Cognitive Elaboration and the Formation of False Memories from Fake News

Zenon H. Sommers

University of Michigan-Dearborn

Abstract

The spread and influence of fake news have risen significantly in recent years, as evidenced by the recent insurrection at the US Capitol driven by such disinformation. The relevance of characteristics drawn from the elaboration likelihood model to the influence of fake news was tested in the present study. One such global characteristic is reflexive open-mindedness, which is the tendency to accept new information as valuable without evaluating it critically. Another is need for cognition, which describes the tendency to prefer analytical thinking. A third characteristic is the relevance of the message to the person reading it. The prediction was that high reflexive open-mindedness, high need for cognition, and low personal relevance would predict false memory formation when reading fake news articles. A sample of participants (N = 478) recruited from MTurk in the week preceding the 2020 US presidential election viewed summaries of real and fake news articles and reported whether they remembered the events described in the summaries. Reflexive open-mindedness and need for cognition were measured using the Bullshit Receptivity Scale (Pennycook et al., 2015) and Need for Cognition Scale (Coelho et al., 2018). Personal relevance was assessed by asking participants to report how consequential they thought the election's outcome would be. Results both support and contradict hypotheses. Greater reflexive open-mindedness was correlated with the falsely remembering more fake stories ($r(476) = .12$, $p = .01$). Need for cognition was not associated with number of false memories ($r(476) = .06$, p = ns). Predicting a greater impact of the election, used as a measure of personal relevance, was associated with fewer false memories ($r(476) = -.12$, $p < .01$). A five-stage hierarchical binary logistic regression found that both personal relevance and political extremity contributed significantly to the final model, whereas collinearity reduced reflexive open-mindedness to marginally significant. Need for cognition was not significant at any stage of the model. The reliability of all reported scales and subscales was high (all alphas ≥ .94). These results suggest that low personal relevance and high political extremity predict false memory formation upon reading fake news. The marginal effect of high

reflexive open-mindedness may also indicate an influence of that factor. The effects elicited by this study could have significant implications for the design and targeting of interventions against fake news. One presently evident implication is that such interventions should emphasize the importance of the subject matter of such news to the reader.

Keywords: cognitive elaboration, false memory, fake news, bullshit receptivity, need for cognition, election

Cognitive Elaboration and the Formation of False Memories from Fake News

Although media researchers have been studying fake news for several years (e.g., Balmas, 2014), interest in its impact has increased dramatically since the U.S. presidential election in 2016. Many commentators believe that fake news stories favoring Donald Trump were so influential that he would not have been elected without their aid (Allcott & Gentzkow, 2017). Content not based in fact may have influenced the outcome of that presidential election. Fake news, especially that relating to political figures, affects English-speaking countries' political climate more significantly than elsewhere (Humprecht, 2019). The 2020 U.S. presidential election was a unique opportunity to investigate the fake news phenomenon to inform interventions against it. The violent insurrection at the U.S. Capitol in January 2021 was a uniquely vivid reminder of how impactful disinformation can be. The present study aimed to expand the body of knowledge about fake news by examining the factors associated with the formation of false memories from fake news articles. Further understanding of false memory formation in this context may support the development of news literacy interventions.

Fake News

Early research on fake news focused on how negative, clearly satirical entertainment media could influence political attitudes (e.g., Balmas, 2014). Since the 2016 election, in which fake news played a different role than had been previously examined, a new definition was developed of fake news as “fabricated information that mimics news media content in form but not in organizational process or intent” (Lazer et al., 2018, p. 1094). Its purpose is to misinform its readers and influence their perceptions and decisions.

Research on fake news conducted during the last three years has provided reasonable explanations for how people evaluate fake news. Tandoc et al. (2018) conducted a thorough literature review of fake news research and constructed the first theoretical framework for how people authenticate fake news. They found that individuals first evaluate the validity of an article’s content and its source's reputation. They then refer to outside sources such as friends or

other news sources if they are unsure. Since then, research has built on that framework by identifying other factors that may influence the strength of a person's belief in fake news. Pennycook et al. (2018) found that repeated exposure to fake news articles increases participants' belief in those articles over time. Colliander (2019) found that viewing comments that praise or condemn a fake news article will affect a viewer's attitude toward that article and its source. A complementary finding shows that when a real news article is initially portrayed as false, that impression persists even through repeated exposure without such warnings of falsehood (Freeze et al., 2020). This exposure has a more significant effect when a person reads an article rather than only viewing the headline (Simko et al., 2019). These findings are foundational for establishing the effects of individual factors on belief in fake news, but they do not support any single explanation for that belief.

The body of recent research on fake news relies on a considerable range of theories and perspectives. One popular explanation of fake news's success was motivated reasoning, which is bias in selecting which cognitive processes are used to evaluate information to arrive at a conclusion that is consistent with one's preexisting beliefs (Kunda, 1990). Anthony and Moulding (2018) found that participants were more likely to believe news whose content supported their political leanings; this study is one of many similar studies used to support the motivated reasoning narrative. Faragó et al. (2019) found that intense partisanship predicted belief in fake news. However, later research by Pennycook and Rand (2019a) found no significant motivated reasoning effect when controlling for the degree to which each participant thought analytically. This finding was a sound rejection of the motivated reasoning hypothesis and introduced a new paradigm. While the motivated reasoning hypothesis viewed the mechanism behind belief in fake news as a phenomenon localized to fake news, this new paradigm suggests that more global patterns of cognition may be responsible.

Reflexive Open-Mindedness

One such pattern of cognition is reflexive open-mindedness. Pennycook et al. (2015) introduced *reflexive* open-mindedness as an absence of critical thinking when presented with new or ambiguous ideas. It exists in contrast to *reflective* open-mindedness, which is the tendency to question and reflect on one's initial judgment of new information before accepting it (Baron et al., 2015). Researchers measure reflexive open-mindedness by showing participants randomly generated, syntactically correct sentences and asking them to rate their profoundness. Attributing a high degree of profoundness demonstrated a tendency toward reflexive open-mindedness (Pennycook et al., 2015). A connection between this construct and fake news was established by Pennycook and Rand (2019b) when they found that reflexively open-minded individuals are more likely to believe fake news articles.

