Abstract

As misinformation sweeps across the digital world, there is a need to better understand the psychological processes that underlie belief and susceptibility to online misinformation. The present study measured *vulnerability to misinformation* through a proxy construct of *verifying online information*. Using path modeling, we investigated how cognitive styles, as assessed by the Cognitive Reflection Test, predicted the extent individuals verify online information and content. The path model also investigated the mediating role of conspiracy mentality and pseudo-profound bullshit receptivity. Based on a U.S. sample of 194 adults, we found that the cognitive reflection test was positively related to verifying online information. Moreover, whereas a significant indirect effect was observed through the bullshit receptivity mediator, the indirect effect through conspiracy mentality was not significant. The conclusions and practical implications of the present results are discussed.

Key words: misinformation, vulnerability to misinformation, cognitive reflection test, conspiracy mentality, bullshit receptivity, rational-intuitive decision-making

MONTCLAIR STATE UNIVERSITY

Who Falls for Online Misinformation: Examining the Cognitive Correlates of Vulnerability to Misinformation

by

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Who falls for online misinformation: Examining the cognitive correlates of vulnerability to misinformation

Overview of Issue

Sometimes used interchangeably, the terms ‘misinformation’, ‘disinformation’, ‘fake news’, ‘propaganda’, and ‘conspiracy theory’ have become buzzwords whose definitions are still evolving (O’Connor & Weatherall, 2019). All “concern false or misleading messages spread under the guise of informative content, whether in the form of elite communication, online messages, advertising, or published articles” (Guess & Lyons 2020, p. 10). The Google dictionary defines misinformation as “false or inaccurate information, especially that which is deliberately intended to deceive”. Guess and Lyons (2020) define misinformation as claims that contradict or distort common understandings of verifiable facts. For the purpose of this study, we define misinformation as false information that is spread, regardless of intent to mislead. While there may be a valid and ongoing debate on the epistemology of what constitutes ‘true’ and ‘false’, the definition adopted here assumes that factual claims are, and should be, verifiable.

To illustrate, as the 2016 US presidential election was nearing, a news article titled “Pope Francis shocks the world, endorses Donald Trump for president” spread on Facebook with nearly a million shares (CNBC, 2016). The claim was verifiably false, hence a quintessential piece of

misinformation. Disinformation, on the other hand, is a subset of misinformation that is intentionally, and often strategically, pushed (dictionary.com). If someone sees a piece of false but intriguing information, believes it, and then shares it with their friends, they are spreading misinformation but not disinformation. On the other hand, if a political candidate, for example, spreads an array of information that they know is false or misleading, they are spreading disinformation. Likewise, fake news is a special class of misinformation presented as news, mimicking the appearance of news articles from trusted news outlets. Disinformation and propaganda are often used synonymously. Relatedly, false, misleading, distorted, and unverifiable claims and beliefs underlie conspiracy theories, forming systems of explanatory and pervasive beliefs or worldviews about various aspects of reality (van Prooijen & Douglas 2018). Here, we mostly stick to the general term 'misinformation.'

Powered by modern technology such as the internet, television, computers, and smartphones, information is being produced, transmitted, and consumed with unprecedented speed and reach today (Council on Foreign Relations, 2022). Unfortunately, a considerable portion of the information people encounter is misinformation - intentionally or unintentionally transmitted untruthful information, distortions of truths, misleading information, and conspiracy theories. To illustrate, 53% of US adults in a YouGov survey in 2023 reported encountering false or misleading information online daily; among the respondents 65 years or older, 66% reported the same (YouGov, 2023). When a reader, viewer, or listener encounters a piece of misinformation, they may take it for true, they may recognize it as untrue, or somewhere in between. The ability of an individual to identify a piece of misinformation as such and hence not fall for it could be called one's *resistance to misinformation.* For the current study, we use the

term *vulnerability to misinformation*, which can be considered an attribute opposite of *resistance to misinformation.*

Vulnerability to Misinformation

We claim that *vulnerability to misinformation* (VTM) - and particularly vulnerability to online misinformation - is a novel, emergent, complex, multifaceted psychological disposition that remains to be thoroughly understood and defined. Research in recent years has illuminated some of its demographic correlates. Age seems to be positively correlated with VTM, with older people showing higher susceptibility (Wylie et al., 2014). Guess, Nagler and Tucker (2019) found that people aged 65+ were more likely to share misinformation on social media compared to other age groups. Findings about the role of gender in vulnerability to misinformation are mixed. For example, Laato et al. (2020) found that men are more likely than women to share health information without fact-checking, but Lazer et al. (2020) found that women are more likely than men to share pandemic-related fake stories on Twitter. While there is evidence that education serves as a protective factor against misinformation, educated people are by no means invulnerable to its insidious effects. Multiple studies suggest that higher levels of education are associated with reduced belief in conspiracy theories (Douglas et al., 2016; Georgiou et al. 2020; van Prooijen, 2017). A Pew Research (2018) report found that college-educated adults were better at discerning political opinions - such as the prime-time television talk shows that are most typically partisan - from facts -such as objective news reporting. Relatedly, higher cognitive ability is generally linked to less susceptibility to misinformation (Keersmaecker & Roets, 2017).

