

**Simple interventions can help inhibit the spread of fake news about climate change**

Lauren Lutzke

School for Environment and Sustainability, University of Michigan, Ann Arbor, MI 48109



## TABLE OF CONTENTS

Abstract.....	3
Introduction.....	4
Methods.....	7
Results.....	10
Discussion.....	13
References.....	17

## **ABSTRACT**

Since the period leading to and following the American election cycle of 2016, a variety of sources have warned that people in the U.S. are being exposed to fake news. In light of this problem, our study tested the effect of exposure to guidelines (for evaluating the credibility of news online) on a person's assessment of real and fake news about climate change on Facebook. Through an online experiment (n = 2,750 participants), we tested two conditions and a control. Those in our Guidelines condition read guidelines for evaluating news online while participants in our Enhanced Guidelines condition read the same guidelines and rated them in terms of how important each guideline would be for evaluating news online. The control group was not exposed to guidelines at all. Then, participants were shown a Facebook post containing either real or fake news about climate change and asked to evaluate the post in terms of its trustworthiness, and how likely they would be to like or share the post on Facebook. Our results show that participants in both conditions were less likely to trust, like, or share fake climate news compared to the control group. Encouragingly, these interventions did not reduce a participant's likelihood to trust, like, or share real climate news. Both conditions had consistently small effect sizes for each dependent variable (trusting, liking, and sharing). However, even if exposure to guidelines only has a small chance of reducing a person's likelihood to trust, like, or share fake news, that small probability could still provoke meaningful behavior change if a population as massive as all U.S. internet users were to experience our interventions.

**Keywords:** fake news, social media, climate change

## INTRODUCTION

Since the period leading to and following the American election cycle of 2016, a variety of sources have warned that people in the U.S. are being exposed to “fake news”, referring to “news” that deliberately spreads fabricated information, mimics the format of legitimate reporting, and is intended to mislead its consumers (Lazer et al. 2018). Though not a new problem, the reach and potentially deleterious influence of fake news has been exacerbated by its prevalence on a wide range of social media platforms, and, the purported role of fake news in influencing voters during the 2016 election cycle has given the issue renewed attention (Allcott and Gentzkow 2017, Guess et al. 2018, Grinberg et al. 2019). Recent studies have approximated the reach and magnitude of fake news on social media. A conservative estimate is that the average American adult viewed between one and three fake news stories on social media in the month leading up to the 2016 election (Allcott and Gentzkow 2017). And a separate study of Twitter users estimated that fake news accounted for approximately 6% of total news consumption on social media (Grinberg et al. 2019).

In light of this problem, researchers and media providers have been searching for ways to limit the reach and influence of fake news. One way to do so may be through arming internet users with the information they need to effectively assess the news they encounter online. Many webpages offer advice about how to detect fake news, or to evaluate the credibility of information online. Facebook, in its online help center, offers advice for spotting fake news<sup>1</sup>, including “be skeptical of headlines” and “investigate the source”; the public-facing Psychology Today offers<sup>2</sup> similar advice. Our study sought to understand if familiarity with guidelines for evaluating the credibility of news, similar to those above, could make a person less likely to trust or engage with fake news on social media, specifically on Facebook.

There are several reasons social media platforms have become effective conduits for the spread of false information. First, social media outlets typically do not police the accuracy or sources of content posted to their sites. Second, by nature of the platforms, information can be shared or promoted over and over, which gives information (true *or* false) the ability to spread very widely and very quickly. Indeed, there is evidence that false information is shared or promoted even more often than accurate information (Vousoughi *et al.* 2018). And third, social media sites are popular sources of news; 47% of Americans report that they use social media to check the news “sometimes” or “often” with Facebook being the most popular platform for this purpose (Shearer and Gottfried 2017).

---

<sup>1</sup> <https://www.facebook.com/help/188118808357379>

<sup>2</sup> <https://www.psychologytoday.com/us/blog/socially-relevant/201711/how-spot-fake-news>

Due to Facebook's popularity as a news source and its widespread use in general, we focused our research on just this platform. In our study, we presented participants with fake news formatted as if it were news that had been posted to Facebook, or, a Facebook "post". Although fake news on Facebook can "cover" any topic, we focused our research on fake news about climate change because of its importance to global environmental, social, and economic affairs. Fake news about climate change typically perpetuates falsehoods that climate change is not occurring, that it is not caused by human activities, or that it does not pose a threat to humans and the environment (Farrell et al. 2019). Therefore, our Facebook post stimuli contained content about climate change.