Cognitive Elaboration

Extensive research on the factors by which communication successfully persuades individuals to alter their behavior has been conducted within the elaboration likelihood model (Petty & Cacioppo, 1986), which shows that a target is less likely to be persuaded by a message when that target elaborates on that message. The more one relates a message to previous knowledge and experiences, the less likely it is to persuade successfully. Like reflective open-mindedness, need for cognition is a personality trait that describes the tendency to prefer tasks that require analytical thinking (Cohen et al., 1955). Individuals with high need for cognition have an increased tendency to think elaboratively about messages presented to them (Cacioppo et al., 1983). This elaborative thinking increases the influence of the strength of a message's argument on whether the individual will be persuaded by the message. The same study found that individuals are more likely to elaborate on messages that are highly relevant to them; that is, a personally relevant message that makes a weak argument will be less persuasive than such a message that is irrelevant to the person who receives it. As reflective open-mindedness

decreases persuasiveness, it may also be posited that reflexive open-mindedness increases persuasiveness of weakly argued or fake messages.

Fake news is essentially a persuasive message with the goal of leading its reader to believe the content presented. Research on persuasion and cognitive elaboration may be extended to information sources such as fake news. That need for cognition leads individuals to think elaboratively may suggest a connection with fake news; perhaps individuals with a high need for cognition would be less likely to believe in fake news. When presented with a plausible, fictitious story, participants with a high need for cognition are likely to believe the information presented, even when they know the source is fictitious (Strange, 2002). Recent research has found a contrary effect: that participants are less likely to believe fake news when given time to think elaboratively (Bago et al., 2020). This inconsistency may be because this study was conducted with fake news headlines that were relatively implausible (e.g., "BLM Thug Protests President Trump with Selfie…Accidentally Shoots Himself In The Face;" Bago et al., 2020) when compared with the real news headlines used in the study (e.g., "Trump Lashes Out at Vanity Fair, One Day After It Lambastes His Restaurant;" Bago et al., 2020). Whether a high need for cognition affects belief in plausible fake news stories remains an open question. Just as need for cognition has been demonstrated to increase the persuasiveness of strongly argued messages, it may also increase the probability of belief in a fake news story that seems plausible to the reader. Additionally, research on which cognitive characteristics may be involved with this relationship is limited. Need for cognition and personal relevance are two factors that may help explain the observed relationship between cognitive elaboration and the influence of fake news.

False Memories

Recently, understanding of the connections between global cognitive characteristics and belief in fake news has been expanded to include the involvement of false memories. Numerous factors influence the formation of false memories when an individual is later exposed to misinformation (Loftus, 2005). Need for cognition is one of these factors; individuals with a

high need for cognition are more likely to think elaboratively when processing misinformation, leading to an increased likelihood of forming false memories (Graham, 2007). These factors are essential to consider when investigating fake news, as the formation of false memories may be one mechanism by which fake news influences its readers' thoughts and attitudes.

False memories have recently been investigated in connection with fake news. Murphy et al. (2019) found that many participants who viewed summaries of fake news articles formed false memories that confirmed those articles' veracity. They failed to support the hypothesis that this was a result of low cognitive ability. However, they did find a significant interaction between cognitive ability and ideological congruence between the article and its reader. Individuals with low cognitive ability were more likely to be biased in favor of their political position when forming false memories.

The Present Study

The present study sought to expand the research support for a global cognitive explanation of belief in fake news by investigating if reflexive open-mindedness predicts the formation of false memories of fake news articles. Reflexive open-mindedness is strongly associated with cognitive ability (Pennycook et al., 2015). However, it measures a more specific facet of an individual's cognitive style, so directly measuring it may explain the formation of false memories more strongly than overall cognitive ability did in the study by Murphy et al. (2019). Although it has also been observed that analytical thinking reduces belief in implausible fake news headlines (Pennycook & Rand, 2019a), a high need for cognition has been associated with the formation of false memories (Graham 2007). The prediction was that individuals with high reflexive open-mindedness and need for cognition would be more likely to form false memories about fake news than individuals with low reflexive open-mindedness or need for cognition. Given that personal relevance also promotes cognitive elaboration, it was predicted that individuals who are interested in the election would be less likely to believe the fake news stories and, as such, be less likely to form false memories.

Method

Materials

News Stories

In the week preceding data collection, eight real news stories were selected and summarized for use in the study. Additionally, four fake news articles were written, two about each candidate. The four fake news stories were written in two pairs. Each pair's stories are identical except for the name of the candidate in question. This process mirrors the method used to create fake news stories in previous research (Murphy et al., 2019). All stories are included in Appendix A. Items from Murphy et al. (2019), found in Appendix B, were used to ask participants if they believed and remembered the event described in the story, where they heard about the event, and what they remembered about the event.

Political Measures

Another series of measures was used to investigate participants' political characteristics. Political orientation and expectations about the election were measured using questions from the ANES 2016 Time Series Study (American National Election Studies et al., 2017). These items may be viewed in Appendix C. One item asked participants to rate their political orientation on a 9-point scale (1 = *extremely liberal*, 9 = *extremely conservative*). The other item asked participants who identified as moderate or did not provide a political orientation to choose whether they would identify as a liberal or a conservative if they had to choose. The researcher wrote two items pertaining to support for presidential candidates. One item asked the participants to indicate which candidate they planned to vote for. Another asked which candidate they voted for in the 2016 election. An item adapted from Murphy et al. (2019) asked each participant to rate on a 5-point scale what impact they thought the outcome of the election would have on the country if Trump were reelected (1 = *very bad for the country*, 5 = *very good for the country*).