Findings on the role of personality traits in shaping one's acceptance of misinformation are mixed. Buchanan and Benson (2019) found that individuals low in agreeableness of the Big Five personality traits showed more readiness to subscribe to any information that counters the

mainstream worldview, which goes parallel to their inherent tendency to play 'devil's advocate'. Akbar et al. (2018) demonstrated that extroverts are more likely than introverts to share unverified and unverifiable information with others. A number of studies approached *vulnerability to misinformation* as a two-dimensional construct, with a cognitive component called *belief in misinformation (BIM)*, and a behavioral component called *sharing misinformation (SM)*. Ahmed and Rasul (2022) found a positive association of BIM with openness, extraversion, and neuroticism but a negative association with conscientiousness; SM was negatively correlated with conscientiousness and positively correlated with extraversion. Ahmed and Tan (2022) found BIM to be positively correlated to extraversion but negatively correlated to agreeableness; SM was negatively correlated with conscientiousness and agreeableness. Other studies have investigated how the Dark Triad personality factors relate to belief in and sharing of misinformation. Enders et al. (2023) found that narcissism and psychopathy traits predict BIM. Escola-Gascon et al. (2023) found only narcissism to be positively correlated with BIM. Morosoli et al. (2023) found that all three traits - narcissism, psychopathy, and Machiavellianism - are positively associated with sharing misinformation.

Pennycook and Rand (2019) identified "reflexive open-mindedness", a tendency to be intrigued by salient, outlandish, and unsubstantiated claims, to be associated with proneness to misinformation beliefs. In addition, individuals who are primarily driven by emotions rather than rational thinking are found to be more inclined to misinformation (Martel, Pennycook & Rand, 2020), with the affective states of anger, anxiety, and stress strongly linked to vulnerability to misinformation (Lommen et al., 2013; Weeks, 2015).

VanBavel et al. (2020) propose a multi-path, multi-directional, and cyclical model of misinformation belief and sharing, according to which exposure to misinformation increases belief, which in turn increases sharing. However, exposure alone, without belief, can boost sharing. These relationships are facilitated by a host of psychological risk factors such as partisan bias, polarization, political ideology, cognitive style, memory, morality, and emotion in complex ways. In an attempt to identify the cognitive mechanism underlying the perceived truth of incoming information, Brashier & Marsh (2020) posit that people (i) exhibit a bias to accept (rather than reject) incoming information since most claims that we encounter are true, (ii) interpret feelings, such as ease of processing, as evidence of truth, and (iii) consider whether a given assertion matches facts and source information stored in memory, suggesting that false information if aligns with prior beliefs, is likely to be perceived as true. In their investigation of the "illusory truth effect", Pennycook, Cannon and Rand (2018) found that repeated exposure is a strong predictor of belief in misinformation in that even the information tagged as false or inconsistent with one's political ideology grow in processing fluency and hence perceived truth in subsequent exposure. In this study, the news headlines were perceived to be more accurate as they appeared the second or third time versus the first time. This may explain why viral contents are likely to be accepted as true as they keep showing up on people's social media feeds. This well-replicated cognitive vulnerability has been routinely exploited by politicians and peddlers of misinformation who succeed in convincing people of false claims by the mere force of repetition (Brown, Alan, Nix & Lori, 1996).

Cognitive Reflection

A cognitive predictor of misinformation vulnerability that the current thesis focuses on is the analytical/reflective thinking style. A common method of measuring this construct is through the Cognitive Reflection Test (CRT; Frederick, 2005), where participants are provided a series of analytic problems that have an intuitive (but incorrect) numerical answer. Higher cognitive reflection is measured by one's ability to inhibit this intuitive answer to arrive at the correct numerical answer. Pennycook and Rand (2019) found that analytical thinking - measured by the CRT - was positively associated with the ability to discern between fake news and real news, suggesting that "lazy thinking" or cognitive miserliness - rather than motivated reasoning - predicts vulnerability to misinformation. Looking specifically into susceptibility to health-related online misinformation, Scherer et al (2021) found that deficits in knowledge or skill, pre-existing attitudes, trust in science, and cognitive miserliness - as measured by the CRT - predicted vaccine hesitancy. Similarly, Ali and Qazi (2020) found that higher CRT scores were linked with greater truth discernment for COVID-19 information and stronger commitment to health safety behaviors such as mask-wearing. Martire et al. (2023) found that those who took a longer time to complete the CRT were less likely to endorse implausible beliefs, suggesting that such beliefs are associated with a more reflexive, intuitive, or non-analytic cognitive style. Finally, in a systematic review, Nan et al. (2022) found the analytic thinking style (as measured by the CRT) to be negatively related to susceptibility to health misinformation in all seven studies that included thinking style as a predictor of misinformation.