To evaluate the effectiveness of guidelines in helping to inoculate against fake climate news, we asked participants to rate the trustworthiness of the information in the post. Then, to mimic the choices Facebook users encounter on the platform, participants were also asked how likely they would be to "like" or "share" the post. On Facebook, "liking" a post indicates interest in content, whereas "sharing" a post directly proliferates the content by showing it to more Facebook users. Likelihood to trust, like, or share the post were our main dependent variables in assessing the effectiveness of our interventions on fake news about climate change on Facebook.

Prior research has offered two theories for why individuals may be susceptible to fake news. First, the messages imparted by fake news may align with deeply held political beliefs which, in turn, triggers identity protective cognition. People tend to be motivated to protect their beliefs from evidence to the contrary and may, therefore, align themselves with information that confirms what they already believe to be true or right (Kunda 1990, Nir 2011). Prior research suggests that when people are the recipients of fake news that is in line with their preexisting beliefs or values, they will be less motivated to engage in critical reflection about its accuracy (Taber and Lodge 2006, Allcott and Gentzkow 2017). Secondly, recent research has suggested that a general lack of critical thinking—independent of partisan motivations—is responsible for an individual's susceptibility to fake news. Controlling for political ideology, Pennycook and Rand (2018) found that individuals who scored highly on an assessment of analytical reasoning ability were better able to distinguish between fake and real news headlines.

In light of these findings, we were generally skeptical about the ability of mere exposure to guidelines to inoculate consumers against the effects of fake news; in our view, simple guidelines would not be powerful enough to overcome the partisan tug of motivated reasoning or the absence of critical thinking that may be common to consuming false information while absentmindedly scrolling through the Facebook interface. Thus, we hypothesized that people who read guidelines for spotting fake news

immediately before being exposed to inaccurate Facebook posts would be no less likely to trust, like, or share them when compared to a control group that did not receive the guidelines.

We did, however, speculate that encouraging people to more deeply process guidelines could prove powerful enough to subsequently influence their perceptions of fake news about climate change, in terms of trusting, liking, and sharing. Therefore, we created a second intervention—which we called enhanced guidelines—where participants, along with reading the guidelines, were asked to rate the importance of each in terms of helping to determine the credibility of news received on Facebook. In the same way that attribute weighting tools in research on decision support help people to make better calibrated decisions (in terms of their needs and priorities) (Gregory et al. 2016, Bessette et al. 2019), we hypothesized that rating individual guidelines would help people to process them more deeply; this, in turn, would lead people to trust, like, and share fake news less when compared to a control group.

In addition to testing these interventions on fake news, we also tested them on news about climate change that was accurate. We did so to address concerns that any positive results with respect to inoculating people against fake news would be counterbalanced by also encouraging people to distrust legitimate reporting about climate change.

Finally, we also included a series of covariates in our research. First, given ideological differences in public perceptions of climate change, we tested whether the effectiveness of guidelines and enhanced guidelines differed across both climate change skeptics and believers, and political conservatives and liberals. Second, we included an individual's level of knowledge about climate change as a covariate; we hypothesized that participants who were more knowledgeable would be more discerning consumers of our fake news stimulus. Third, we measured participants' general disposition—negative or positive—toward Facebook as a covariate, speculating that a positive attitude toward the social media platform would lead people to view all posts as more trustworthy regardless of their accuracy. Additionally, we measured whether or not participants recognized the sources of the news posts. We hypothesized that climate doubters, who are more likely to be politically conservative, would be more likely to trust the fake news if they recognized the source, since they may have positive preconceived notions of sources with far-right reputations. On the other hand, we expected climate believers to be less likely to trust the fake news if they recognized the source due to *negative* preconceived notions. For real news, all sources had non-partisan reputations, so we hypothesized that recognizing the source would lead to a higher likelihood of trusting, liking, or sharing the post. We ended our experiment with standard demographic questions which covered gender, age, and education level.

## METHODS

### *Design*

Our study adopted a 3 × 2 experimental design involving two fake news interventions (Guidelines and Enhanced Guidelines) and a control (no intervention), and two types of news about climate change (fake and real). Participants were randomly assigned to just one of the six possible experimental variations, and their progression through the experimental design followed the same sequence of tasks.

*Conditions.* Participants in the control condition were informed that they would view a Facebook post about climate change, and then be asked to answer questions about what they saw.

