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Priming Caution Does Not Decrease Receptivity to Fake News

Fake news is fabricated news content that is presented as factual for the purpose of ideological and financial gain. Much of the existing research seeks to find ways to reduce people's susceptibility to fake news. The first aim of this study was to replicate findings that suggest higher scores on the Cognitive Reflection Test (CRT) are linked with lower receptivity to fake news. The second aim was to test whether this relationship would be affected by priming cautions, either General or Specific, about the possibility that the information in question may be fake. It was predicted that exposure to a General caution would reduce the receptivity to fake reports, and that a Specific caution would lead to a further decrease in susceptibility. A total of 55 males and 56 females first completed the CRT, then evaluated a series of three true and three fake news articles through a set of four questions via an online survey. The results showed that indeed higher CRT scores were correlated with lower receptivity to fake news; however, using priming cautions did not have an effect on reducing susceptibility to fake news. It was concluded that analytical ability is the most important predictor for being able to recognize false media content. Implementing workshops or developing apps to improve critical thinking skills might help to improve the analytical abilities of individuals, thus making them less vulnerable to fake news.

Keywords: Cognitive Reflection Test, cognitive style, fake news, priming, social media

INTRODUCTION

Digital social networks have facilitated the way people process and share information (Hara & Sanfilippo, 2016). A recent Pew survey indicated that 62% of Americans obtain their news from social media websites (Pew Research Center, 2016a). However, relying on online news sources for updates about current events has become problematic because of the increase and spread of misleading information (Tambuscio et al., 2015). While the circulation of inaccurate information on social media is not a new phenomenon, this problem has attracted more attention

from both the public and academic community as a result of the 2016 US Presidential election during which fake news circulated widely on social media to the apparent advantage of one candidate over another (Tambuscio et al., 2015).

Fake news has been defined as fabricated information resembling news content in presentation and format, circulated on social media (Lazer et al., 2017). The two main motives behind the propagation of fake news are ideological influence and financial gain (Tandoc et al., 2017). As the 2016 United States presidential election approached, the stakes rose significantly. One study reported that in the months preceding the election, fake news articles on Facebook were more popular than mainstream media reports (Silverman et al., 2016). It has been speculated that the spread of online disinformation may have played a role in the outcome of the election (Parkinson, 2016). The ease with which information proliferates on social media allows fake news and other forms of misinformation to spread quickly because this type of news is rarely verified by consumers, making it challenging to correct (Lazer et al., 2017). Consequently, fake news reports create confusion about basic facts and events (Pew Research Center, 2016b), thus posing a threat to democratic institutions and norms (Knight Foundation, 2018).

The reception of global health news, climate change reports, and other pressing issues are also influenced by the circulation of fake news. Its potential influence on health literacy and the spread of medical conspiracy theories is of special concern. Indeed, the findings from one study indicated that large numbers of Americans believe false claims about the relationship between autism and vaccination, as well as the supposed negative effects of genetically modified products (Jolley & Douglas, 2014). Social media networks provide a media environment where it is difficult to assess the credibility of information. This is especially of concern regarding university students because they are such frequent online users. Research involving 6,000 university students found that 89% relied heavily on social media for news updates (Head et al., 2018). Moreover, the results of another study found that more than 60% of students had shared inaccurate information online, indicating that young adults may contribute to the spread of fake news (Chen et al., 2015).

Analytic Thinking Dispositions

According to dual processing theory, cognition consists of two different thinking systems. System 1 is fast, automatic, and intuitive, while System 2 involves deliberate and analytic thinking. System 1 creates "first impressions" and is often the cause of our impulsive judgments. System 2 is responsible for a more controlled process of reasoning, such as problem-solving, analysis, and reflection. We spend most of our time engaging in System 1 thinking, which constantly produces suggestions for System 2 (Kahneman, 2011). In most instances, System 2 passively accepts the proposed ideas from System 1 without contributing any further analysis; however, when System 1 processing is insufficient to deal with the situation, System 2 is

activated to assist with more detailed processing that may help to resolve the problem (Kahneman, 2011).