The CRT (Frederick, 2005) is widely used in the judgment and decision-making literature more broadly as it is known to capture a tendency to override a tempting but inaccurate intuitive answer to a problem through reflective, analytic effort. The CRT has been found to correlate with various measures of mental heuristics as well as measures of intelligence (e.g. IQ) (Oechssler et

al., 2009). It has also been shown to correlate with various measures of economic thinking, such as numeracy, temporal discounting, and gambling preference (Szaszi et al., 2017). Due to the previously found relationships between the CRT and various forms of misinformation susceptibility, a primary hypothesis of the current thesis is a negative relationship between cognitive reflection (measured by the CRT) and vulnerability to online misinformation.

Verifying Online Information

While measuring cognitive reflection through the CRT is a commonly used and accepted method, evaluating our dependent variable (vulnerability to misinformation) presents some challenges. One method used in the literature is to present participants with real and fake information (e.g., real and fake news headlines) and have them distinguish between the two. For example, Maertens et al. (2023) developed a 20-item Misinformation Susceptibility Test (MiST-20), which consists of presenting the participants with a mixture of true and false news headlines to discern. Though there are clear benefits to these types of discrimination tasks, solely relying on such news discernment tasks invites several questions: how do we decide which news articles and headlines to include? Who decides? How recent should the news be? If one attempts to replicate this study at different times and places, the items on the scale must be updated. In addition, in polarized socio-political environments where the news considered true by half the population can be considered false by the other half, the news discernment approach is prone to politicization, bias, and controversy.

As an alternative to the news discernment approach to assessing vulnerability to misinformation, Tifferet (2021) developed an instrument called Verifying Online Information (VOI). This is a self-report measure of the behaviors involved in verifying information and

identifying misinformation encountered online, such as reading the story in its entirety, double-checking the source, and conducting a Reverse Image Search. While the news discernment tasks are primarily analogous to knowledge or achievement tests, where one's knowledge or ability is tested, the VOI self-report focuses on the behavioral steps one tends to take upon encountering questionable online content. Such behavioral steps reflect one's ability, skills, and motivation to critically evaluate the quality and veracity of information encountered online. Tifferet validated a 22-item self-report scale (the VOI-22) and a 7-item abridged version (the VOI-7), consisting of two constructs: direct and indirect verification of online information. Direct verification consists of behaviors such as searching for the original story and conducting a reverse image search. Indirect verification includes checking to see if the story had been updated and looking for the website's owner. This general-context, self-report, continuous scale with robust psychometric properties (specifically the VOI-7) is thus adapted to serve as the measure of the dependent variable for the current study. However, it is important to note that higher scores on the VOI would be an indicator of *less* susceptibility to online misinformation.

Conspiracy Mentality

The current thesis examines two potential mediators of the relationship between cognitive reflective thinking style and vulnerability to online misinformation. The first one is conspiracy mentality, which Imhoff et al. (2022) cautioned to differentiate from mere belief in a set of conspiracy theories, while conspiracy mentality is a "relatively stable disposition characterized by readiness to interpret world events as being caused by plots hatched in secret, conspiracy beliefs are manifest indicators of conspiracy mentality partially contaminated by other dispositions." A number of studies have established that higher scores on the CRT are associated

with lower conspiracy beliefs (Adam-Troian et al., 2019; Alper et al., 2021; Sanchez & Dunning, 2021; van Bavel et al., 2022; Wagner-Egger et al., 2018). For the current study, we utilize the five-item Conspiracy Mentality Questionnaire (CMQ), an instrument developed by Bruder et al. (2013), to assess differences in the generic tendency to engage in conspiracist ideation within and across cultures. There is evidence that conspiracy mentality and belief in misinformation are related. Enders et al. (2022), for example, found a strong association between belief in conspiracy theories, belief in misinformation, and COVID-19 vaccine hesitancy. It is also reasonable to expect an individual or group that believes in certain conspiracy theories to then produce and spread disinformation to perpetuate or promote their theories. As an illustration, Kaplan (2023) draws a detailed picture of how the QAnon "brand" of conspiracy theories has led to a barrage of misinformation saturating social media.

