# Network approaches to misinformation evaluation and correction

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## Abstract

Network research offers a useful toolkit allowing us to explore the social aspects of opinion formation, information credibility, media trust, and digital content diffusion. Understanding the social processes that drive the spread, exposure, and acceptance of *fake news* can inform the design of both policy and industry solutions.

This chapter explores the social component of content evaluation and dissemination with view to possible regulatory and technological remedies for digital misinformation. It starts with a brief overview of recent developments in our understanding of online misinformation. The following sections offer an overview of the role social networks play in our exposure to, engagement with, dissemination of, and belief in *fake news*. Social influence is discussed as a pathway to debunking false stories. The chapter concludes by describing a case study that demonstrates the potential of network approaches to correcting misinformation.

## Network approaches to misinformation evaluation and correction

In a complex media environment, new social and technological factors are shaping the way we evaluate information. Changing content consumption patterns make us increasingly dependent on social media companies and search engines. On digital platforms, legitimate news is regularly displayed alongside commentary, personal stories, rumors, jokes, and deliberate misinformation. Within those diverse digital streams, it can be more difficult to tell high-quality reports apart from false or misleading claims.

Designing and implementing effective policies requires access to accurate and reliable information. Exposure to specious narratives or fabricated evidence can cloud the judgment of well-meaning policymakers, leading to misguided decisions (see also Purtle's chapter in this volume for a discussion of evidence dissemination to policymakers). Baseless rumors can also cause the public to lose confidence in elected officials and ignore guidelines that serve the best interest of the community.

Political polarization and declining trust in traditional social institutions (Citrin & Stoker, 2018) have contributed to the current concerns about citizens being vulnerable to digital misinformation. The proposed approaches to this problem include regulatory measures, technological solutions, and literacy campaigns (Bulger & Davison, 2018; European Commission, 2018; Tromble & McGregor, 2019; Wardle & Derakhshan, 2017). Examining the misinformation challenge through a network lens, however, suggests that in order to succeed, any approach would need to leverage mechanisms of social influence. The trust we place in messages, information sources, and institutions is not a simple, individual-level choice. Trust emerges in a social context and is influenced by both interpersonal and community factors. Perceived social costs and benefits guide our decision whether to spread, ignore, or debunk a piece of information.

This chapter explores the social component of content evaluation and dissemination with view to possible regulatory and technological remedies for digital misinformation. It starts with a brief overview of recent developments in our understanding of online misinformation. The following sections offer an overview of the role social networks play in our exposure to, engagement with, dissemination of, and belief in *fake news*. Social influence is discussed as a pathway to debunking false stories. The chapter concludes by describing a case study that demonstrates the potential of network approaches to correcting misinformation.

## The *fake news* challenge

*Fake news*, a term with a long history of use in journalism and research, gained a new prominence during the 2016 U.S. presidential election (Tandoc et al., 2018). At present, the label is generally applied to intentionally deceptive digital misinformation and propaganda (Egelhofer & Lecheler, 2019). A definition put forward by Lazer and colleagues (2018) describes *fake news* as fabricated information that has the format of news content but lacks the editorial standards and practices of legitimate journalism. Fake news outlets are information producers willing to disregard journalistic norms in order to profit financially or advance a political agenda. Their content is detrimental both to our public discourse and to political decision-making.

A number of factors have facilitated the spread of fake news online. Technological shifts made content production and distribution easier than ever before. Changes in the information environment weakened the gatekeeping power of traditional journalism, challenging the role of news media as intermediaries between political actors and the public (Waisbord, 2018). Social information consumption on the Internet blurred the boundaries between mass and interpersonal communication. The active role of audiences in the framing and distributing of media messages left many of us drowning in an unfiltered flow of content with various levels of credibility and accuracy.

In many Western democracies, the changing media landscape also reflects a growing political polarization (Mason, 2018). Partisan bias affects not only the production of news, but also the way it is processed by individuals. Misinformation is more likely to be accepted as true when it aligns with our ideology and confirms pre-existing opinions (Flynn et al., 2017). While researchers have recently suggested that belief in fake news is best explained by failure to engage in analytical thinking (Pennycook & Rand, 2018), previous studies have found that politically motivated reasoning affects both belief in misinformation and consequent behavior (Weeks & Garrett, 2014). Americans with more extreme ideological positions are also more likely to consume and spread fake news (Grinberg et al., 2019; Guess, Nagler, and Tucker, 2019). Not surprisingly, both Democrats and Republicans also tend to believe that the influence of fake news is considerably greater among supporters of the opposite side (Jang & Kim, 2018).