One measure of the effects of these processes is the Cognitive Reflection Test (CRT) (Frederick, 2015). It consists of three mathematical problems that elicit fast, intuitive, but incorrect responses (Pennycook et al., 2016). To recognize that the intuitive response is wrong, the individual must engage in analytic thinking. Thus, low scores on this test indicate that intuitive responses dominate reasoning, while high scores indicate the opposite (Frederick, 2015).

Pennycook and Rand (2019a) examined the link between cognitive dispositions and susceptibility to fake news. Participants were asked to complete the CRT and then read five true and five false news headlines and answer questions about the veracity of each. Participants with higher scores on the CRT were better at distinguishing between true and false news (Pennycook & Rand, 2019a). This finding was replicated in a second similar study where participants were shown 15 news headlines containing true content and 15 news headlines that were false (Pennycook & Rand, 2019b). Individuals were asked to judge the perceived accuracy of the headlines and to complete the CRT. Results again indicated that participants with lower scores on the CRT were more likely to perceive fabricated news stories as real reports (Pennycook & Rand, 2019b).

Priming caution

It has become clear that exposing individuals to particular cues can subtly influence, or prime, their responses even outside their awareness (Molden, 2014). Priming research has demonstrated that information processing involves the development of the "activation tags" that are the basis for connection between concepts (Collins & Loftus, 1975). According to Tversky and Kahneman (1982), these activation tags are easy to access and impact the way subsequent information is processed. Priming involves employing accessible representations to encode and evaluate subsequent information (Chawarski, 1996). The process of priming has been investigated from a variety of angles; however, little research has been conducted to examine the effect of priming on the perception of fake news.

It has been noted that detecting inaccurate information is difficult (Flynn et al., 2017). One stream of research into fake news has investigated approaches that may help reduce one's susceptibility to fake news. In an attempt to lessen the degree to which an individual might be inclined to view fake news as accurate, Pennycook et al. (2019b) presented one group of participants with fake news headlines that were labelled "disputed." A second group was exposed to the same headlines but without warning labels. Findings from this study suggested that the presence of the "disputed" tag moderately reduced the susceptibility of participants to fake news.

The continued influence effect (CIE) refers to the perception of false information as true even after retraction (Seifert, 2014). One study by Ecker et al. (2010) focused

on techniques to reduce the CIE of misinformation. The investigators presented participants with either a general or a specific warning before asking them to read 14 sentences about a minibus accident. The general warning condition involved a message stating that the information presented had not been verified before its publication, while the specific warning condition provided a detailed explanation of the CIE along with examples of the phenomenon. It was concluded that general warnings may have less impact on reducing the perception of false sources compared to specific warnings; however, neither of the two warning types were found to be completely effective (Ecker et al, 2010). Similarly, Clayton et al. (2019) evaluated the effectiveness of attaching general ("disputed") and specific ("rated false") tags to news headlines, as well as providing participants with general and specific warning instructions on the perceived accuracy of fake news stories. The results of this study indicated that while both general and specific tags reduced susceptibility to false information, specific tags were overall more effective at reducing susceptibility to false information (Clayton et al., 2019); however, the influence of warning instructions in both cases on the susceptibility of participants to false headlines was small. Furthermore, general warnings appear to eliminate the perception of real news headlines to be declared as real.

The implications of these studies show that participants are more likely to evaluate whether a tag such as "disputed" was accurate, rather than encouraging critical thinking about the information provided in each item.

Current Study

The present research examines whether a caution, either General or Specific, would prime participants to be broadly critical of both true and false news items. This approach is more challenging for participants and is much more relevant to real-life situations where the goal is to deliver a caution to encourage critical thinking without first having to inform readers about which items might be in dispute.