'Bullshit' Receptivity

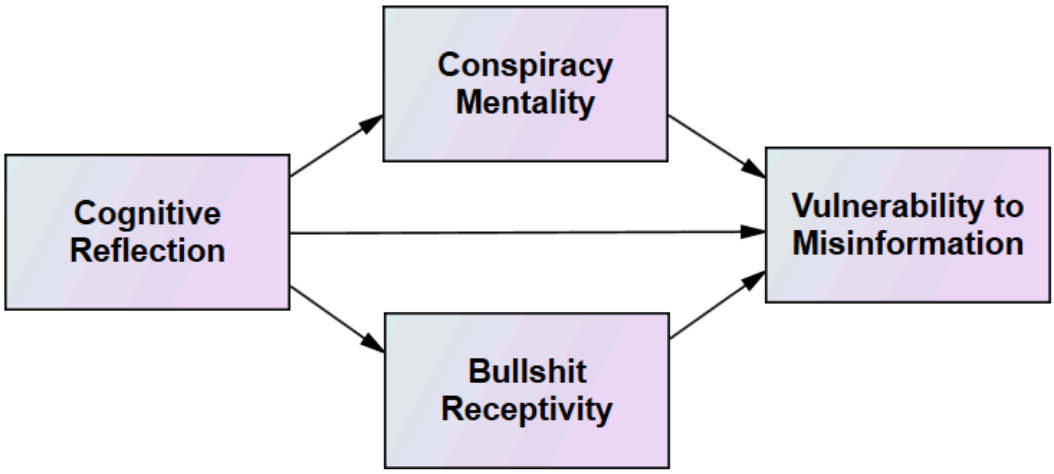
The second construct of mediation interest for the current study is *bullshit receptivity*, a term coined by Pennycook et al(2015), defined as a tendency to reflexively ascribe profundity to ultimately meaningless information and context. This has been measured in the literature by providing participants with randomly generated sentences that, if superficially heard, sound profound but in close inspection are revealed as being empty of meaning. Some examples of pseudo-profound bullshit statements would be "The river of awareness flows upstream when the mounts of perception dissolve into the ocean of thoughtlessness" and "The silence of the void echoes louder than the symphony of being, yet neither exists without the shadow of the other" (generated by ChatGPT). These types of sentences are not outright lies but are often misleading, hence bullshit receptivity can be viewed as a gateway to believing in misinformation (Lacobucci & Cicco, 2022). Lai et al. (2022) found that bullshit receptivity predicts willingness to share

misinformation about climate change. An emerging body of research also links cognitive reflection negatively to bullshit receptivity (Cavojova et al., 2019; Littrell et al., 2023; Pennycook & Rand, 2020). It is thus reasonable to expect that individuals who are high on cognitive reflection will be less receptive to bullshit, which in turn indicates less vulnerability to misinformation.

Overview of Current Hypotheses

The confluence of the literature discussed above supports the following conceptual model and set of hypotheses:

Figure 1. The analytic model tested in the current thesis



Hypothesis 1: Cognitive reflection is negatively associated with vulnerability to misinformation.

Hypothesis 2: Conspiracy mentality negatively mediates the association between cognitive reflection and vulnerability to misinformation, due to:

Hypothesis 2a: Cognitive reflection is negatively related to conspiracy mentality.

Hypothesis 2b: Conspiracy mentality is positively related to vulnerability to misinformation.

Hypothesis 3: Bullshit receptivity negatively mediates the association between cognitive reflection and vulnerability to misinformation, due to:

Hypothesis 3a: Cognitive reflection is negatively related to bullshit receptivity.

Hypothesis 3b: Bullshit receptivity is positively related to vulnerability to misinformation.

Method

After receiving the IRB approval from Montclair State University, the study plan was pre-registered on Open Science Framework (https://osf.io/7zr95). The survey was designed on Qualtrics. The online platform Cloud Research was used for data collection.

Participants

Two hundred adults (18 years or older) residing in the US were recruited on Cloud Research. The survey was estimated to take 10 minutes to complete, and a compensation of $1.5 was pledged upon completion. Out of the 199 participants who completed the survey, five failed the attention checks and thus were excluded from the analysis. The final sample size comprised 194 participants.

The average age of the participants was 38 years, with a standard deviation of 11 years. The median age was 35 years. The participants' ages ranged between 18 and 76. There were 103 male participants, 88 female participants, and 2 non-binary participants. One participant declined to disclose their sex/gender identity. In terms of race, 132 participants were White, 25 were Black, 30 were Asian, and 7 were other races or did not disclose their race.

Materials

The following measures were included in the survey:

Vulnerability to Misinformation

The Verifying Online Information (VOI) self-report scale was used to measure vulnerability to online misinformation (Tifferet, 2021). The seven-item VOI (VOI-7) was adapted for the current study. This self-report scale has participants imagine an encounter with an online article or post. Participants are instructed to imagine that the article interests them but they have potential doubts about the accuracy of the content. The self-report scale then has the participants rate the likelihood of completing a series of verifications on the online content (e.g., "Check the link and references in the story"; "Check if the story has been updated"). Three of the items deal with direct verification, and four items deal with indirect verification. All items are completed on a percent slider (0% through 100%) with 10% increments. The Cronbach alpha for the items on this scale was 0.84 with a 95% confidence interval of [0.81, 0.88].