During the 2016 U.S. presidential election, the online consumption and diffusion of misinformation were fairly concentrated. Researchers found that a small percent of people were responsible for most website visits and social media shares of fake news (Grinberg et al., 2019; Guess, Nyhan, & Reifler, 2017; Nelson & Taneja, 2018). While systematic engagement with false stories was relatively rare, many people experienced some exposure. Over 27% of American adults were estimated to have visited at least one fake news source in the final weeks of the 2016 election (Guess et al., 2017). In a representative survey, about 15% recalled seeing a fake news story, and 8% reported believing that story (Allcott & Gentzkow, 2017). Social media in general and Facebook in particular played a key role in exposing people to fake news (Guess et al., 2017). The novelty and emotional resonance of false rumors designed to capture public attention may have helped many of those stories propagate faster and further than legitimate news content (Vosoughi et al., 2018).

While we have some understanding of the prevalence and spread of political misinformation, less is known about its long-term consequences (Lazer et al., 2018). Fake news could plausibly affect the media system, political institutions, and public opinion. Even though its direct electoral impact in 2016 may have been limited (Allcott & Gentzkow, 2017; Garrett, 2019), indirect and cumulative consequences remain a possibility.

One outcome of fake news consumption for individuals is the increased likelihood of adopting political misperceptions (Guess et al., 2020). Inaccurate information can increase uncertainty and confusion or be received uncritically and used to guide future behavior (Rapp & Salovich, 2018). Belief in misleading rumors can have electoral consequences as candidate misperceptions are known to affect vote choice (Weeks & Garrett, 2014). Exposure to false political facts can also influence attitudes even after a person finds out and accepts that the information was not true (E. Thorson, 2016). This presents considerable challenges to the design of good public policy as its effectiveness can be undermined in unforeseen ways by wide-spread misinformation.

Another challenge linked to fake news is its capacity to erode public confidence in democratic institutions. Researchers and public figures have expressed concern about domestic and foreign disinformation sources producing misleading content specifically for the purpose of destabilizing political institutions and delegitimizing traditional media (Bennett & Livingston, 2018). Empirical evidence suggests that consuming fake news is

indeed associated with a lower trust in mainstream news outlets, though its relationship with political trust is more complicated (Ognyanova, Lazer, et al., 2020).

Politics is only one of the many areas where we see negative consequences of fake news consumption. During the COVID-19 pandemic, misperceptions about the cause, prevalence, and treatment of the disease could put individuals and communities in danger (Swire-Thompson & Lazer, 2020). Especially concerning is the fact that those misperceptions seemed more prevalent among Black and Hispanic Americans – two communities who were also more vulnerable to the virus to begin with (Ognyanova, Perlis, et al., 2020). Similar concerns have emerged in other knowledge domains, resulting in a general consensus that misinformation is a major challenge in the realm of scientific communication (Scheufele & Krause, 2019). Fake news is especially problematic when it undermines the development of policy and the public adherence to guidelines with regard to health, emergency management, and natural disasters.