Bullshit Receptivity Scale

Reflexive open-mindedness was measured using the Bullshit Receptivity scale (BSR; Pennycook et al., 2015). The 20 items used in this study are found in Appendix D. These items were randomly generated using computer software. Reliability in that research was very high (α = .93). Participants rated each item on a scale ranging from 1 = *not at all profound* to 5 = *very profound*. High scores indicate high reflexive open-mindedness. Example statements from the scale included "The infinite is calling to us via superpositions of possibilities" and "Mechanics of Manifestation: Intention, detachment, centered in being allowing juxtaposition of possibilities to unfold." Reliability in the present research was high, α = .97.

Need for Cognition Scale

A short form of the Need for Cognition Scale (NCS-6; Coelho et al., 2018) was used to measure need for cognition. This short form has six items, which can be found in Appendix E. The reliability of this scale in two past samples was high (α = .90, α = .86; Coelho et al., 2018). Participants rated each item on a scale ranging from 1 = *extremely uncharacteristic of me* to 5 = extremely characteristic of me. For four items, high scores indicated high need for cognition. One of these was, "I would prefer complex to simple problems." The other two items were reverse coded, such as "Thinking is not my idea of fun." Reliability in this study was high, α = .94.

Participants and Procedure

A power analysis was conducted through G*Power to determine a target sample size. Assuming a small effect size of d = .25, which is equivalent to an odds ratio of 1.57, an alpha of .05, and a target power of .80, the calculated target sample size was 404. A target sample of 480 participants was selected to allow for equal distribution across age groups. Additionally, the larger sample size would allow tolerance for some participants whose responses require their exclusion from some analyses. Participants were recruited through Amazon Mechanical Turk (MTurk). The aim of the study was described as documenting the effects of media on the 2020

election. Participants followed a link from MTurk to a survey hosted on Qualtrics and completed a screening questionnaire to ensure that they were native English speakers and were eligible to vote in the 2020 U.S. presidential election. Further, three separate samples were recruited within MTurk to ensure a somewhat even distribution between three age ranges: 18–29 (n = 166, 34.7%), 30–50 (n = 148, 30.9%), and 51 & older (n = 164, 34.3%).

Data were collected during the two weeks preceding the U.S. presidential election on November 3, 2020. Several attention checks were used to ensure that participants paid attention to the survey and gave honest responses. One of these was a time check; if a participant spent less than one-third of the average time observed in a pilot study on the survey, their data were excluded from the sample. The other attention checks were questions within the survey asking participants to choose a given option or recall which candidate was mentioned in a story. Of the 528 participants who began the survey, 504 finished. After removing 26 more participants who failed several attention checks, the final sample had 478 participants.

After completing the eligibility questionnaire and consent form, participants proceeded to provide demographic information. Participants' ages ranged from 18 to 77, M = 40.9, SD = 14.4. The sample was 47.1% female (n = 225) and composed primarily of White participants (n = 381, 79.7%), with other participants identifying as Black (n = 34, 7.1%), Asian (n = 22, 4.6%), Hispanic (n = 18, 3.8%), multiracial or multiethnic (n = 20, 4.2%), or belonging to other races (n = 3, 0.6%). Participant education varied greatly, with a plurality holding a four-year degree (n = 226, 47.3%), some having completed some college (n = 125, 26.2%), some holding a graduate degree (n = 70, 14.6%), and many having only a high school education (n = 57, 11.9%).

Participants then completed the political items. When asked to report whom they voted for in the 2016 election, most participants voted for Hillary Clinton (n = 224, 46.9%) or Donald Trump (n = 158, 33.1%). Some voted for another candidate (n = 26, 5.4%), chose not to vote (n = 58, 12.1%), or could not vote (n = 12, 2.5%). In the 2020 election, fewer participants planned to vote for a third-party candidate (n = 7, 1.5%) or refrain from voting (n = 11, 2.3%). Instead, most

planned to vote for Joe Biden (n = 280, 58.6%) or Donald Trump (n = 176, 36.8%). Each participant then completed the BSR and NCS-6. The remainder of the procedure was then the experimental portion of the study.

Two different fake news stories were created for this study. One of these concerned a fictitious scandal over manipulating footage from the first presidential debate in creating a video for sharing on social media. The other concerned a nonexistent leak from the candidate's personal physician that stated he was incompetent to serve in the White House. For each story, a Biden version and a Trump version were created to produce a final group of four fake news stories. Additionally, eight real news articles were summarized and matched in pairs. Each pair was comprised of a similar story for each of the two candidates. Each article was composed of an image followed by a short paragraph summarizing the story. The stories reflected negatively on the candidates they mentioned. All these stories may be viewed in Appendix A. Participants answered items asking if they remember the event, where they heard about it, and how they felt about it, using the same items as Murphy et al. (2019).

After reading and rating all the news stories, participants were told that some stories might have been false. They could then identify any stories that they thought were false. Finally, a debriefing page was displayed to indicate where deception was used in the study and why it was necessary. The median time to complete the survey was 15 minutes. They received a $2 USD payment upon completion of the survey.

Design

The study was conducted using a within-subjects design. In following the method established by Murphy et al. (2019), each participant viewed four real news stories and two fake news stories. All stories were picked from different pairs, such that no participant ever viewed two stories from the same pair or two versions of the same story. Each participant viewed two real stories and one fake story about each candidate. Those stories were presented in random order to control for order effects. The first independent variable was the level of truth of each

news story that participants viewed (real or fake). The second independent variable was whether the viewed story aligned with the participant's ideology, such that each story reflected negatively on either the candidate the participant supported or the candidate they did not support. Participants were forced to choose between Trump or Biden if they indicated that they would prefer another candidate or planned not to vote.

The dependent variable was the reporting of memories after reading a news article; these memories were real or false. Each participant received both levels of each independent variable across the six news stories they read: Each received two real stories and one fake story about the candidate they supported, and each also received two real stories and one fake story about the candidate that they did not support. In addition to the experimental portion of this study, additional variables were assessed to predict the likelihood of forming false memories in the analyses. These included reflexive open-mindedness, need for cognition, and the political items.

