

Misinformation and Biases Infect Social Media, Both Intentionally and Accidentally

By Giovanni Luca Ciampaglia and Filippo Menczer

¹Social media are among the primary sources of news in the U.S. and across the world. Yet users are exposed to content of questionable accuracy, including **conspiracy theories**, **clickbait**, **hyperpartisan** content, pseudo science and even **fabricated** “fake news” reports.

²It’s not surprising that there’s so much disinformation published: Spam and online fraud are **lucrative** for criminals, and government and political **propaganda yield** both **partisan** and financial benefits. But the fact that low-credibility content spreads so quickly and easily suggests that people and the **algorithms** behind social media platforms are **vulnerable** to manipulation.

³Our research has identified three types of bias that make the social media **ecosystem** vulnerable to both intentional and accidental misinformation. That is why our Observatory on Social Media at Indiana University is building **tools** to help people become aware of these biases and protect themselves from outside influences designed to **exploit** them.

Bias in the brain

⁴**Cognitive biases originate** in the way the brain processes the information that every person encounters every day. The brain can deal with only a **finite** amount of information, and too many incoming **stimuli** can cause **information overload**. That in itself has serious implications for the quality of information on social media. We have found that **steep** competition for users’ limited attention means that some ideas **go viral** despite their low quality – even when people prefer to share high-quality content.

⁵To avoid getting overwhelmed, the brain uses a number of tricks. These methods are usually effective, but may also become biases when applied in the wrong contexts.

⁶One cognitive shortcut happens when a person is deciding whether to share a story that appears on their social media **feed**. People are very affected by the emotional **connotations** of a headline, even though that’s not a good indicator of an article’s accuracy. Much more important is who wrote the piece.

⁷To counter this bias, and help people pay more attention to the source of a claim before sharing it, we developed **Fakey**, a mobile news literacy game (free on Android and iOS) simulating a typical social media news feed, with a mix of news articles from mainstream and low-credibility sources. Players get more points for sharing news from

reliable sources and **flagging suspicious** content for fact-checking. In the process, they learn to recognize signals of source **credibility**, such as hyperpartisan claims and **emotionally charged** headlines.

Bias in society

⁸Another source of bias comes from society. When people connect directly with their peers, the social biases that guide their selection of friends come to influence the information they see.

⁹In fact, in our research we have found that it is possible to determine the **political leanings** of a Twitter user by simply looking at the partisan preferences of their friends. Our analysis of the structure of these partisan communication networks found social networks are particularly efficient at **disseminating** information – accurate or not – when they are closely tied together and disconnected from other parts of society.

¹⁰The **tendency** to evaluate information more favorably if it comes from within their own **social circles** creates “**echo chambers**” that are ripe for manipulation, either consciously or unintentionally. This helps explain why so many online conversations **devolve** into “us versus them” confrontations.

¹¹To study how the structure of online social networks makes users vulnerable to disinformation, we built Hoaxy, a system that tracks and visualizes the spread of content from low-credibility sources, and how it competes with fact-checking content. Our analysis of the data collected by Hoaxy during the 2016 U.S. presidential elections shows that Twitter accounts that shared misinformation were almost completely **cut off from** the corrections made by the fact-checkers.

¹²When we **drilled down** on the misinformation-spreading accounts, we found a very **dense** core group of accounts retweeting each other almost exclusively – including several **bots**. The only times that fact-checking organizations were ever quoted or mentioned by the users in the misinformed group were when questioning their **legitimacy** or claiming the opposite of what they wrote.

Bias in the machine

¹³The third group of biases arises directly from the algorithms used to determine what people see online. Both social media platforms and search engines employ them. These **personalization** technologies are designed to select only the most engaging and relevant content for each individual user. But in doing so, it may end up **reinforcing** the cognitive and social biases of users, thus making them even more **vulnerable to manipulation**.

¹⁴For instance, the detailed advertising tools built into many social media platforms let disinformation campaigners exploit **confirmation bias** by **tailoring** messages to people who are already inclined to believe them.

¹⁵Also, if a user often clicks on Facebook links from a particular news source, Facebook will tend to show that person more of that site's content. This so-called "filter bubble" effect may isolate people from diverse perspectives, strengthening confirmation bias.

¹⁶Our own research shows that social media platforms expose users to a less diverse set of sources than do non-social media sites like Wikipedia. Because this is at the level of a whole platform, not of a single user, we call this the **homogeneity** bias.

¹⁷Another important ingredient of social media is information that is trending on the platform, according to what is getting the most clicks. We call this popularity bias, because we have found that an algorithm designed to promote popular content may negatively affect the overall quality of information on the platform. This also feeds into existing cognitive bias, reinforcing what appears to be popular **irrespective of** its quality.

¹⁸All these algorithmic biases can be manipulated by social bots, computer programs that interact with humans through social media accounts. Most social bots, like Twitter's Big Ben, are harmless. However, some conceal their real nature and are used for malicious intents, such as boosting disinformation or falsely creating the appearance of a **grassroots** movement, also called "astroturfing." We found evidence of this type of manipulation in the run-up to the 2010 U.S. midterm election.

¹⁹To study these manipulation strategies, we developed a tool to detect social bots called **Botometer**. Botometer uses machine learning to detect bot accounts, by inspecting thousands of different features of Twitter accounts, like the times of its posts, how often it tweets, and the accounts it follows and retweets. It is not perfect, but it has revealed that as many as 15 percent of Twitter accounts show signs of being bots.

²⁰Using Botometer **in conjunction with** Hoaxy, we analyzed the core of the misinformation network during the 2016 U.S. presidential campaign. We found many bots **exploiting** both the cognitive, confirmation and popularity biases of their victims and Twitter's algorithmic biases.

²¹These bots are able to construct **filter bubbles** around vulnerable users, feeding them false claims and misinformation. First, they can attract the attention of human users who support a particular candidate by tweeting that candidate's hashtags or by mentioning and retweeting the person. Then the bots can **amplify** false claims **smearing** opponents by retweeting articles from low-credibility sources that match certain

keywords. This activity also makes the algorithm highlight for other users false stories that are being shared widely.

Understanding complex vulnerabilities

²²Even as our research, and others', shows how individuals, institutions and even entire societies can be manipulated on social media, there are many questions left to answer. It's especially important to discover how these different biases interact with each other, potentially creating more complex vulnerabilities.

²³Tools like ours offer internet users more information about disinformation, and therefore some degree of protection from its harms. The solutions will not likely be only technological, though there will probably be some technical aspects to them. But they must take into account the cognitive and social aspects of the problem.

Editor's note: This article was updated on Jan. 10, 2019, to replace a link to a study that had been retracted. The text of the article is still accurate, and remains unchanged.

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