Given that analytic thinking is linked with lower receptivity to fake news (Pennycook & Rand, 2019a), the first goal of this study was to replicate these findings to see if this effect generalizes to situations in which there is no specific tagging of each of the items (e.g., not explicitly stating tags such as "disputed" or "rated false"), offering instead only a General or Specific caution about some of the items. Based on previous results by Pennycook and Rand (2019a), it was predicted that the performance on the CRT would be positively associated with the ability to differentiate between true and false news stories. The second aim of the research was to examine the relative effectiveness of General and Specific cautions in reducing susceptibility to fake news. It was predicted that exposure to a General caution about misleading news reports would lead to a decrease in the acceptance of false items compared to the control condition of no caution provided, while the Specific caution would lead to a further decrease in the acceptance of false news items.

METHOD

Design

Raw data were gathered online using SurveyMonkey, an online survey development service. Participants were randomly assigned to either a control condition or one of two experimental conditions. Each participant first completed the CRT, then they were asked to rate the credibility of six randomly presented news articles where half of the articles were true, and the other half false. In the first experimental condition, participants were given a General caution about the accuracy of the presented information. In the second experimental condition, participants received a Specific caution indicating that some of the news items may not be true. After reading each article, participants then rated their confidence in whether what they read was essentially true using a 0-100 visual analog scale, where 0 represents not at all confident, and 100 represents absolutely confident, which provided a credibility score. The average credibility score of the three true and three false articles was then taken. The dependent variable was the Differential Credibility Index (DCI), defined as the difference between a participant's average credibility score on the three true items minus their average credibility score on the three false items. A higher, positive score indicated a better ability to differentiate between real and fake content. For the first aim of the study, the relationship between the cognitive style and the DCI was assessed by computing a Pearson product-moment correlation coefficient. For the second aim, a 1 x 3 (No Caution, General Caution, Specific Caution) between-subjects Analysis of Variance (ANOVA) was used to determine the effect of priming caution instructions on the receptivity to fake news.

Participants

A total of 111 undergraduate students from York University (55 males M = 22.0 y, SD = 2.9; 56 females M = 22.8 y, SD = 2.5) volunteered to participated in this study, with n = 37 students assigned to each of the three experimental conditions. The recruitment letter was posted on the Glendon Participant Pool (Glendon College, York University) and potential student participants contacted the primary investigator by email.

Materials

Recruitment letter

This form asked potential participants to take part in the research project and provided instructions as well as the contact information of the primary investigator.

Consent form

This document informed the participant that they were under no obligation to participate, could decline to answer any questions, and could withdraw at any time. It also indicated that collected research data would remain anonymous and

confidential, and that participation in the study would not involve any risk or direct benefit to the participants.

Demographic questionnaire
This form contained questions about participant background information including age, gender, degree program, and year of study.

Cognitive Reflection Test (CRT)
The purpose of this measure was to determine an individual's propensity to use intuitive rather than analytical thinking by asking participants to complete problems that evoke quick but ultimately erroneous responses. In order to arrive at correct answers, this hasty form of response would have to be abandoned in favour of more careful analysis. The current study employed a version of the CRT consisting of seven items (see Appendix A): three mathematical problems from the original CRT developed by Frederick (2005), and four non-numeric items from CRT-2 from Thomson and Oppenheimer (2016). Scores on the CRT indicate the number of correct responses given by the participants. Higher scores on this test reflect a more analytic cognitive style.

News articles
Six news articles were selected from the independent fact-checking website Snopes.com. This website sorts articles into three categories based on veracity: true, false, and disputed or partially true. For the purpose of this investigation, the articles came from either the "true" or "false" category, with three of the items chosen to represent true content, and the other three selected to represent false content. The items were of approximately equal length (250-350 words each) and were designed to resemble newspaper reports.

Debriefing statement
This document provided participants with background information and revealed the true aims of the study. It also provided suggestions in the form of additional resources, including websites, on how to identify fake news. Finally, the form furnished participants with researcher contact information along with the note of appreciation.