Results

BSR and NCS item responses were averaged within each scale to form a scale score for each participant, ranging between 1 and 5. The average BSR scale score was 2.65 (SD = 0.98), with scores ranging from 1 to 5. The average NCS scale was 3.50 (SD = 1.07), with scale scores ranging from 1 to 5. There was no significant association between BSR and NCS scores, $r(476)$ = .04, p = .383.

To assess the predicted impact of the election (and by proxy the importance of the election to the participant), the question about the predicted impact of Trump's reelection was recoded to indicate how far from the center a participant responded (1 = *neither good nor bad for the country*, 2 = *somewhat good or bad for the country*, 3 = *very good or bad for the country*). Participants tended to believe the election would have a strong impact, M = 2.54, SD = 0.64. Predicted impact of the election was significantly associated with BSR scores, $r(476)$ = -.14, p = .002. Participants whose responses indicated more reflexive open-mindedness tended to

predict a less extreme outcome of the election. Predicted impact was not associated with NCS scores, $r(476) = .05$, $p = .248$.

Responses to the item asking whether participants remembered fake stories were used to classify participants into three categories: those who neither believed nor remembered any fake stories ($n = 306$), those who believed at least one fake story but remembered none ($n = 65$), and those who falsely remembered at least one fake story ($n = 107$). Those in the second group are excluded from analyses comparing individuals who formed false memories to those who did not.

The relationships between false memory formation and BSR scores, NCS scores, and predicted impact of the election were assessed using a series of *t*-tests reported in Table 1 along with means and standard deviations for each group. BSR scores were significantly higher among those who formed a false memory than among those who did not. Additionally, participants who formed a false memory tended to think the election would be less consequential than those who did not. However, there was no significant difference in NCS scores between those who did and did not form a false memory.

As seen in Table 2, correlational analysis of false memory formation and potentially related variables revealed several significant relationships. Along with the previously discussed associations with BSR and NCS, false memory formation was also associated with supporting Trump. Several significant associations were found between demographic variables and a variety of other variables. Older participants tended to have lower BSR scores, more extreme political views, and a higher predicted impact of the election. They also tended to support Trump over Biden. Male participants tended to have less extreme political views and a lower predicted impact of the election.

A five-stage hierarchical binary logistic regression was conducted to examine the relationship between the various predictor variables and false memory formation. False memory formation was the dependent variable (0 = *neither believed nor formed a false memory about any story*, 1 = *formed a false memory*). The predictors examined were age, gender, race, NCS,

BSR, political extremity, predicted impact of the election, and supported candidate. There were significant correlations between some of these variables, so variance inflation factors (VIF) were calculated to test for multicollinearity. Traditionally, VIF below 10 are considered acceptable (Marquardt, 1970), but some conservative standards place that cutoff as low as 2.5 (Johnston et al., 2018). In the present study, all VIF < 1.19, indicating that there were no significant sources of multicollinearity in this regression.

Age, gender, and race were entered at the first step to control for possible effects of these demographic variables. NCS was entered at the second step, BSR at the third step, and political extremity at the fourth step. The variables were entered in this order because it seemed plausible that need for cognition develops earlier in the lifespan than reflexive open-mindedness. Political extremity is a characteristic that varies over time, so it was entered after the personality variables. Finally, forward conditional variable selection was used to enter predicted impact of the election and supported candidate in the fifth step to determine which of the two variables would contribute substantially to the model. These variables were entered last because they represent the participant's view of the present situation and do not directly reflect any stable characteristics.

The results of the regression may be found in Table 3. Chi-square comparisons of the model coefficients may be found in Table 4. The first and second steps showed no significant predictors and no significant improvement over the chance model referred to as Step 0. BSR scores entered as a significant predictor in the third step, and the change in fit from the second step to the third step was significant. However, the third step still showed no significant difference in goodness of fit from the chance model. The fourth step showed no new significant predictors and no improvement from either the third step or Step 0, although the effect of BSR scores on the model increased.

Only predicted impact of the election entered the model in the fifth step. Supported candidate, although it was correlated with false memory formation, did not contribute

significantly to the model, suggesting that its effect overlaps with other variables that contributed significantly to the model. On this final step, both political extremity, which was entered in the fourth step, and predicted impact of the election emerged as significant predictors, with BSR reduced to marginal significance as a predictor. This final model showed significant improvement over both the previous step and Step 0.

Discussion

The present study investigated possible correlates of false memory formation upon reading fake news. The logistic regression showed that political extremity and personal relevance, as measured through predicted impact of the election, were significant predictors of false memory formation. The fifth step, which added personal relevance, reduced the significance of reflexive open-mindedness from full to marginal, suggesting that it is important to consider the relationship between reflexive open-mindedness and personal relevance as indicated by predicted impact of the election. As there was a small but statistically significant negative correlation between those two variables, it could be that the formation of false memories involves both variables. Perhaps high reflexive open-mindedness leads to considering more possible situations than the available information warrants when that information is somewhat ambiguous, resulting in the individual underestimating any given situation's impact. Need for cognition did not show significance in any part of the study.

Although correlational findings show that Trump supporters were more likely to form false memories, participants' supported candidate failed to contribute significantly to the final logistic regression. This reduction in significance suggests collinearity between one or more of the entered predictors and the participant's choice of candidate. The most likely source of this collinearity is personal relevance, which was significantly negatively related to supported candidate (see Table 2), such that Trump supporters tended to believe the election would have less impact. There are many potential explanations for this relationship. For example, Trump supporters may have thought the election would be less impactful because they underestimated

Trump's impact or viewed his actions as equivalent to Biden's. However, it may also be the case that some factor involved in determining predicted impact of the election, such as an individual's perception of the malleability of various sociopolitical circumstances, may determine which candidate they choose to vote for. Finally, it is of interest that political orientation was involved in no significant results, whereas supported candidate was, implying that fake news belief may have depended on some factor unique to Trump or Biden rather than overall political leaning.