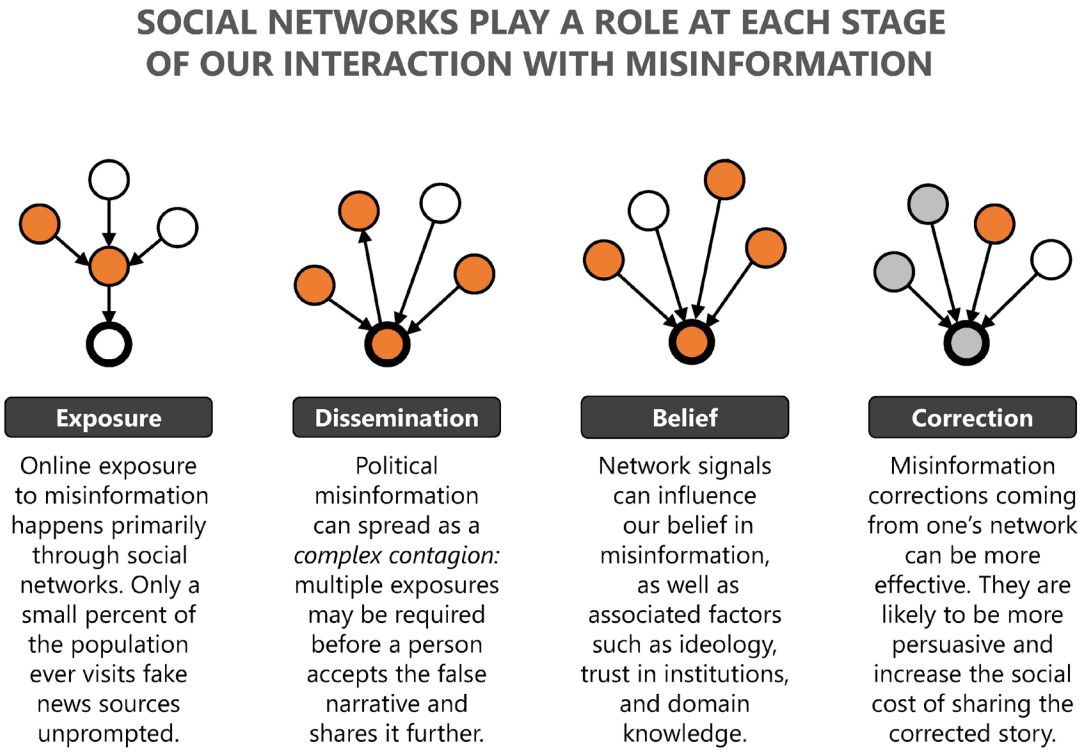
## Networks and fake news

Given its capacity to affect political, health-related, and other outcomes, fake news has come to the forefront of public attention as a challenging social problem. While many researchers have focused on the technological aspects of the issue, understanding and curbing the spread of misinformation requires knowledge of the social mechanisms behind it. Interpersonal interaction, both offline and online, is a key pathway for the spread of rumors and fake news.

The role of social connections and media influence in the formation of public opinion has been examined in network terms by the classic two-step flow of communication paradigm (Katz & Lazarsfeld, 1955). According to that model, media messages are received by the most active and engaged audience members who then disseminate those messages to the broader public. The framework has further been expanded to account for more complicated flows of ideas among both engaged and disengaged members of the public (Weimann, 1982). Recent interpretations of that theory see both individuals and news outlets as elements of complex networks with multiple types of connections that can carry information and be used to exert influence (Ognyanova, 2017). These are the interconnected systems through which both legitimate and false information spreads today.

**Figure 1**

*The role of social networks at each stage of our interaction with misinformation*




### *Exposure to misinformation*

One of the main ways in which people encounter misinformation online is through social media (Guess et al., 2017). Digital platforms more broadly are also a key channel facilitating the distribution of evidence to policymakers (see Lawlor et al.'s chapter in this volume). Exposure to misleading online content can thus have far-reaching consequences for both individuals and governing bodies.

While only a small percent of users ever distribute fake news (Grinberg et al., 2019), a larger number of people are exposed to it. The vast majority of online information consumers will not seek out a fake news site unprompted but may get exposed to misinformation shared by their social contacts. Network methods allow us to understand the flow of misinformation as it emerges and evolves over time.

Research exploring the dynamics of online misinformation suggests that its diffusion may differ from that of legitimate content. Vosoughi and Aral (2018) conducted a large-scale examination of true and false news propagating through Twitter from 2006 to 2017. Their analysis found that false stories spread further and faster than true ones, generating deeper cascades (unbroken chains of retweets) that reached more people. This pattern was especially prominent in political news, more so than in fake news regarding natural disasters, scientific information, or urban legends.

Earlier findings from Facebook research similarly show that rumors tend to produce deeper re-sharing cascades compared to other types of content (Friggeri et al., 2014). Other scholars have identified temporal patterns in the diffusion of true and false stories, with misinformation more likely to resurface and spread again multiple times compared to other content (Shin et al., 2018).

As with legitimate news, people's exposure to misinformation on social media depends on a series of content producers and curators—the authors of the message, the strategic players who amplify it, the audience members who share it, the platforms that carry it, and the consumers themselves (K. Thorson & Wells, 2016). Many decisions along the way are driven by social rather than purely financial, political, or technological factors. The platform algorithms that filter and sort the content we see rely on network metrics to make their decisions. Our social media streams strategically present us with more information from our closest contacts and less from the weaker ties at the periphery of our personal networks.