Procedure
The recruitment letter was posted on the Glendon Participant Pool. The primary investigator contacted potential student participants by email. Participants then received a link to the survey grounded in one of the three experimental conditions (No caution, General caution, or Specific caution). On the first page, students were given the consent form to read and sign. The following page asked participants to fill in their demographic information and to complete the CRT. Afterwards, students were presented with a randomized series of six news articles that were only viewable one at a time.

Instructions and caution manipulations

In the control condition, participants were given these instructions: "Please read the news articles below and progress to the next article at your own pace." In the General caution condition, participants were asked the following: "Please read the news articles below and progress to the next article at your own pace. Beware that in their desire to sensationalize, the media sometimes does not check facts before publishing information that turns out to be inaccurate. It is therefore important to read the following news articles carefully." In the Specific caution condition, participants were presented with the following message: "Please read the news articles below and progress to the next article at your own pace. Although some of the news articles may be true, others may be misleading. It is important to engage in critical thinking while reading this news and to think carefully about whether the story could be true in order to help stop the spreading of misleading articles." These cautions were adapted from Clayton et al. (2019).

Once participants finished reading the six news reports, they were provided with a brief reminder statement of the content of each news piece and asked to respond to four questions associated with each article (see Appendix B). After the final task, participants were presented with a debriefing statement asking if they still wanted their data to be included in the research analysis.

A pilot study was initiated to ensure the validity of the six news articles and to provide a time estimate of the experiment. Furthermore, the news articles that were selected by the primary investigator based on their level of interest to a general audience were verified to be suitable for the rest of the investigation. A sample of convenience $N = 10$ (5 males, 5 females) was recruited from York University for this pilot, and these participants underwent the same testing procedure as those in the actual experiment.

RESULTS

The first aim of the study was to test the hypothesis that cognitive analytic style is positively correlated with an ability to identify fake news, independent of Caution condition. It was predicted that the DCI, calculated by subtracting each participant's acceptance of the three false items as genuine from their acceptance of the three true items as genuine, will be positively correlated with the number of correct answers on the Cognitive Reflection Test (CRT).

For this analysis, the three caution conditions were combined and the main results were summarized in Figure 1. A positive correlation between the DCI and CRT was found ($r(109) = 0.32$, $p < .01$) supporting the hypothesis that greater analytic ability is associated with an increased ability to distinguish true from false news reports (Figure 1). The effect size was determined to be medium.

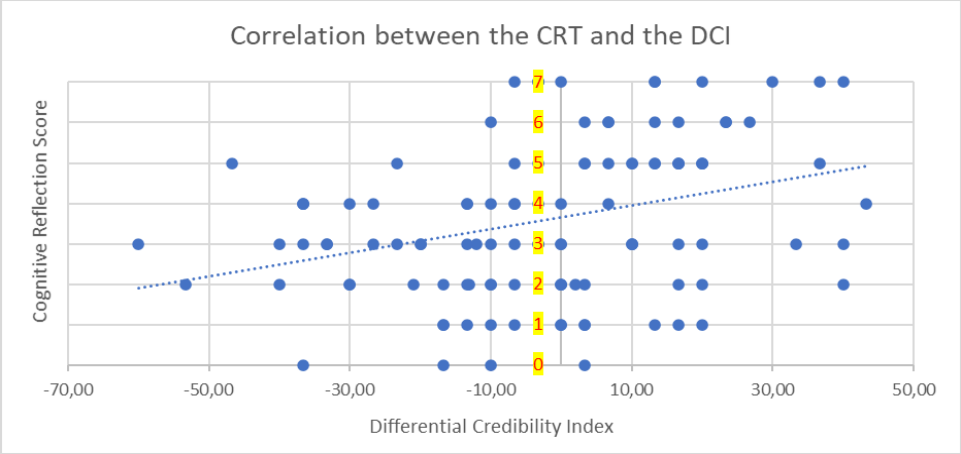

Figure 1: The relationship between the score on the Cognitive Reflection Test (CRT) and the Differential Credibility Index (DCI). The score of the CRT is represented by the central vertical axis ranging from 0-7. Pearson's r value of 0.32 was significant at p < .0

The second aim of the study was to assess the influence of three priming caution instructions on the susceptibility to fake content. The ANOVA showed that no statistically significant differences were found when comparing each of the conditions ($F(2,108) = 1.08$, $p = .34$), indicating that susceptibility to fake content was not affected by priming cautions (Figure 2).