Cognitive Reflection

The seven-item Cognitive Reflection Test - Multiple Choice Questions (CRT MCQ-4) (Sirota & Juanchich, 2018) was derived from the original three-item Cognitive Reflection Test (Frederick, 2005). Specifically, four more items/questions were added to the measure and adapted to provide four responses to choose from. Each item was coded to be correct or incorrect based on selection of the response option that was mathematically correct. The Cronbach's Alpha for the scale was 0.80 with a 95% confidence interval of [0.75, 0.84].

Rational and Intuitive Decision Style

A ten-item Rational and Intuitive Decision Style Scale (Hamilton et al., 2016) was included in the survey. This scale is a self-report measure of rational and intuitive decision making. This scale was included so that we could run a version of the analytic model with this measure instead of the CRT as a robustness check. The intuitive items were reverse scored and

combined with the rational items to construct an overall scale score of rational decision style. The Cronbach alpha for this scale was 0.89 with a 95% confidence interval of [0.87, 0.91].

Conspiratory Mentality

The five-item Conspiracy Mentality Questionnaire (CMQ-5) (Bruder et al., 2013) was used to measure the conspiracy mentality attribute of participants. This is a self-report questionnaire with items such as “I think that many very important things happen in the world which the public is never informed about” and “I think that government agencies closely monitor all citizens”. Participants indicated on a 5-point scale how strongly they agreed with the statements, from 1 (Strongly disagree) to 5 (Strongly agree). The Cronbach's alpha for this scale was 0.77 with a 95% confidence level of [0.72, 0.82].

Pseudo-profound Bullshit Receptivity

To assess the pseudo-profound bullshit receptivity attribute of participants, we employed the original Bullshit Receptivity Scale (BSR; Pennycook et al., 2015) which is a 10-item scale consisting of statements such as “Hidden meaning transforms unparalleled abstract beauty” and “Good health imparts reality to subtle creativity”. Participants were asked to rate how profound - i.e., how deep in meaning - these statements were on a scale of 1 through 5. The Cronbach’s alpha for the scale was 0.92 with a 95% confidence interval of [0.91, 0.94].

Data Analysis

The initial treatment of the dataset was done using the IBM SPSS software. R statistical program was used for further processing, preparing, and analyzing the data. The path models were done using the Lavaan package in R. For all the multiple-item scales, mean scale scores were computed to construct aggregate construct scores.

A parallel mediation path model was performed to test the conceptual model (see Figure 1). The cognitive reflection test (CRT) was the exogenous independent variable in the model, the Verifying Online Information scale (VOI), was the endogenous dependent variable in the model, and the Conspiratory Mentality Scale (CMS) and pseudo-profound Bullshit Receptivity Scale (BRS) were both entered as mediators in the path model. A residual direct effect between the CRT and the VTM was included in the path model to estimate any residual direct association between the IV and the DV (after adjusting for the two mediators). Moreover, a residual covariance among the two mediators was included in the path model to estimate any residual relationship between conspiratory mentality and bullshit receptivity (after adjusting for the direct effects of the CRT on the two mediators).

An alternative path model was run by replacing the CRT with the Rational/Intuitive Decision-making Styles Scale (DMS) as the exogenous variable in the path model. Additionally, a bootstrapping model based on 5000 resamples was fit and run to test the significance of the two indirect effects in the path models. Upon completion of the thesis project, all study materials, de-identified data, and analysis scripts will be posted to the study project on OSF (https://osf.io/z95bm/).

Results

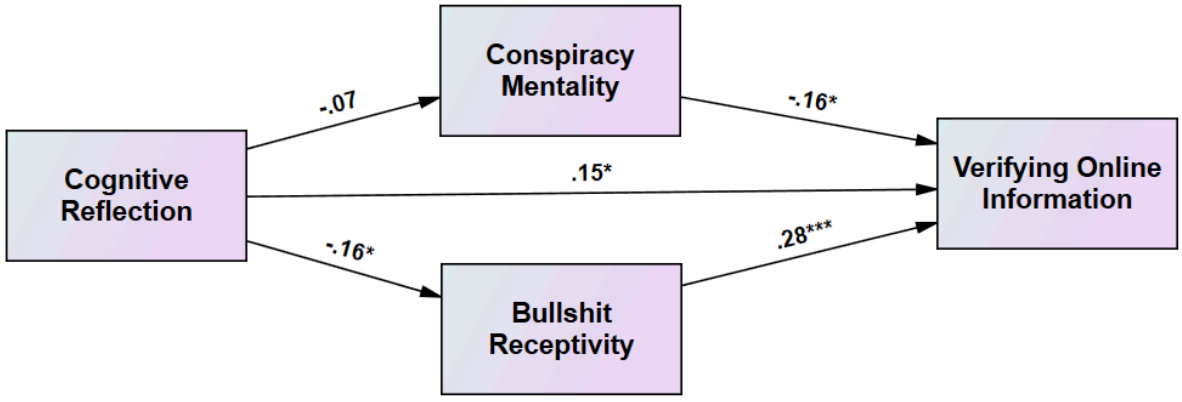
Table 1. Bivariate (Pearson) correlations between all study variables along with their mean and standard deviation.