In the Guidelines condition, participants were informed that they would view a Facebook post about climate change. Next, they were asked to consider a series of four questions (i.e., the guidelines) that would help them to evaluate the credibility of news online. The questions were: (1) *Do I recognize the news organization that posted the story?*; (2) *Does the information in the post seem believable?*; (3) *Is the post written in a style that I expect from a professional news organization?*; and (4) *Is the post politically motivated?* These guidelines reflected common recommendations<sup>34567</sup> for identifying fake news.

In the Enhanced Guidelines condition, participants were also informed that they would view a Facebook post about climate change, and they were also asked to consider the same four questions from the Guidelines condition. But, participants in this condition were also asked to rate the importance of each guideline (on a 1 – 10 scale from not at all important to very important) in terms of its ability to help them evaluate the credibility of news online.

*Fake vs. Real News.* In total, our study contained six Facebook news posts about climate change, three of which were based on fake news with the other three based on real news. Participants were randomly assigned to view one of the six posts. The three fake news posts were drawn from three different “hyper-partisan” media outlets – Breitbart, InfoWars, and Natural News – which are outlets that peddle in conspiracy theories, disinformation, and heavy bias in favor of a particular political party or ideology (Marwick & Lewis 2017). The three real news posts were drawn from NASA, USA Today, and Scientific American.

---

<sup>3</sup> <https://www.facebook.com/help/188118808357379>

<sup>4</sup> <https://www.psychologytoday.com/us/blog/socially-relevant/201711/how-spot-fake-news>

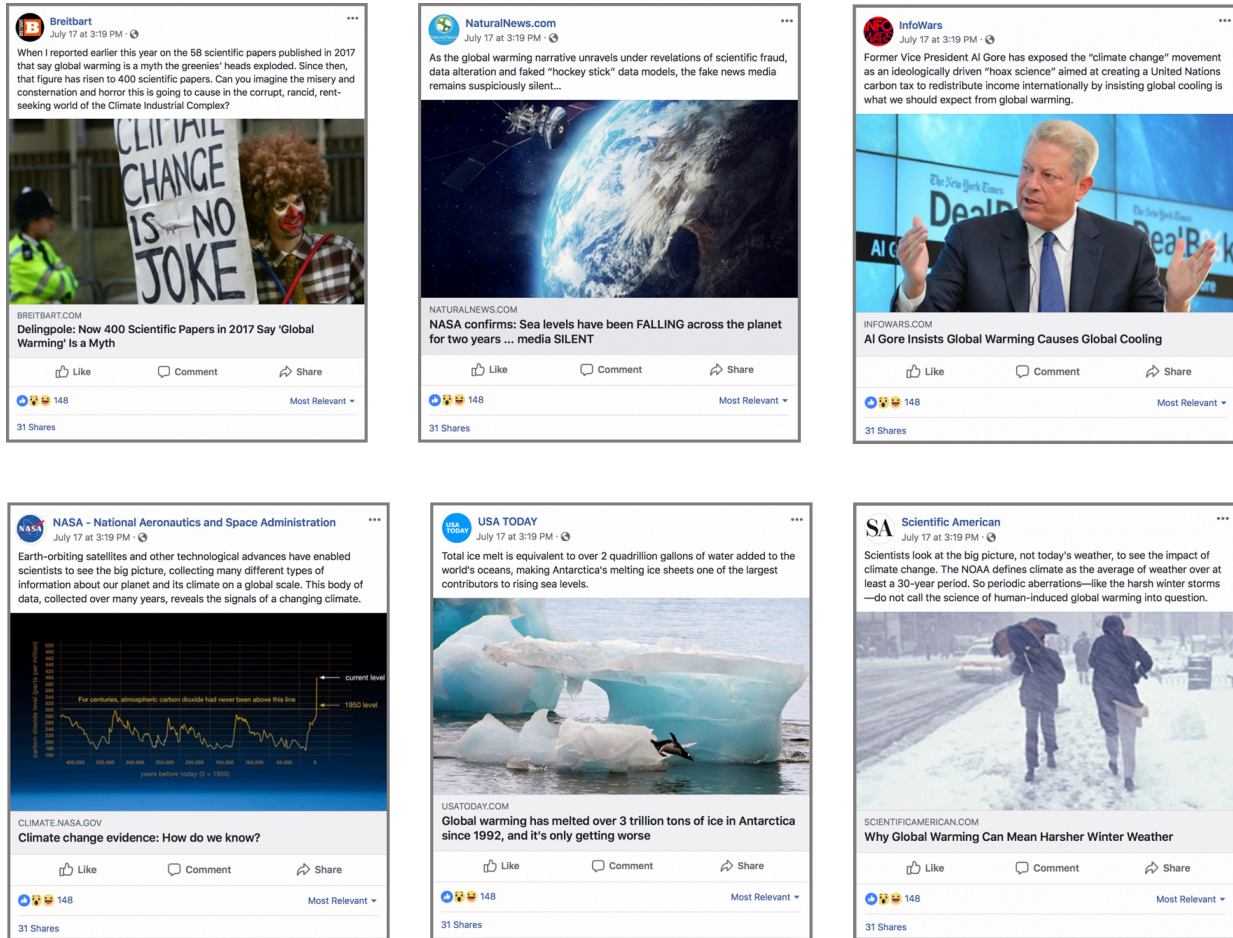
<sup>5</sup> <https://www.factcheck.org/2016/11/how-to-spot-fake-news/>

