus pandemic struck the world, these Anti-5G sites started to spread the seemingly absurd conspiracy theory that the pandemic was caused by the 5G radiofrequency radiation (Manhattan Neighbors, 2020). These rumors started to spread on Facebook and Twitter initially, but some anti-5G websites started to publish articles about this conspiracy theory. One of the most notable sites that relates 5G to the coronavirus is Manhattan Neighbors, a website dedicated to purge New York of any 5G antennas. In their article, they cite Arthur Firstenberg's book "The Invisible Rainbow", where he connects past pandemics to new wireless technology. He points out that the United States was building the world's largest radio communication network during the 1918 Influenza Pandemic; he also links the electrified railroad expansion in the late 19th century to the 1889 Flu Epidemic (Firstenberg, 2020). In both of these cases, Manhattan Neighbors and Firstenberg ignores all other factors that might lead to the virus, such as World War I and the massive amount of movement during the 1910s, and concludes without any evidence beyond "they happened at the same time" that the cause of the virus is the wireless communication network. One thing Manhattan Neighbors and Arthur Firstenberg fails to acknowledge is that correlation does not equal causation. While the Spanish Flu and the building of the US Army radio network occurred at the same time, it is irresponsible to claim, without conclusive proof, that the radio network caused the Spanish Flu. Additionally, one of the website's published articles, Pall (2020), concluded that

"These all argue that 5G radiation is likely to greatly exacerbate the spread of the coronavirus and to greatly increase the lethality of the infections produced by it. The good news is that it is likely that those of us that live in areas with no 5G radiation and who avoid other EMFs wherever possible will probably escape much of the impacts of this prospective global pandemic (p. 7)".

This statement, however, can be easily proven untrue within his own citation. Ookla, a technology data analysis company, has been tracking 5G installment all around the globe (Ookla, 2020), and Arthur cites their data to back up his claim that Wuhan was the first city in China to commercialize 5G. While it is hard to distinguish whether that statement is true or not, it is clear from Ookla's data that his claim that areas without 5G should be rather unscathed from the virus is completely untrue, considering India, the third most affected country, has no 5G availability anywhere (Worldometers, 2020; Ookla, 2020). Yet, even after these clear flaws with the conspiracy theory have been pointed out, they still have an extremely large following. The destruction of cell towers even after multiple public notices proves the sheer size of the spread of this misinformation (Reichert, 2020). This is because these websites used multiple psychological mechanisms to manipulate the reader's mind and to gain the following and profit. These websites cater to the motivated reasoning of the reader and low cognitive reflection skills by manipulating their information and taking advantage of social media platforms.

3.3 Motivated Reasoning and Asymmetry of Knowledge

Motivated reasoning plays into the spread of almost all misinformation, and this is no exception. The main type of motivated reasoning at play when it comes to the virus is political, where a person intentionally or accidently misunderstands an article due to their political beliefs (Slothuus & Vreese, 2010). The virus has always been a political topic, and both sides of the political spectrum are trying to defend their point of view on the internet, which leads to strong motivated reasoning when it comes to articles about the topic. As a rather new technology, 5G is not widely understood by everyone, and the website takes advantage of that asymmetry of knowledge as wellpe. Since the website seems to be extremely scientific and professional, for those who don't understand the technology and mechanisms of 5G as well, they are more likely to believe the claims made, especially when the claims made on the website helps their argument and fits into their motivated reasoning. Conservatives living in metropolitan settings are the target audience for sites like 5G Crisis and Manhattan Neighbors, and they generally view the virus as a liberal scheme. When they read that the virus could be caused by 5G communication, something Liberals are pushing in large cities, their motivated reasoning overpowers their skepticism, and they immediately give their trust to these websites. To disguise themselves as reliable, they would cherry pick topics and keep in certain parts of actual real information, which would make it incredibly confusing for a reader who decides to check the legitimacy of the source (Lorenz-Spreen, Lewandowsky, Sunstein, & Hertwig, 2020). To further confuse the reader and curb the skepticism, these websites cite an enormous number of sources, even if their relevance to the topic is extremely low. It is hard for an average person to track down academic papers, and when they see the hundreds of papers and research journals cited by these websites, instead of checking the paper, they would choose to believe these sources, and in turn, the website and the article. This becomes incredibly clear on 5G Crisis and their Science Studies page, where they cite 195 scientific studies regarding radiofrequency electromagnetic radiation and its effect on newborn development, children, DNA, male fertility and tumors (5Gcrisis.com, 2019). An average reader would have no way of tracking down all 195 sources, and the amount of studies that actually back up their claim could be extremely scarce. However, due to the political motivated reasoning of the website's target audience and the asymmetry of knowledge, the website successfully disguises itself as a reliable source, and spreads the misinformation to the first layer of the rumor cascade. From there, social media's influence becomes increasingly greater.