	1	2	3	4	mean	sd
1. Cognitive Reflection	--				0.58	0.33
2. Rational Decision Style	.16*	--			3.7	0.67

3. Conspiracy Mentality	-.06	-.14	--		3.5	0.75
4. Bullshit Receptivity	-.16*	-.41***	.25***		2.7	1.01
5. Verifying Online Information	.11	.15*	-.10	.22**	52.48	21.76

The bivariate correlations between all study variables can be seen in Table 1 (appendix). The path modeling results can be seen in Figure 2. There was a significant negative association between cognitive reflection test scores and bullshit receptivity (B = -0.502, SE = 0.217, p = .021, β = -0.164). Though the association between cognitive reflection test scores and conspiracy mentality was in the hypothesized negative direction, the association failed to reach statistical significance (B = -0.148, SE = 0.164, p = .365, β = -0.065).

Figure 2. The main path model with standardized beta values for each path



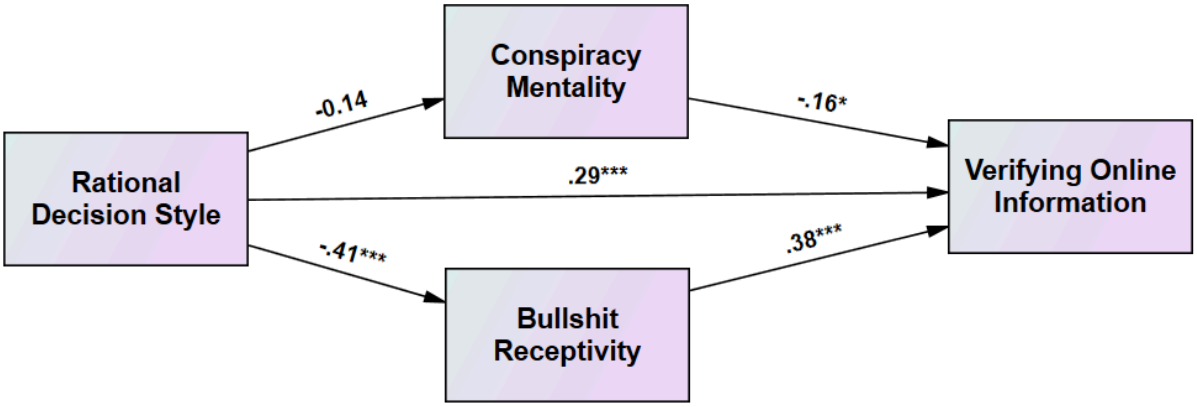
Cognitive reflection test scores had a residual direct effect on the verifying online information dependent variable (B = 9.800, SE = 4.553, p = .031, β = 0.149). The mediating conspiracy mentality variable had a negative association with verifying online information (B = -4.692, SE = 2.029, p = .021, β = -0.163). Finally, the bullshit receptivity mediating variable was

also significantly associated with verifying online information (B = 6.065, SE = 1.530, $p < .001$, $\beta = 0.282$), but the relationship was in the positive direction (opposite of the hypothesized negative direction).

The indirect effect from cognitive reflection test scores to verifying online information through conspiracy mentality was not significant ($p = .399$), but the indirect effect through bullshit receptivity was statistically significant ($p = .046$). However, as described above, this indirect effect was in the opposite direction as hypothesized. The bootstrapped confidence intervals supported the significance patterns of the two indirect effects. Specifically, the 95% bias-corrected bootstrap confidence interval for the indirect effect with the conspiracy mentality mediator included zero (-0.699 to 3.549), but the confidence interval did not include zero for the bullshit receptivity mediator (-6.925 to -0.824). Finally, the explained variances in the three endogenous variables in the path model were conspiracy mentality ($R^2 = .004$), bullshit receptivity ($R^2 = .027$), and verifying online information ($R^2 = .095$).

The alternative path model that used the self-report rational decision styles variable instead of the cognitive reflection test as the exogenous variable had similar results (see Figure 3). There was a significant negative association between rational decision style and bullshit receptivity (B = -0.625, SE = 0.099, $p < .001$, $\beta = -0.413$). Though the association between rational decision style and conspiracy mentality was in the hypothesized negative direction, the association was marginally significant (B = -0.155, SE = 0.080, $p = .053$, $\beta = -0.138$).