It was hypothesized that individuals with high reflexive open-mindedness, high need for cognition, and low predicted impact of the election, indicating low personal relevance, would be more likely to form false memories. The results both supported and contradicted hypotheses. The hypothesis about personal relevance was supported by the results, whereas the reflexive open-mindedness hypothesis was only marginally supported. The need for cognition hypothesis was not supported. In addition to providing a direct replication of Murphy et al. (2019) by demonstrating that individuals form false memories when viewing fake news articles, this study supports the findings of Pennycook and Rand (2019a) by demonstrating that high reflexive open-mindedness is associated with a higher impact of fake news. Although past research suggests that need for cognition is involved in fake news belief (Bago et al., 2020; Strange, 2002), the present study found no significant associations with need for cognition. This lack of findings suggests that false memory formation from fake news, which is not associated with need for cognition, may not necessarily be related to belief in fake news, which could be associated with need for cognition. The plausibility of the stories presented may also have resulted in the lack of a significant effect, as individuals with high need for cognition are more persuaded by strongly argued messages than by weakly argued messages.

Responses to the open-ended questions about the fake news stories provided insight into the nature of the participants' false memories. The temporal distance participants placed between themselves and their memory of first hearing the story varied greatly. For the same

story, one participant reported remembering reading the story 20 minutes ago, whereas another remembered hearing it 30 years ago. Aside from these outliers, most participants reported first hearing the stories within a few months of the study.

As in Murphy et al. (2019), many participants formed vividly detailed memories of hearing about these fake news stories. After reading the fake story about Trump manipulating video from the first presidential debate, one 60-year-old male Biden supporter reported, "I remember a friend sharing an article about the event on social media. I remember that the article showed Biden's actual speech alongside the manipulated Trump one." After reading the fake story about Biden's doctor leaking to the press, one participant claimed that Biden released the report recommending that Biden cease his campaign, whereas another recalled Trump discussing the doctor's leak. Some participants reported that they heard about the stories from specific individuals such as mothers, brothers, and friends. Another pattern was observed of participants who reported remembering thinking that the article must be fake, such as one 64-year-old male Trump supporter who called an article "a scumbag Democrat scam." Even though the article was fake and never existed outside the study, a participant who recognized it as fake still formed a false memory about it. This sequence of events also suggests that fake news belief may not be essential to the formation of false memories from fake news.

Strengths, Limitations, and Future Research

Many factors strengthen the validity of the present study. The final sample size (N = 478) was large, granting robustness to complex analyses like the logistic regression. Typically, samples collected on MTurk are more representative of the general population than typical samples of undergraduate students, and results are as reliable as those from such traditional samples (Buhrmester et al., 2011). This sample was highly diverse in terms of age, education level, gender, race, and political ideology, bolstering the study's generalizability. Because the study was conducted so near the day of the presidential election, the information gathered about the participants' planned voting behavior was likely very accurate. Additionally, reliability

coefficients indicate that the constructs under consideration were internally consistent. The study design also has strong internal validity due to the random assignment of real and fake news stories. Matching pairs of stories ensured that each participant received similar stories to minimize potential stimuli effects. Finally, survey items were ordered randomly when possible to control for potential order effects.

The present study also has some limitations. First, the sample was limited to American participants in an American election. Although these findings add to that of past research in Ireland (Murphy et al., 2019), the body of fake news research, especially that addressing false memory formation, has to this point occurred almost exclusively in samples from rich, Western populations. Further research across cultural and temporal contexts may also determine whether the present results were due more to the recent political climate in the United States than to the hypothesized variables. Additionally, as this study was primarily quasi-experimental, future research may employ experimental interventions to attempt to establish causal relationships between some of these variables.

Other limitations rest in the measurements used in the study. The findings regarding political extremity should be taken with caution because it was measured using a single item recoded into a four-point scale and, thus, lacks the reliability that a longer validated political extremity scale could provide. Future research should investigate the complex interplay of political beliefs and personal relevance to obtain a more comprehensive view of the role of cognitive elaboration in fake news processing. In this study, personal relevance was assessed with a combination of items chosen for this study but not developed as part of a particular scale. Some of the observed outcomes may have been due to confounding factors associated with participants' predicted impact of the election, rather than due to the connection between predicted impact and personal relevance. Future research should employ a wider variety of items to measure personal relevance to avoid these possible confounding influences. These additional measures may also result in more normal distributions than that of the predicted

impact variable, which was limited in sensitivity and somewhat skewed toward high predicted impact. A final limitation to consider is that the very high scale reliabilities (α_{BSR} = .97, α_{NCS} = .94) may indicate an attenuation paradox, which would indicate a lack of sensitivity in the measurements due to excessive consistency between items. This effect would reduce the scales' validity. Scale modification or development could allow this issue to be addressed by future studies.

Potential Applications

These results may help inform interventions to combat the misinformation spread by fake news. These interventions are essential, as most individuals believe that only members of their political outgroups are susceptible to fake news (Jang & Kim, 2018). The continued prevalence of fake news can cause people to become desensitized to its harmful nature (Effron & Raj, 2020). In a world permeated by deepfakes and other forms of highly plausible disinformation, it is increasingly important to think intentionally and critically when approaching resources that claim to be factual, especially news media.

Past research indicates that the population of fake news readers is small, distrustful of mainstream news media, and also consumes real news (Guess et al., 2020; Nelson & Taneja, 2018), so common-sense interventions, such as attempting to increase real news readership, may fail. These interventions need to work preemptively rather than correctively, as it is difficult to change a person's opinion after exposure to either real or fake news sources (De keersmaecker & Roets, 2017). Research on the fake news mechanisms has included widely used interventions against fake news. Pennycook et al. (2019) found that Facebook's practice of displaying warnings next to potentially fake news articles increased the authority of articles without warnings, even if they were also fake. They also presented an alternative intervention, which they tested and showed to be more effective. This intervention added fact-checker endorsements to some stories, which indicated that the stories without warning or endorsement were not

necessarily accurate or fake. The body of applied research on fake news shows that the present research may be of benefit to society.