<sup>6</sup> <https://www.ifla.org/publications/node/11174>

<sup>7</sup> <https://www.freedomforuminstitute.org/first-amendment-center/primers/fake-news-primer/>



Because the online presentation of Facebook posts varies from post to post (e.g., in terms of the number of “likes” and “shares”, and the types of emojis applied to content by users), we modified each post to ensure consistency in presentation (Figure 1). Thus, in each post shown to participants, the post date, number of likes, and number of shares, were identical. However, all of the text and the images in the post were as they appeared in the original stories from the three fake news and three real news outlets.



**Figure 1.** The fake news and real news posts used in this experiment.

### Measures

After reviewing their randomly assigned news post, participants were asked to rate its trustworthiness on a 10-point scale from 1 (not at all trustworthy) to 10 (very trustworthy). Participants also rated each post in terms of perceived accuracy on a 10-point scale from 1 (not at all accurate) to 10 (very accurate). Judged trustworthiness and accuracy were combined to create a single item index variable for trust (Chronbach’s alpha = 0.93). Participants were also asked to indicate their likelihood of “liking” or “sharing” their assigned post; these responses were collected on an 11-point bi-polar scale from -5

(definitely not) to 0 (neutral) to +5 (definitely yes). The scales for “liking” and “sharing” were converted to continuous (1-11) scales for data analysis.

In terms of covariates, participants were asked if they recognized the source of the Facebook post and chose between dichotomous response options (yes or no). Next, we determined participants’ knowledge level regarding climate change using a 12-item scale used in previous research by us and others (Tobler et al. 2012, Shi et al. 2015, Shi et al. 2016). In our study, one item of the scale was accidentally omitted. The scale included three subscales representing three different forms of knowledge: knowledge about physical characteristics measured fundamental knowledge about the physics underlying climate change, knowledge about the causes of climate change assessed the reasons that climate change is happening, and knowledge about the consequences of climate change included items about the different natural hazards and environmental effects of climate change. Then, because of increasing public concern and regulator scrutiny regarding Facebook’s role in the spread of disinformation as well as the company’s handling of consumer data and privacy issues, we asked participants to rate their current attitudes toward the platform; responses were collected on an 11-point bi-polar scale from -5 (strong negative feelings) to 0 (neutral) to +5 (strong positive feelings). Finally, we collected demographic information from participants regarding their gender, age, education level, and political orientation (measured from very conservative to moderate to very liberal).

### ***Participants***

Data collection took place in September 2018 using an online Qualtrics panel. The instrument was sent to adults ages 18 and over in the United States. Quota sampling was used to balance gender and belief in human-caused climate change; roughly 50% of recruited participants believed climate change is human-caused (labeled “believers”), and 50% did not believe climate change was human-caused or were unsure (labeled “doubters”).

Initially 3,842 participants responded to our instrument. A total of 1,092 participants were removed from the sample because they failed attention checks (n = 1,015 deleted), because they completed the experiment in less than half the median time (n = 69 deleted), or because they provided gibberish responses to a series of open-ended questions, which were not analyzed (n = 8 deleted). This left us with a final sample of 2,750 participants.

## RESULTS

When looking at each dependent measure across the combined fake news and real news post types, participants reported lower ratings for trust, liking, and sharing when confronted with posts based on fake news as compared to real news (Table 1).