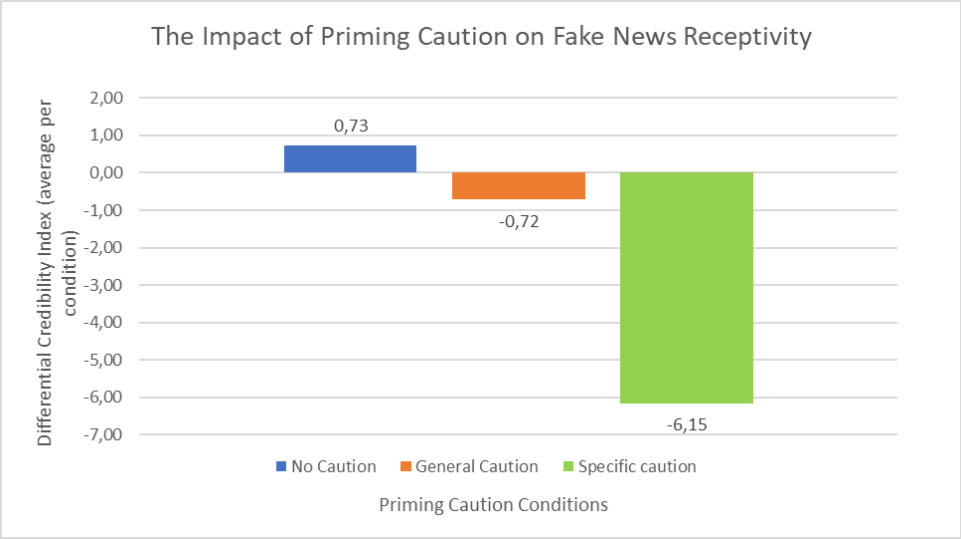

Figure 2: The influence of No, General, and Specific caution conditions on the Differential Credibility Index. No statistically significant differences were found, with p = .34.

Subsequent inspection of the data suggested an influence of the covariate (CRT) on the dependent measure. The mean values of No and General caution did not vary significantly. Interestingly, the Specific caution that was anticipated to show the largest positive DCI score, indicative of a reduction to the susceptibility to fake news, showed the lowest DCI average, suggesting that participants in this condition underperformed recognizing fake content. In order to explore this further, a one-way Analysis of Covariance (ANCOVA) was carried out to examine possible differences between No, General, and Specific caution conditions on the DCI when controlling for the cognitive style. No significant difference was found $F(2,107) = 0.69$, $p = .50$, suggesting that the instruction type had no impact on the ability of participants to identify fake news even after controlling for cognitive reflection.

DISCUSSION

The current study explored the relationship between cognitive style and susceptibility to fake news. The findings suggested that participants with a higher cognitive reflection ability were more likely to distinguish between true and fake news stories. These results were consistent with previous research concerning the factors involved in fake news believability (Pennycock et al., 2019a; Pennycock et al., 2019b). This paper thus provided additional support for the importance of analytic reflection in the ability to recognize false information.

The present experiment also investigated the effect of No, General, and Specific priming instructions on the perception of false content. Based on the findings of previous studies, participants in the General and Specific caution conditions were expected to show less receptivity to fake news stories. It was reasoned that priming participants with messages containing General and Specific cautions should mobilize their existing critical thinking skills, which in turn would make them less susceptible to false content. This did not occur. Instead, students receiving the General and Specific priming instructions did not perform differently from those in the control condition. This suggested that providing readers with a caution did not have a significant impact on the way they process the information. On the contrary, the observed association between cognitive reflection style and fake news receptivity underscores the important role that the propensity to think analytically plays in differentiating between true and false content. Due to the correlational nature of the analysis, no causal link can be attributed to the analytic reflection and the tendency to credit fake news. However, given that the present results estimated a relationship between the CRT and DCI, the importance of cognitive style must be considered in future studies.