The specific application of the present study's findings may be in targeting interventions against fake news at the populations most susceptible to them. Knowing that reflexive open-mindedness, political extremity, and personal relevance impact the formation of false memories from fake news will help organizations target interventions to those who are known to be high or low on those dimensions. For example, political interest may be used to deliver interventions through groups and media that are frequented by people who are interested in politics. Trends in these variables within certain groups can be used to apply the present study's findings to the targeting of interventions against fake news to the populations in which they are most needed. Additionally, the implication of reflexive open-mindedness in the impact of fake news suggests that critical thinking may serve as an effective inoculant against fake news. Interventions that foster critical thinking as a reflex instead of open-mindedness may also combat disinformation's effect on the individuals who remember it.

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Table 1

Differences Between Individuals Who Formed False Memories and Those Who Did Not

Individual Characteristic	No memory[a]		False memory[b]		$t(411)$	p	Cohen's d
	M	*SD*	*M*	*SD*			
Reflexive open-mindedness	2.60	1.00	2.85	0.93	2.262	.024	0.25
Predicted impact of the election	2.60	0.61	2.40	0.68	2.819	.005	0.32
Need for cognition	3.45	1.10	3.61	1.07	1.246	.213	0.14

[a]n = 306. [b]n = 107.

Table 2

Correlational Analysis of False Memory Formation and Variables of Interest

Variable	1	2	3	4	5	6	7	8	9
1	—								
2	-.04	—							
3	.06	-.25***	—						
4	-.05	.25***	-.14**	—					
5	.06	.08	.03	-.02	—				
6	.10*	-.13**	-.01	-.06	.05	—			
7	.04	.17**	-.14**	.05	.10*	-.09	—		
8	-.14**	.17**	-.13**	.04	.05	-.14**	.37**	—	
9	.10*	.13**	-.01	.10*	-.11*	.07	-.09	-.23***	—

Note. 1. False memory formation. 2. Age. 3. Gender. 4. Race. 5. Need for cognition scale (NCS). 6. Bullshit receptivity scale (BSR). 7. Political extremity. 8. Predicted impact of the election. 9. Supported candidate. Dichotomous codes were used for race (1 = *non-White*, 2 = *White*), gender (1 = *female*, 2 = *male*), and supported candidate (1 = *Joe Biden*, 2 = *Donald Trump*). Because a listwise exclusion procedure was used, all correlations had the same sample size, $n = 412$.

*$p < .05$, **$p < .01$, ***$p < .001$

Table 3

Summary of Hierarchical Binary Logistic Regression Results for False Memory Formation

Variable	*B*	*SE*	*OR*	95% CI for *OR*		Wald[a]	*p*
				LL	*UL*		
Step 0							
Constant	-1.06	0.11	0.35			88.48	<.001
Step 1							
Constant	-.90	0.37	0.41	—	—	5.96	.015
Age	>-0.01	0.24	1.00	0.98	1.01	0.10	.748
Gender	-.21	0.28	0.81	0.51	1.29	0.78	.378
Race	.22	0.37	1.24	0.72	2.16	0.59	.442
Step 2							
Constant	-1.30	0.51	0.27	—	—	6.50	.011
Age	>-0.01	0.01	1.00	0.98	1.01	0.19	.665
Gender	-0.20	0.24	0.822	0.52	1.30	0.69	.407
Race	0.21	0.28	1.23	0.71	2.14	0.53	.466
Need for cognition scale	0.12	0.11	1.13	0.92	1.39	1.31	.252
Step 3							
Constant	-1.97	0.62	0.14	—	—	10.23	.001
Age	>-0.01	0.01	1.00	0.98	1.02	0.03	.855
Gender	-0.22	0.24	0.80	0.50	1.28	0.87	.350
Race	0.19	0.29	1.21	0.69	2.10	0.43	.511
Need for cognition scale	0.11	0.11	1.20	0.91	1.38	1.09	.297
Bullshit receptivity scale	0.24	0.12	1.27	1.00	1.60	3.97	.046*
Step 4							
Constant	-2.17	0.64	0.11	—	—	11.46	.001
Age	>-0.01	0.01	1.00	0.98	1.01	0.09	.761
Gender	-0.25	0.24	0.78	0.49	1.24	1.10	.295
Race	0.19	0.29	1.21	0.69	2.11	0.43	.511
Need for cognition scale	0.10	0.11	1.10	0.89	1.36	0.81	.369
Bullshit receptivity scale	0.25	0.19	1.29	1.01	1.61	4.30	.038*
Political extremity	0.12	0.11	1.13	0.92	1.39	1.26	.262

Variable	*B*	*SE*	*OR*	95% CI for *OR*		Wald[a]	*p*
				LL	*UL*		
Step 5							
Constant	-1.04	0.73	.36	—	—	2.00	.157
Age	>-0.01	0.01	1.00	0.98	1.02	0.01	.906
Gender	-0.19	0.24	.82	0.51	1.33	0.63	.428
Race	0.19	0.29	1.21	0.69	2.14	0.44	.507
Need for cognition scale	0.11	0.11	1.12	0.90	1.39	0.99	.319
Bullshit receptivity scale	0.21	0.12	1.23	0.97	1.56	2.94	.086
Political extremity	0.24	0.12	1.27	1.01	1.59	4.26	.039
Predicted impact of the election	-0.58	0.19	.56	0.38	0.81	9.23	.002

[a]For all reported Wald tests, $df = 1$.

Table 4

Chi-Square Tests of Model Coefficients for Logistic Regression

Model	Change from previous			Change from Step 0		
	χ^2	*df*	*p*	χ^2	*df*	*p*
Step 1	—	—	—	2.088	3	.554
Step 2	1.337	1	.248	3.426	4	.489
Step 3	4.037	1	.045*	7.463	5	.188
Step 4	1.261	1	.261	8.724	6	.190
Step 5	9.248	1	.002**	17.972	7	.012*

*$p < .05$, **$p < .01$

Appendix A

These four fake news stories were created for the purpose of this study. The goal was to create stories that were somewhat plausible and reflected negatively on the candidates. Each participant was randomly assigned to view either stories 1 and 4 or stories 2 and 3. Both photographs were taken by Gage Skidmore and are licensed to allow for reuse.