**Table 1.** Mean ratings of perceived trustworthiness, likelihood of “liking,” and likelihood of “sharing” across post type (fake news and real news).

	Trust scale (1 to 10)		Like scale (1 to 11)		Share scale (1 to 11)	
	Mean	Standard Dev.	Mean	Standard Dev.	Mean	Standard Dev.
<b>Fake News</b>						
<b>All Conditions Collapsed</b>	<b>4.08</b>	<b>2.53</b>	<b>4.23</b>	<b>3.21</b>	<b>4.10</b>	<b>3.21</b>
Control	4.28	2.55	4.55	3.25	4.51	3.32
Guidelines	3.93	2.60	4.12	3.27	4.00	3.24
Guidelines Plus	4.03	2.44	4.00	3.09	3.80	3.03
<b>Real news</b>						
<b>All Conditions Collapsed</b>	<b>6.56</b>	<b>2.34</b>	<b>6.24</b>	<b>3.16</b>	<b>5.69</b>	<b>3.19</b>
Control	6.38	2.34	6.17	3.23	5.65	3.20
Guidelines	6.69	2.40	6.32	3.17	5.78	3.15
Guidelines Plus	6.60	2.27	6.22	3.09	5.65	3.21

We conducted a two-way ANOVA to measure the effect of condition and post type (fake vs. real news) on the dependent measures. In addition, we used multiple linear regressions to more thoroughly study the effect of condition on the dependent measures when controlling for our covariates. We conducted 12 regressions, predicting each of our three dependent measures separately for doubters and believers who saw fake or real news.

An ANOVA detected a significant main effect of post type ( $F_{1, 2744} = 710.8, p < 0.001$ ), and a significant interaction between post type and condition ( $F_{2, 2744} = 4.53, p = 0.011$ ) for the dependent variable measuring trust. Here, the effect of condition on trust depended upon whether participants received real or fake news. We also detected a significant main effect of post type ( $F_{1, 2744} = 275.4, p < 0.001$ ) on “liking”; for this variable, the interaction between post type and condition approached, but ultimately was not significant ( $F_{2, 2744} = 2.7, p < 0.066$ ). For the variable that accounted for “sharing”, the ANOVA detected a significant main effect of post type ( $F_{1, 2744} = 171.9, p < 0.001$ ), a significant main effect of condition ( $F_{2, 2744} = 3.1, p = 0.047$ ), and a significant interaction between post type and condition ( $F_{2, 2744} = 4.53, p = 0.011$ ); thus, participants’ likelihood of sharing a Facebook post was influenced by both condition and post type.

**Table 2.** Regression analyses for climate change doubters and believers on perceived trustworthiness of, likelihood of “liking”, and likelihood of “sharing” posts based on fake news.

FAKE NEWS	DOUBTERS						BELIEVERS					
	TRUST		LIKE		SHARE		TRUST		LIKE		SHARE	
	scale (1 to 10)		scale (1 to 11)		scale (1 to 11)		scale (1 to 10)		scale (1 to 11)		scale (1 to 11)	
	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.
Intercept (Control, Breitbart)	3.64 ***	0.52	4.94 ***	0.67	4.05 ***	0.67	4.61 ***	0.57	4.60 ***	0.69	4.37 ***	0.70
Guidelines	-0.55 **	0.21	-0.66 *	0.27	-0.44	0.27	-0.31	0.22	-0.36	0.27	-0.70 *	0.28
Enhanced Guidelines	-0.11	0.21	-0.78 **	0.27	-0.55 *	0.27	-0.53 *	0.22	-0.51	0.27	-1.03 ***	0.28
Natural News	0.13	0.24	0.14	0.31	0.16	0.32	0.42	0.28	0.96 **	0.33	0.73 *	0.34
InfoWars	-0.21	0.27	-0.61	0.35	-0.66	0.35	-0.14	0.31	-0.02	0.37	-0.30	0.38
Recognize Source (Breitbart)	2.21 ***	0.32	2.48 ***	0.41	2.15 ***	0.41	0.18	0.33	0.22	0.39	0.14	0.40
Recognize Source (Natural News)	1.11 **	0.39	1.87 ***	0.50	1.18 *	0.51	1.41 ***	0.37	1.61 ***	0.45	1.80 ***	0.46
Recognize Source (InfoWars)	0.20	0.30	0.42	0.39	1.00 *	0.40	0.08	0.32	0.03	0.39	0.33	0.40
Knowledge of Climate Change	-0.01	0.04	0.01	0.05	0.02	0.05	-0.24 ***	0.04	-0.21 ***	0.05	-0.14 **	0.05
Positive Feelings Toward Facebook	0.14 ***	0.04	0.24 ***	0.05	0.25 ***	0.05	0.24 ***	0.04	0.40 ***	0.05	0.38 ***	0.05
Female	-0.10	0.18	-0.33	0.24	-0.04	0.24	-0.24	0.19	-0.12	0.23	-0.28	0.24
Age	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Education	-0.02	0.06	-0.27 **	0.08	-0.19 *	0.08	-0.03	0.07	-0.17 *	0.08	-0.17 *	0.08
Conservatism	0.14	0.09	0.21	0.12	0.23	0.12	0.40 ***	0.09	0.49 ***	0.11	0.50 ***	0.11
R-squared	0.13		0.16		0.12		0.20		0.24		0.22	
<i>F</i> (df1, df2)	7.89 (13, 678)		9.97 (13, 678)		7.20 (13, 678)		13.67 (13, 691)		16.90 (13, 691)		15.11 (13, 691)	