The individual choices we make are similarly skewed. When information appears in our news feeds, we may or may not choose to pay close attention. We dismiss some posts after a brief glance, while others merit more careful consideration, such as following a link to the original story. Experimental research suggests that people are considerably more likely to read news (or at least report intent to do so) if it has been shared by a strong tie (Kaiser et al., 2018). Our vulnerability to misinformation is similarly higher when it is shared personally with us and coming from close friends or family (Garrett, 2011).

Exposure to fake news could also occur through mainstream media as they repeat false claims, report on the spread of fictitious stories, or attempt to debunk misinformation. So far, research using automated analysis of media content has indicated that fake news sources may not have a strong influence on the agenda of mainstream media (Vargo et al., 2018). Problematic news sources do have a somewhat closer relationship with partisan

online outlets, leading their political coverage on some issues and following it on others. One area where online misinformation has had some success in shifting the media agenda is in the 2016 pre-election coverage of Donald Trump (Guo & Vargo, 2018).

In the future, tracking the diffusion of false messages—not only from outlets to audience members, but also within a larger system incorporating legitimate sources—will be essential, and network methods give us the ability to do it at scale (Ognyanova, 2018; Ognyanova & Monge, 2013).

### *Sharing misinformation*

Much like exposure to misinformation, the choice to spread those stories further is often prompted by social considerations. Through a series of online experiments, Pennycook and Rand (2018) show that people's perception of news story accuracy is only weakly related to their likelihood of sharing that story. Instead, decisions to disseminate information seem to be driven primarily by social and reputational factors. We tend to share stories that fit our personal narrative and projected identity, often selecting content we know will be viewed positively in our social circles (Marwick, 2018). While people may be exposed to opposing viewpoints, those will rarely be shared with others.

Engagement on social media (sharing, liking, or commenting) is thus considerably more politically polarized than information exposure (Garrett, 2017). Engagement is similarly concentrated even outside of the realm of politics. Examining a broad set of science-based and conspiracy-theory groups on Facebook, Del Vicario et al. (2016) identify separate echo chambers, leading them to conclude that people are most likely to share content that supports their preferred narrative.

Online engagement echo-chambers can be described in network terms as clusters of interconnected users with similar interests and preferences who share pro-attitudinal information with each other. Some models of news diffusion through social networks suggest that the presence of such like-minded clusters could help the spread of misinformation. The reasons for that association are detailed in the next few paragraphs.

Many things we are interested in studying—information, attitudes, behavior, infectious diseases—can spread through social interaction. Viral phenomena can travel from person to person fairly quickly and easily. A single exposure to a virus (or a music video) may be enough for us to get infected and spread the disease (or earworm) to our friends.

Not all songs, stories, or opinions, however, will spread among us quite that easily. Behaviors that are difficult, risky, or costly may not be adopted unless they are promoted and reinforced by multiple sources in our social networks. This type of spreading process is known as a *complex contagion* (Centola, 2018). It requires multiple independent exposures before transmission can occur (Guilbeault et al., 2018).

While memes may spread virally from person to person, political information often seems to travel through social media as a complex contagion (Romero et al., 2011). In an increasingly polarized society, political messages can be controversial and costly, sparking disagreement among our contacts. Fake news stories are arguably especially socially risky, as many of them seek to provoke audiences by being intentionally sensational and divisive (Duffy et al., 2019). Using simulation models, researchers have examined the dynamics of social media misinformation spread as a complex contagion process (Tornberg, 2018). The results suggest that the dissemination of fake news may be helped along by clusters of like-minded users in our online networks. While such clusters may make it more difficult for viral content to escape and reach other parts of the network, they help the spread of complex contagions by ensuring messages will be reinforced by multiple like-minded contacts. Contentious topics and polarized communities may therefore be especially vulnerable to false rumors.

The tendency to spread political misinformation is, furthermore, not distributed at random in the population of online users. It is linked to ideology strength and related to more traditional forms of political participation and news consumption (Valenzuela et al., 2019). Those who actively spread political messages in general are more likely to share fake news as well (Lazer et al., 2017).

Network analytical tools have also been used to track the role of bots (automated accounts) in misinformation dissemination on social media. Bots may be at least part of the reason why the initial sharing of fake news on social media tends to be concentrated among so few users. Twitter studies, for instance, find that a small number of human and automated "super-spreader" accounts are responsible for a large proportion of the shared falsehoods (Grinberg et al., 2019; Shao et al., 2018). The nature of the links (retweets, replies, or mentions) in the Twitter diffusion network also seems to matter. Fake news spreads less often through *replies* compared to other types of content such as fact-checking and corrections.