Figure 3. The alternative path model with standardized beta values for each path



Rational decision style had a residual direct effect on the verifying online information dependent variable (B = 9.302, SE = 2.371, $p < .001$, $\beta = 0.287$). The mediating conspiracy mentality variable had a negative association with verifying online information (B = -4.486, SE = 1.977, $p = .023$, $\beta = -0.156$). Finally, the bullshit receptivity mediating variable was also significantly associated with verifying online information (B = 8.048, SE = 1.604, $p < .001$, $\beta = 0.375$), but the direction remained in the positive direction (opposite of the hypothesized negative direction).

The indirect effect from rational decision style to verifying online information through conspiracy mentality was not significant ($p = .140$), but the indirect effect through bullshit receptivity was statistically significant ($p < .001$). However, similar to the previous path model, this indirect effect was in the opposite direction as hypothesized. The bootstrapped confidence intervals supported the significance patterns of the two indirect effects. Specifically, the 95% bias-corrected bootstrap confidence interval for the indirect effect with the conspiracy mentality mediator included zero (-0.017 to 2.233), but the confidence interval did not include zero for the bullshit receptivity mediator (-7.999 to -2.852). Finally, the explained variances in the three

endogenous variables in the alternative path model were conspiracy mentality ($R^2 = .019$), bullshit receptivity ($R^2 = .171$), and verifying online information ($R^2 = .142$).

Discussion

The present study arose with a broad interest in the nature of vulnerability to misinformation. The guiding question was: "Who falls for misinformation?" A motivating social observation was that some of the commonly believed misinformation, especially around the COVID pandemic, was extremely outlandish and blatantly false, such as "Alcohol kills the coronavirus" and "The Covid vaccine contains mind-control chips". On the other hand, a large swathe of misinformation is not as obvious and hence not as easily dismissible. There are subtle distortions of truth, carefully planned omissions, and untruths wrapped around truths. It was evident that some people are more resistant to misinformation than others. Since the mechanisms of perceiving, processing, evaluating, and adopting information cuts into the heart of cognition, the guiding question evolved into the form: "What are the cognitive correlates of vulnerability to misinformation (VTM)? Is there any relationship between VTM and cognitive styles?" The cognitive styles that the existing literature pointed to as playing a role in scrutiny and acceptance of potential misinformation were rational/analytical/reflective thinking/decision-making versus intuitive/impulsive/reflexive thinking/decision-making. The research converges to a broad consensus that individuals inclined to deliberative thinking and decision-making based on reflection and analysis as opposed to impulsive thinking based on intuition or gut-feeling, are better able to identify and resist misinformation. Since the Cognitive Reflection Test (CRT) has been established as a valid and reliable measure of how likely one is to resist impulsive, intuitive thinking and engage in effortful, rational thinking, the current study set out to further explore the relationship between the CRT and vulnerability to misinformation.

However, VTM is a complex and multifaceted construct. The most common attempts at capturing VTM have included news discernment tasks where participants are given a list of false and true pieces of information/news to evaluate. Because of the limitations inherent in this process, such as the information or news being ephemeral, place-specific, and potentially politicized, a more inclusive and broadly applicable method to capture VTM was sought. The Verifying Online Information (VOI-7), which is a self-report measure by Tifferet (2021), was thus adopted for this purpose. Those who take multi-layered steps in verifying the information that they consume are expected to be less susceptible in general and more resistant to misinformation. The adoption of this scale also narrowed the scope of the study to the information - or rather, misinformation- available and consumed on the internet. Hence the term vulnerability to misinformation (VTM) in this study's context means vulnerability to online misinformation even though it could possibly be argued that those who take measures to verify online information may have tendency to verify "offline" information, such as the information obtained from television and newspapers, as well.

The two mediating variables - namely, conspiracy mentality as measured by the Conspiracy Mentality Questionnaire (CMQ-5, Bruder et al. 2013) and bullshit receptivity as measured by the Bullshit Receptivity Scale (BSR-10, Pennycook et al 2015) - were introduced considering the proximity of these two constructs with both the VTM and the CRT. Indeed, there is ample literature indicating that cognitive styles influence susceptibility to conspiracy beliefs and vice versa. Generally, higher levels of cognitive reflection are associated with lower conspiracy mentality (Ballova, 2021, Gligoric et al 2021). In contrast, an inclination for intuitive thinking and a propensity to jump to conclusions without rational thinking has been linked to a higher tendency to believe in conspiracy theories (Pytlik et al., 2020). Furthermore, research

indicates that a stronger conspiracy mentality correlates with a higher likelihood of endorsing false scientific claims such as misconceptions about vaccinations and genetically modified organisms, thus making one more vulnerable to misinformation (Landrum, 2019). During the COVID-19 pandemic, individuals with a conspiracy mindset were more prone to believing misinformation about vaccine safety, leading to increased vaccine hesitancy (Romer & Jamieson 2025). Moreover, studies have found that receptivity to pseudo-profound bullshit is associated with an intuitive cognitive style and a lack of reflective thinking; individuals who engage in reflective, analytic thinking are less likely to find such statements profound (Littrell et al., 2023). Likewise, individuals who are receptive to pseudo-profound bullshit often accept information that seems superficially plausible but lacks depth or real evidence, hence making them less resistant to misinformation (Littrell et al., 2023).