3.4 Social Media's Influence on the Spreading of Misinformation

Social media algorithms, rumor cascades and source monitoring also contribute greatly to the spread of misinformation. With rumor cascades, it can be even more difficult for an average reader to track down the source and verify the information. Unlike websites created by professional writers, social media users don't tend to be as scientific and as formal when drafting their posts. While websites like 5G Crisis cite an enormous number of sources, an average social media post most likely cites none. This is because when an average reader reads an article, they only focus on the content of the article, not the

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website that published it. This leads to "#5GCorona" on Twitter showing a lot of users posting images or statements about 5G causing corona, but very few can back up their claim with any source, let alone a reliable source ("Truth Warrior", 2020). However, social media and their algorithm promote a user's content to people they already know, and likely share the same opinion and motivated reasoning with (Milan, 2015). Moreover, with these algorithms and cookies in place, once you express interest in a subject or opinion, social media platforms will push you more content about that subject, whether that opinion is correct or not. With the social media algorithm and rumor cascades, more people will read about these rumors, and their motivated reasoning, which are usually similar to the sharer of the rumor, will drive them to not only believe in the rumor, but also share it to their feed. This creates another layer of the rumor cascade, and so forth and so on. Rumor cascades and algorithms like this make it increasingly difficult to track down the sources, and extend the potential reach of the rumor far greater than it could have been without social media.

3.5 Cognitive Reflection and Pseudo Profound Hogwash

While it is clear to some that these conspiracy theories are clearly untrue, for others, these articles seem not only plausible, but is possibly the truth. This can be attributed to one's cognitive reflection skills, general intelligence and illusion of understanding. Professor Gordon Pennycook once concluded that readers with a higher CRT score can distinguish fake news from real ones, and while carefully manipulated content has been more significant in recent years, and social media has become more prevalent as well, this rule still stands (Pennycook & Rand, 2019). One clear example is the product description on 5G Bioshield's website, which claims their product "acts as a carrier for the Quantum Nano Layer technology for the balance and harmonisation of the harmful effects of most forms of imbalanced radiation" (5GBioshield, 2020). While this sentence seems to be incredibly scientific, with words like "Quantum Nano Layer Technology" and "imbalanced radiation". However, both of these terms are completely made up and non-existent in the real world. "Quantum Nano Layer Technology" is a parody of Quantum Nanoscience, which is an extremely abstract field in physics that refers to manipulating particles that range from 1 to 100 nanometers (Milburn & Woolley, 2008). However, electromagnetic radiation, which is what's often considered by these websites to be the harmful side of technology, is essentially a wave, not a particle. Furthermore, since radiation is a wave, there is no such thing as an "imbalanced radiation". Nevertheless, quantum nanoscience is an extremely abstract and hard to understand subject. It is highly unlikely that the average reader, especially those with lower cognitive reflection skills, can find an article that explains this field well enough for them to understand. In fact, even with high education and extensive research, it is still hard to understand this extremely abstract and new field of physics. However, it is also because of its abstractness that one is likely to write it off it as real. Someone with low cognitive abilities also often has a fragile ego due to the lack of said ability and an illusion of understanding. When they see something extremely abstract and "scientific" that also happens to fall into their motivated reasoning, instead of doubting the legitimacy of the sources, they end up writing it off as true and pretend to understand the articles to prove to

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themselves that they have a higher cognitive reflection ability than they actually do. This is not only a way to validate their ego, but also to validate their biased views (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015). This is why pseudo-profound hogwash is extremely hard to detect, and it is also why misinformation can be spread so easily in the form of pseudo profound hogwash to those with lower cognitive reflection skills.

4. Discussion

4.1 Spreading of Misinformation

The fabrication and spreading of misinformation regarding 5G and its link to the coronavirus are largely connected with multiple psychological mechanisms. These websites knew extremely well how take advantage of their reader's political motivated reasoning through a divisive time and topic by creating misinformation that would benefit themselves financially or socially through popularity. They knew their target audience extremely well and used their audience's political motivated reasoning against them (Slothuus & Vreese, 2010). They were also aware of the asymmetry in knowledge between themselves and their readers, and through careful and subtle manipulation, such as cherry-picking articles, mixing correct information with misinformation, and citing an enormous number of sources, they appear scientific to their readers, and spread the misinformation through the first layer of the rumor cascade (Lorenz-Spreen, Lewandowsky, Sunstein, & Hertwig, 2020). The misinformation then gets spread even further through rumor cascades on social media with the algorithms for these platforms. Due to the nature of these algorithms, people with the same biases and same views are often subjected to see the same contents (Milan, 2015), which makes it incredibly easy for these websites to spread their conspiracy theories to those who wouldn't have been able to see these otherwise. Finally, websites like this would take advantage of the readers' low cognitive reflection skills and the fact that it would be less likely for them to realize their false first impression to spread their misinformation. They would purposefully use pseudo-profound hogwash or other confusing and seemingly scientific concepts to justify their misinformation (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015). At the end of the day, the spread of misinformation regarding the coronavirus and 5G is an incredibly dangerous and harmful phenomenon. Not only does it promote the destruction of cell towers and other properties, it can be incredibly dangerous for those involved. Claiming 5G is the cause of the coronavirus downplays the actual scientific research behind it and can confuse those who are just afraid and seeking a solution and cure to this incredibly complex public health crisis.

4.2 Possible Ways to Identify and Combat the Spread of Misinformation

One possible way to counter this effect is to promote checking for source biases, reliability, and fact-checking before forming an emotion-based opinion or a biased conclusion while using social media platforms. Nudging readers towards forming an unbiased opinion through a "related links" that directs readers towards easy to understand and peer-reviewed articles is one way to combat the effect of misinformation. (Benartzi et al., 2017) Another possible way to combat the effect of misinformation is

to flag misinformation manually with independent fact-checkers instead of automatically through flagging keywords, which would verify the misinformation of flagged posts and increase credibility of the fact-checking and flagging process. When a reader sees a post, which is flagged by a reliable and trustworthy fact-checker and links to the correct information, the spread of misinformation would not only slow down, but in turn become a way of promoting real and educational facts.

Acknowledgement

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