Network metrics not only help us understand the diffusion of misinformation, they can also influence its spread. Researchers find that posts with high network engagement metrics are more likely to be shared and less likely to be fact-checked on social media (Avram et al., 2020; Li & Sakamoto, 2014). Those posts are perceived as more believable and worth amplifying at least in part because their social metrics signal to people that a broader community values the spread of that message (Kim, 2018). Knowing that a news story has been shared by many other users makes us more likely to engage with it and increases our vulnerability to news from outlets with low credibility.

### *Belief in misinformation*

How accurate or believable people find online news can influence whether and how they act upon it. Persuasion and credibility research have examined how people respond to messages in general and online content in particular. Traditional frameworks suggest credibility assessments depend on characteristics of the message, its source, and its receiver. Online, those patterns are more complex as multiple sources take part in the production, modification, contextualization, and dissemination of information before it reaches us.

Much of the news we see on the Internet is socially curated (K. Thorson & Wells, 2016), which can affect its perceived value and trustworthiness. Limited by their ability and motivation to process online messages, people often rely on cognitive heuristics rather than systematically examining the relevant information (Metzger & Flanagin, 2015). Social factors play an important role in this evaluation. As mentioned above, we may be influenced by seeing the number of users who have previously engaged with a message. We may also be swayed by endorsements coming from our strong ties, from people we like, and from those who share our views. Endorsements by trusted personalities can also increase the perceived credibility of fabricated online content (Mena et al., 2020).

Social networks can shape our belief in fake news not only directly, but also by influencing other associated attitudes and opinions. Political ideology, domain knowledge, and trust in experts can affect our acceptance of low-quality information from dubious sources. These individual characteristics are also powerfully affected by the people around us and the communities we belong to (Lazer, Ognyanova, et al., 2015; Rolfe & Chan, 2017).

Political knowledge, another factor linked to our assessment of news credibility, is also shaped by our social environment (Ognyanova, 2020a). Discussions with social contacts, especially knowledgeable and politically like-minded ones, can help us learn (Carlson,

2019). Conversely, being part of communities that place less value on knowledge and expertise makes us more likely to encounter fake news, as well as to be more susceptible to its messages.

Our views can shift as we learn new information, but they can also change based on normative influence from our social contacts (Deutsch & Gerard, 1955). The opinions and actions of people around us inform what we perceive as socially acceptable views. When we are surrounded predominantly by like-minded people, our views can become more entrenched and extreme. Once that happens, even neutral messages we encounter may appear to be biased against us (Eveland & Shah, 2003). This skewed view of reality leaves us more vulnerable to misinformation designed to appeal to our ideological predispositions.

Our propensity to trust misinformation is also linked to our general trust in experts and institutions, including political actors and media sources (Ognyanova, Lazer, et al., 2020). Trust is a networked phenomenon, grounded in social relationships (Newton, 2001). It is generated and embedded in our exchanges with other actors and influenced by the opinions of our contacts. This is especially true in periods of uncertainty and risk—disasters, economic instability, or disease outbreaks (Cook & Santana, 2018). During such times, we tend to rely more heavily on our social networks for information. Those are also the times when rumors—both true and false—are especially prevalent.

The dwindling public trust in mainstream media and experts is one reason why people may turn to alternative and potentially unreliable sources of information. The erosion of journalistic legitimacy (Broersma, 2019) leaves Americans more likely to discount news and make choices based on their ideological predispositions (Ladd, 2012).

Media trust can be understood not only as resulting from changes in journalistic practices and political factors but also as an outcome of social influence processes. People's views of the media industry are shaped by the network structure of social groups (Ognyanova, 2019). Social contacts, especially close personal relationships, affect opinions about journalism and, indirectly, vulnerability to problematic sources of news.

### *Correcting misinformation*

One of the more challenging questions examined by fake news research is whether and how misperceptions can be corrected once they have been adopted. Studies in that area suggest that telling people the truth does not always produce the desired effect,

especially among the most committed and ideologically motivated participants (Nyhan & Reifler, 2010). In a number of settings, research has found a "belief perseverance" or "a continued influence" effect with misperceptions lingering even after being refuted (Flynn et al., 2017). Even when information is successfully debunked and people believe the correction, they may retain other associated attitudes triggered by the initial information (E. Thorson, 2016). For instance, information about the corrupt behavior of a political actor may change our opinion of that person for the worse. If the information is corrected and we accept the fact the corrupt behavior did not really occur, we may nonetheless retain the negative opinion of that person the story prompted in the first place.