After analyzing the main data, it was suspected that cognitive style acted as a covariate on one's ability to identify fake news stories as false. However, the post-hoc test did not confirm this trend, suggesting a need for further investigation with the appropriate research design.

Though the results of this study contribute to the theoretical framework relating analytic thinking to the receptivity of fake news, there are several limitations that should be highlighted. Foremost, the present study employed only six news articles—half true and half false. This amounted to only a very limited sampling of the broad range of fake news items that circulate in the larger world and thus did not capture the variety of techniques employed to deceive readers. Nevertheless, a larger sample size of news articles would result in far greater demands on participants' time and thereby could result in recruitment problems.

In addition, the present research was conducted over the Internet. It was challenging for the researcher to ensure the validity of the participants' responses because there was no opportunity to observe them during the task. For instance, it was uncertain whether the participants used extra sources or aids to complete the CRT math questions. However, the program that was used for this study reported the completion time for each of the participants. On average, it took participants about 14-20 minutes to respond to all the questions. These time limits are consistent with estimates from the pilot session and thereby suggest that participants did not take the time to consult outside sources.

Given that participants in this study were all university undergraduates, the conclusion that greater cognitive reflection ability is associated with decreased susceptibility to fake news cannot be generalized beyond that population. However, that does not diminish the importance of this finding since members of this demographic are most likely to engage with social media platforms on a regular basis and therefore most likely to encounter fake news reports (Head et al., 2018).

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

The most significant finding of this research is that participants with higher cognitive reflection ability are less likely to fall for fake stories. This result is correlational in nature and further research is required to explore whether there is a causal connection. Thus, subsequent studies might seek to determine if the skills associated with cognitive reflection directly lead to better analysis, better recognition, and firmer rejection of deliberately misleading news reports. Future studies might also employ a larger sample size of news items and gather participation data in a laboratory setting in order to eliminate problems associated with Internet research.

Despite its limitations, the present study points to the importance of fostering cognitive reflection ability amongst the public in general, and university students in particular. Workshops or classroom instruction promoting these abilities, while focusing attention on the detection of fake news, could provide students with an aptitude for avoiding deception when reading news reports. In addition, in this age of phone apps, it would be beneficial to develop an app that encourages improvement of critical thinking skills as well as offering recommendations on how to spot fake information online.

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APPENDIX A

Cognitive Reflection Test (CRT) from Frederick (2015):

1. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? _____ cents.
2.
3. If it takes 5 machines 5 min to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ min
4.
5. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days

Cognitive Reflection Test -2 (CRT-2) from Thomson and Oppenheimer (2016):

1. If you're running a race and you pass the person in second place, what place are you in? _____
2.
3. A farmer had 15 sheep and all but 8 died. How many are left? _____
4.
5. Emily's father has three daughters. The first two are named April and May. What is the third daughter's name? _____
6.
7. How many cubic feet of dirt are there in a hole that is 3′ deep x 3′ wide x 3′ long? _____

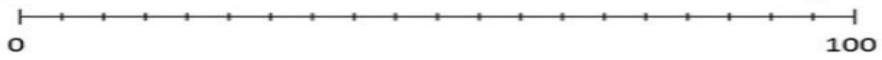
APPENDIX B

DIRECTIONS: Please recall the article you have just read about the presence of cocaine in the freshwater shrimp and answer the questions below. Please be honest. There is no right or wrong answer.

1. Have you seen or heard about this story before? Yes____ No____ Unsure____

2. How confident are you that the report you have read is essentially correct?

Not at All Confident Absolutely Confident



3. How interesting do you find the news article above?

Not at All Interesting Very Interesting

4. How likely it is that you would share this story online (for example, through Facebook or Twitter)?

Extremely Unlikely Extremely Likely