The foregoing discussion reiterated and summarized the overarching thinking that led to the hypotheses and design of the current study. The discussion that follows will interpret the results and deliberate on the findings. The path models demonstrated support for the main hypothesis tested, that cognitive reflection predicts vulnerability to misinformation (as measured by the proxy Verifying Online Information scale) such that higher score on CRT implies less vulnerability to misinformation. The current study, therefore, adds evidence to the emerging literature that links cognitive styles to effects of misinformation. The higher one scores in the CRT, the less vulnerable one is to misinformation through higher verification of online information. Since the current state of misinformation research has yet to come up with a reliable psychometric scale to assess how likely an individual is to fall for misinformation, the mapping of the Cognitive Reflection Test to the measure of vulnerability to misinformation can be useful to that end.

The path models didn't support the two meditational hypotheses. While the data trended in the predicted direction, the association between CRT and VOI via conspiracy mentality (CM) was not statistically significant. In other words, the current study didn't support the hypothesis that conspiracy mediates the relationship between CRT and VOI. Despite ample evidence in the extant literature for the link between cognitive reflection and conspiracy mentality, it is curious that the current study did not find evidence to support that. While speculating the possible explanation for how the results turned out, some choices made, and steps taken during the design and implementation of the study may be worth noting. For example, the CMQ-5 scale was adapted from its original 0% through 100% response scale to 1 through 5 response scale. A sample size of 194 was probably not big enough. The study had been pre-registered on Open Science Framework, committing to 200 participants due to funding restrictions. At that sample size, the path model was likely underpowered. The negative relationship between the self-report rational decision style scale and conspiracy mentality was stronger than the CRT model, but the relationship still did not reach statistical significance.

On the other hand, the association between CRT and VOI via bullshit receptivity (BR) was statistically significant but the direction was the opposite of what was hypothesized. The current results imply that higher BRS scores are associated with higher verification of online information - hence less vulnerable to misinformation. This runs counter to the trend in literature, where the individuals more receptive to bullshit are found to be more vulnerable to misinformation. One potential explanation might come from the items used in the BRS-10 scale. Pennycook et al. derived these items from a website of a popular spiritual guru Deepak Chopra, whose quotes the authors judged to be pseudo-profound. The statements such as "Good health imparts reality to subtle creativity" and "Today, science tells us that the essence of nature is joy"

may not necessarily be “bullshit”. It could be argued that these statements are not as “bullshit” as the authors of the BRS-10 make them to be. What is nonsensical to some can be meaningful to others. A future replication of this study should, therefore, consider replacing the BRS-10 items with a new set of pseudo-profound statements.

Additional limiting aspects of the study and future directions are noted as follows. In order to reflect the construct Vulnerability to Misinformation (VTM), which was the primary dependent variable in the study, we used the construct termed Verifying Online Information (VOI), assuming that a higher score in VOI indicated lower levels of VTM. Since conducting psychometric tests to establish such correspondence of these two constructs was beyond the scope of the current study, we cannot be certain about how well the two constructs correspond to each other. For the future replication of this study, a psychometrically validated measure that directly captures the VTM construct should be sought. For this study, we collected data only from U.S.-based participants. Thus, the findings of this study are generalizable only within the U.S. population. The replications of this study should aim to expand the target population. Moreover, for each of the construct scales used (VOI, CMQ, BRS), we utilized the abridged versions of the scales developed by the source studies. While those were of satisfactory psychometric properties (e.g., alphas), the fuller versions of those scales would likely capture the constructs more comprehensively.

In the current study, we excluded various potential correlates from the model, especially the demographic factors such as age and education, which the broader literature links with belief in misinformation. The future replications could consider including such factors in the model. It is also important to note that the current data were cross-sectional and correlational in nature, so no causality can be inferred from the present path modeling results.

Finally, it is worth appreciating that the study undertook a challenging task of exploring the interrelationships among broad, multi-faceted, and high-level constructs such as vulnerability to misinformation, conspiracy mentality, and bullshit receptivity. The relationships explored in this study are of high relevance to the current socio-political discourse and lend insights to various fields of research, such as cognitive psychology, social psychology, personality psychology, psychometrics, and other social science fields such as sociology, political science, and linguistics. Instead of claiming the definiteness of the findings, we close this paper by appreciating the questions that the study leads us to grapple with: How does misinformation originate, spread, and affect? Why are some people more vulnerable to misinformation than others? How does conspiracy mindset relate to belief in misinformation? What is bullshit receptivity, really? How is it different from and similar to conspiracy mindset? And most importantly, how do we accurately measure these constructs?

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