The public debunking of false rumors by fact-checkers or mainstream media may have other unfortunate consequences. One problem is that repeating a story, even if it is to correct it, increases people's familiarity with the information (Fazio et al., 2019). Psychological research consistently finds that stories are perceived as more credible if they are familiar, making them easier to recall and process (Berinsky, 2017). This fluency effect means that attempts to refute a story could have the result of making it appear more plausible to the public.

Ideally, corrections of falsehoods should come from authoritative sources that people trust, especially ones that do not benefit directly from exposing the information as false (Berinsky, 2017). Finding such a source can be difficult, especially against the backdrop of the ever-declining public confidence in media and experts. In an uncertain environment where no trusted institutions can serve as neutral arbiters of truth, many of us lean more heavily on our social networks to help us separate facts from fiction. This points to one relevant way of approaching misinformation corrections: relying on interpersonal relationships.

The growing literature exploring fact-checking on social media points to the usefulness of mobilizing network resources in the fight against misinformation. Exploring the social context of misinformation debunking on Twitter, Margolin et al (2018) report that users were more likely to accept corrections offered by someone in their social network rather than a stranger. Both normative influence and higher trust in our social connections may prompt such reactions. Experimental research looking into social corrections on Facebook and Twitter uncovers similar patterns. Vraga and Bode (2018) find that corrections coming from social contacts were able to reduce misperceptions about the causes of the spread of the Zika virus.

## Case study

To demonstrate the value of a social network approach to misinformation research and its practical applications, this chapter ends with a brief summary of a relevant study. The study, reported in full elsewhere (Ognyanova, 2020b), examines the capacity of our social networks to debunk pro-attitudinal misinformation.

The findings described here are based on an online experiment conducted in February 2018 with a panel of 1,500 adult Americans provided by Qualtrics. The data collection used quotas for age, gender, race/ethnicity, and region of the U.S. Post-stratification weighting based on 2018 Census Bureau data was applied to ensure representativeness with regard to demographic characteristics.