Fake Story 1 (Biden Ad Contained Misleading Video): Fact-checkers at a prominent national newspaper determined that a video ad released by the campaign of former Vice President Joe Biden used selectively edited video footage from the first presidential debate to misrepresent President Trump's words. Biden shared the video on social media, where no action was taken against it.

Fake Story 2 (Biden's Doctor Says "Drop Out"): A document leaked to a major news outlet by an anonymous source showed that the primary care doctor of former Vice President Joe Biden gave a professional recommendation that he discontinue his presidential

campaign for health reasons. The doctor cited the possibility that Biden's age and fragile medical condition would be a considerable risk in the White House.

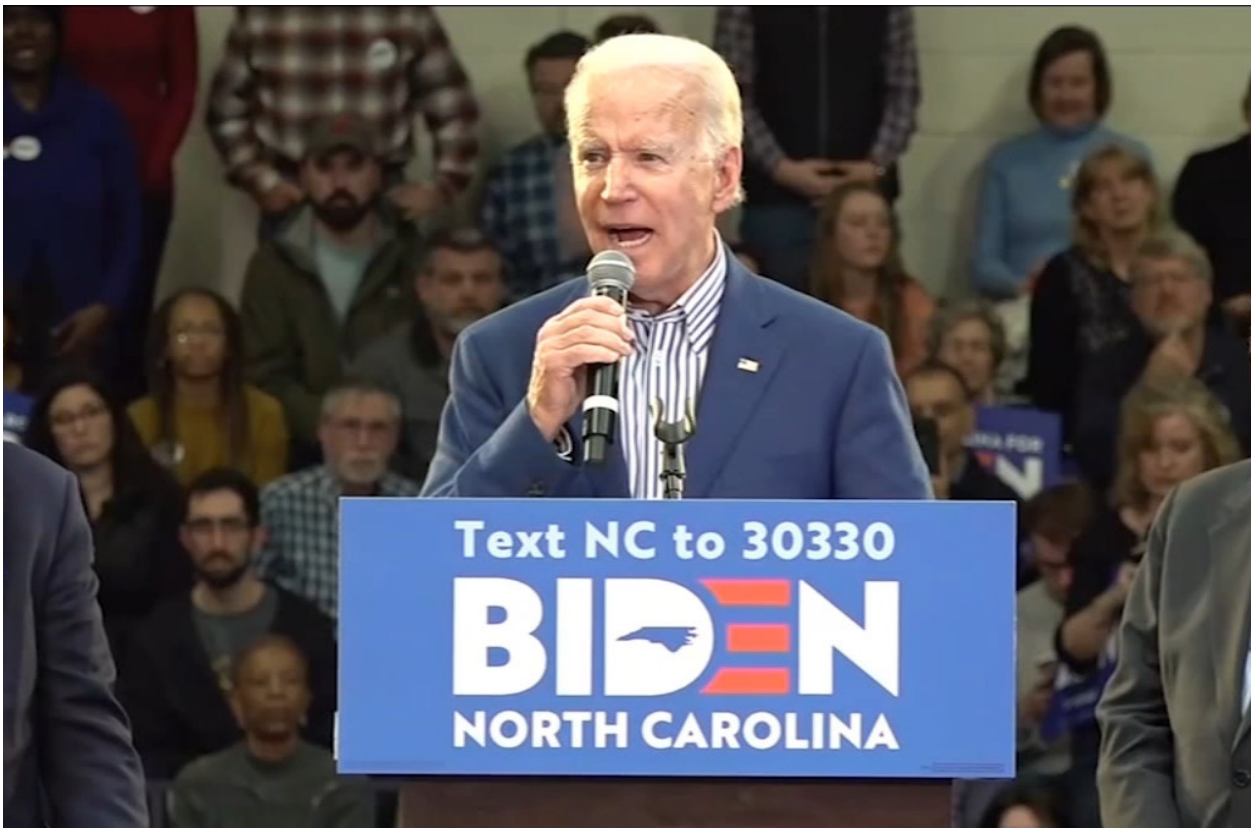
Fake Story 3 (Trump Ad Contained Misleading Video): Fact-checkers at a prominent national newspaper determined that a video ad released by the campaign of President Donald Trump used selectively edited video footage from the first presidential debate to misrepresent former Vice President Joe Biden's words. Trump shared the video on social media, where no action was taken against it.

Fake Story 4 (Trump's Doctor Says "Drop Out"): A document leaked to a major news outlet by an anonymous source showed that the primary care doctor of President Donald Trump gave a professional recommendation that he discontinue his presidential campaign for health reasons. The doctor cited the possibility that Trump's age and fragile medical condition would be a considerable risk in the White House.

Below are the eight summaries of real news stories that were used in the study. Each is presented with a photograph followed by the summary and a citation of the article of which the summary was written. The text of the original story was copied to the greatest extent possible to avoid misrepresenting the original content of the articles. Each participant was randomly assigned to view either the odd-numbered stories or the even-numbered stories.

Real Story 1 (Biden Says African Americans Not as Diverse as Latinos):

During a widely publicized interview, former Vice President Joe Biden said that the Latino community is "incredibly diverse," "unlike the African American community." He later praised the Latino community on having "full diversity, unlike the African American community" (Choi, 2020).



Real Story 2 (Biden Quotes Chairman Mao at Fundraiser): During a campaign fundraiser, former Vice President Joe Biden claimed to quote an old Chinese proverb that was actually a saying coined by Chinese communist dictator Mao Zedong. Biden quoted Mao in saying that "women hold up half the sky" as a call for economic relief for women (Wulfsohn, 2020).