**Figure 2**

*Political and correction condition in the social correction experiment*

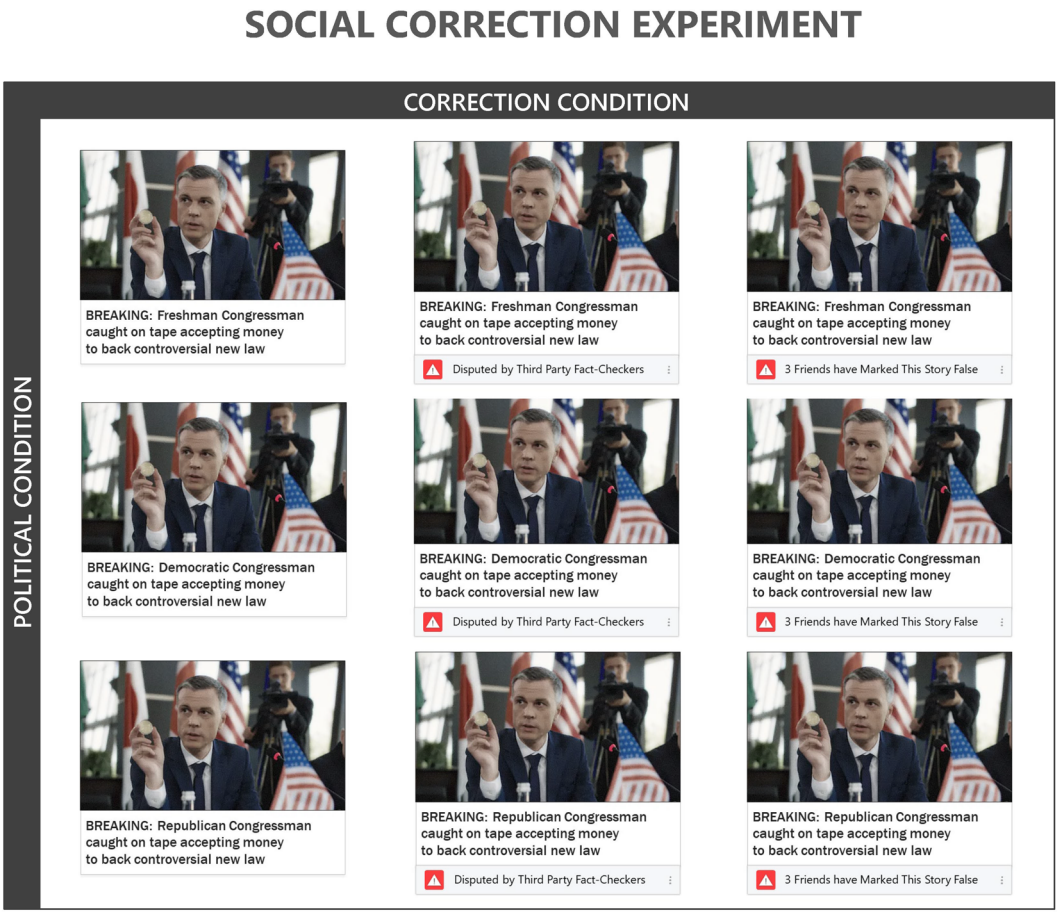


**Figure 3**

*Perceived accuracy by correction type*

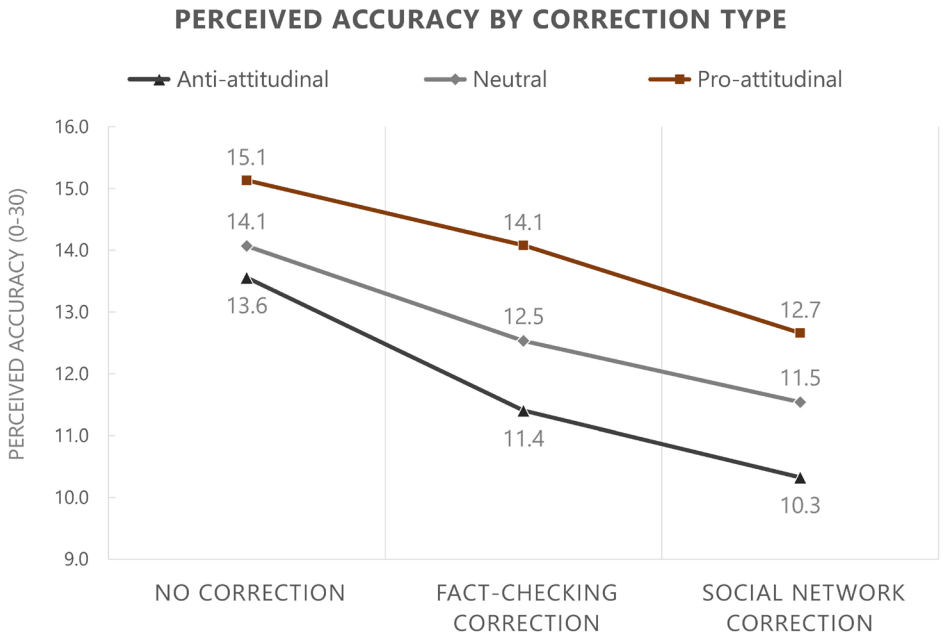
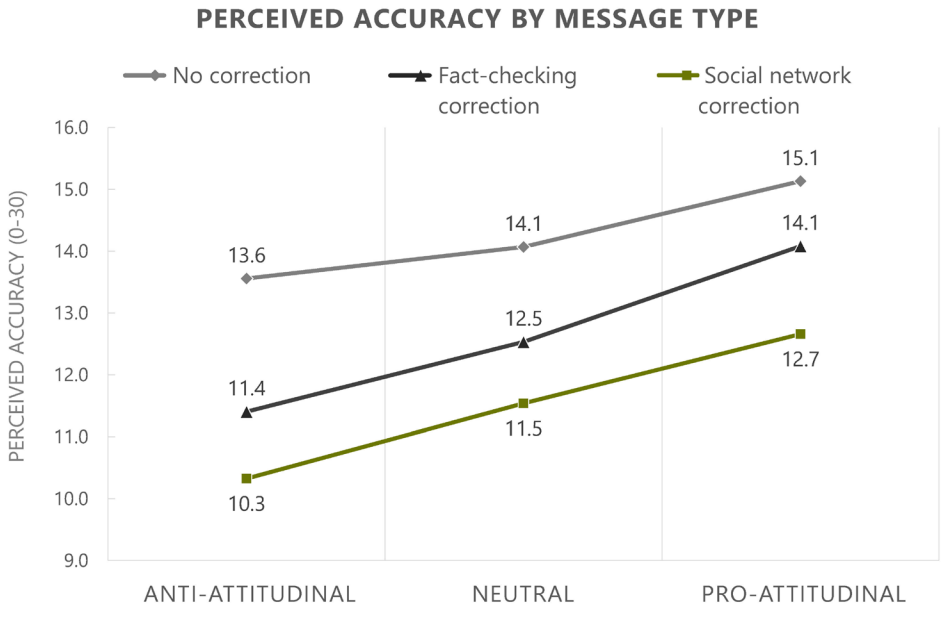