Real Story 3 (Trump Thanks a Man For Chanting "White Power"): A video depicting a man driving a golf cart covered in Trump campaign posters, in which the man chanted "white power," was retweeted by President Donald Trump. He thanked the "great people" in the video for their support. He deleted the retweet shortly after to avoid further criticism (Stracqualursi & Westwood, 2020).

Real Story 4 (Trump Cancels Racial Sensitivity Trainings): A Trump administration official said that the President asked him to identify all government contracts for training sessions about white privilege or critical race theory. The president ordered that everything possible within the extent of the law be done to cancel these trainings (Dawsey & Stein, 2020).

Real Story 5 (Biden Dismisses Dementia Concerns): Former Vice President Joe Biden was asked whether he had taken a cognitive test for dementia during an interview on a major television network. He dismissed widespread concerns about his mental competency as ridiculous, saying, "No, I haven't taken a test? Why the hell would I take a test" (Barrow, 2020)?

Real Story 6 (Biden Claims "a Black Man" Invented the Lightbulb): During an event in which he focused on racial justice, former Vice President Joe Biden falsely claimed that a "Black guy invented the lightbulb, not a white guy named Edison." He made this claim to support a position that history classes in schools needed to be reformed to be more representative (O'Connell, 2020).

Real Story 7 (Trump Video Taken Down After Failed Fact Check): The social media accounts of President Donald Trump's reelection campaign posted a video in which Trump falsely claimed that children are "almost immune" to the coronavirus. The platforms removed the video for violating their policies about misinformation, and the one account was briefly suspended (Freiman, 2020).

Real Story 8 (Trump Did Not Disclose a Positive COVID Test): President Donald Trump appeared for an interview on a major television network without disclosing that he had tested positive for COVID-19 earlier that day. He waited a full day and night, knowing he was a transmission risk, before informing the public that he had contracted the virus (Bender & Ballhaus, 2020).

Appendix B

The following items will be presented alongside each news story that participants view. These items were taken or modified from Murphy et al. (2019). Options for response are listed after each item and separated by semicolons. Participants may select only one option for item 2 and any number of options for item 1.

1. Where did you hear about this event? (*Television*; *newspaper*; *radio*; *online news website*; *social media*; *from a friend/colleague/family member*; *I didn't hear about this*; *I don't remember where I heard about this*; *other source*)
2. Do you remember this event? (*I remember seeing/hearing this*; *I don't remember seeing/hearing this but I remember it happening*; *I don't have a specific memory of this, but I believe it happened*; *I remember this differently*; *I don't remember this*)
3. How long ago did you hear about this event? (text box response)
4. What do you remember about this event? (text box response)

Appendix C

Items 1 and 2 were taken from the ANES 2016 Time Series Study (American National Election Studies et al., 2017). Items 3 and 4 were written by the researcher. Item 5 was adapted from Murphy et al. (2019). Participants could choose one of the listed responses for each item. Items 1 through 4 measure political orientation, and item 5 measures the predicted consequence of the election.

1. We hear a lot of talk these days about liberals and conservatives. Here is a slider on which the political views that people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on this scale, or haven't you thought much about this? (1 = *extremely liberal*, 2 = *liberal*, 3 = *slightly liberal*, 4 = *moderate/middle of the road*, 5 = *slightly conservative*, 6 = *conservative*, 7 = *extremely conservative*, 8 = *I haven't thought much about this*)
2. If you had to choose, would you consider yourself a liberal or a conservative? (Display only if the answer to the previous question was 4 or 8)
3. If you voted in the 2016 U.S. presidential election, for whom did you vote? (*Hillary Clinton*; *Donald Trump*; *another candidate*; *I chose not to vote*; *I was not eligible to vote*)
4. If the 2020 U.S. presidential election were held today, for whom would you vote? (*Donald Trump*; *Joe Biden*; *another candidate*; *I would choose not to vote*)
5. If Donald Trump were to be reelected, would you consider this to be good or bad for the country? (1 = *very bad for the country*, 2 = *bad for the country*, 3 = *neither good nor bad for the country*, 4 = *good for the country*, 5 = *very good for the country*)

Appendix D

The items below were taken from the Bullshit Receptivity Scale (Pennycook et al., 2015). Each item is rated on a 5-point scale ranging from "not at all profound" to "very profound."

1. We are in the midst of a self-aware blossoming of being that will align us with the nexus itself.
2. Consciousness consists of frequencies of quantum energy. "Quantum" means an unveiling of the unrestricted.
3. Consciousness is the growth of coherence, and of us.
4. We are in the midst of a high-frequency blossoming of interconnectedness that will give us access to the quantum soup itself.
5. Today, science tells us that the essence of nature is joy.
6. As you self-actualize, you will enter into infinite empathy that transcends understanding.
7. The infinite is calling to us via superpositions of possibilities.
8. We are being called to explore the totality itself as an interface between serenity and intuition.
9. Throughout history, humans have been interacting with the dreamscape via bio-electricity.
10. The future will be an astral unveiling of inseparability.
11. Attention and intention are the mechanics of manifestation.
12. Our minds extend across space and time as waves in the ocean of the one mind.
13. Nature is a self-regulating ecosystem of awareness.
14. We are non-local beings that localize as a dot then inflate to become non-local again. The universe is mirrored in us.
15. Mechanics of Manifestation: Intention, detachment, centered in being allowing juxtaposition of possibilities to unfold.

16. Mind and matter are subtle and dense vibrations of consciousness (spirit).
17. We are not an emergent property of a mechanical universe but the seasonal activity of a living cosmos.
18. Every material particle is a relationship of probability waves in a field of infinite possibilities. You are that.
19. As beings of light we are local and non-local, time bound and timeless actuality and possibility.
20. Matter is the experience in consciousness of a deeper non-material reality.

Appendix E

The below items were taken from the NCS-6 (Coelho et al., 2018). Each item is rated on a 5-point scale ranging from (1 = *extremely uncharacteristic of me*; 5 = *extremely characteristic of me*). Items 3 and 4 were reverse coded.

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun.
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
5. I really enjoy a task that involves coming up with new solutions to problems.
6. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.