**Figure 4**

*Perceived accuracy by message type*



The case study tested the capacity of network corrections to reduce belief in the accuracy of news encountered on social media. In an online experiment, respondents were shown a Facebook post of a news story. The story claimed that a congressman was caught on tape accepting money to back a controversial new law. Respondents in the control condition saw the post without any kind of correction. Those in the *fact-check* condition saw the post with a message saying the story was "Disputed by third-party fact-checkers." The visual design and text of this correction were modeled on the warnings Facebook used at the time to flag questionable content. Respondents in the *social* condition saw the post with a similarly styled warning claiming that "3 friends have marked this story false."

In addition to the correction condition, respondents were also placed in one of three political affiliation conditions. In the neutral case, the story title did not mention the political party of the corrupt congressman. In the other two cases, he was identified as a Democrat or a Republican. This resulted in a 3x3 design of correction type by political party.

The first dimension of the experiment was constructed so as to compare the effectiveness of a *fact-checking* and *social network* approaches to misinformation correction. The second dimension was included to reflect our understanding that information is especially difficult to correct if it matches our ideology, political affiliation, or resonates with deeply held beliefs. In this case, there were three *message* conditions under examination: neutral (no political party mentioned), anti-attitudinal (respondents being told a congressman from their own party was corrupt), or pro-attitudinal (respondents being told a congressman from the opposing party was corrupt). Based on research exploring motivated reasoning, respondents could be expected to believe a pro-attitudinal post more, and be less likely to accept its correction (Carpenter, 2019; McDermott, 2019). Consequently, social network corrections would be considered especially useful if they could reduce the perceived accuracy of pro-attitudinal misinformation.

After seeing their assigned post, participants in all the conditions of the online experiment were asked to rate it on a scale from 0 to 10 based on their perceptions of how accurate, convincing, and credible it was. The three scores were summed to create the overall *perceived accuracy* rating ranging from 0 to 30.

A two-way ANOVA found significant effects for both *correction type* [$F(2, 1495) = 16.4$, $p < .001$] and *message type* [$F(2, 1495) = 9.1$, $p < .001$], with a non-significant interaction. A

Tukey HSD test found significant differences in the mean perceived accuracy among all three correction types. Both the *fact-checking* and the *social network* corrections had an effect in the expected direction and resulted in significantly lower perceived accuracy compared to the control condition. The social network correction was also more effective in reducing perceived accuracy compared to fact-checking. Moreover, it did so equally well for pro-attitudinal as well as for neutral and anti-attitudinal information.

## Conclusion

The study outlined above highlights the importance of social networks—not just as infrastructure for the diffusion off fake news, but also as means to correct misinformation and curtail its spread. In times of declining public trust in social institutions and corporate actors, our personal connections remain influential, consistently affecting how we consume and evaluate information.

As the results above also demonstrate, stories that match our biases and predispositions are significantly more likely to be perceived as accurate. For many of us, it is easier to believe a politician may be corrupt when they belong to the opposing party. It is more difficult to imagine dishonesty coming from public figures who are supposed to share our values and convictions. While the network correction cannot fully mitigate that pattern, it performs better than fact-checking for both pro-attitudinal and counter-attitudinal messages. This points to promising directions for future interventions combining technological and social solutions. Adding social reinforcement to fact-checking warnings can increase their usefulness and boost the social cost we pay when sharing false stories.

Both the literature examined in this chapter and the case study presented above clearly show that awareness of social structures can help us improve technological and regulatory approaches to current problems. Network research offers a useful toolkit allowing us to explore the social aspects of opinion formation, information credibility, media trust, and digital content diffusion. Understanding the social processes that drive the spread, exposure, and acceptance of fake news can inform the design of both policy and industry solutions.

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