Signif. codes: \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

### *Participants Shown Fake News*

Linear regression analyses for the posts based on fake news (Table 2) indicated that climate change doubters exposed to the Guidelines condition were less likely to trust ( $\eta^2p = 0.011$ ) and like ( $\eta^2p = 0.009$ ) them. Doubters in Enhanced Guidelines condition were less likely to like ( $\eta^2p = 0.012$ ) and share ( $\eta^2p = 0.006$ ) posts based on fake news. Climate change believers exposed to the Guidelines condition were, by contrast, less likely to share ( $\eta^2p = 0.009$ ) posts based on fake news, while exposure to the Enhanced Guidelines condition led believers to be less likely to trust ( $\eta^2p = 0.008$ ) and share ( $\eta^2p = 0.019$ ) posts based on fake climate news.

When controlling for the other covariates, participants’ ability to recognize the sources of posts based on fake news also influenced their responses to the dependent measures (Table 2). Specifically, participants who were climate change doubters and who recognized either Breitbart or Natural News as sources of a fake news post were more likely to trust, like, and share it. Climate change believers, by contrast, were more likely to trust, like, and share a fake news post if they recognized Natural News as the source.

Beyond recognizing the source, and when controlling for other covariates, higher levels of domain-specific knowledge about climate change (Table 2) led believers to report lower levels of trust, and a lower likelihood of liking and sharing posts based on fake news. Higher levels of domain-specific knowledge had no significant effect on trusting, liking, and sharing amongst climate change doubters.

For both doubters and believers, the more positive a participant’s attitude toward Facebook (Table 2), the more likely they were to trust, like, and share a post based on fake news. And, in terms of political orientation, doubters who self-identified as being more conservative were more likely to like and share posts based on fake news; similarly, believers who self-identified as being more conservative reported higher levels of trust in, and were more likely to like and share posts based on fake news (Table 2).

**Table 3.** Regression analyses for climate change doubters and believers on perceived trustworthiness of, likelihood of “liking”, and likelihood of “sharing” posts based on real news.

REAL NEWS	DOUBTERS						BELIEVERS					
	TRUST		LIKE		SHARE		TRUST		LIKE		SHARE	
	scale (1 to 10)		scale (1 to 11)		scale (1 to 11)		scale (1 to 10)		scale (1 to 11)		scale (1 to 11)	
	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.	<i>B</i>	Std. Err.
Intercept (Control, NASA)	5.13 ***	0.56	6.75 ***	0.72	5.17 ***	0.73	6.40 ***	0.53	6.93 ***	0.73	7.39 ***	0.76
Guidelines	0.16	0.20	-0.06	0.26	0.08	0.26	0.62 **	0.18	0.39	0.25	0.23	0.26
Enhanced Guidelines	0.31	0.20	0.07	0.26	0.24	0.26	0.22	0.18	0.15	0.25	-0.14	0.27
USA Today	-0.82 *	0.38	-0.97 *	0.49	-0.67	0.49	0.79 *	0.39	0.85	0.54	0.81	0.57
Scientific American	-0.67 *	0.32	-1.43 ***	0.41	-1.20 **	0.41	-0.57	0.33	-0.65	0.45	-1.13 *	0.47
Recognize Source (NASA)	0.41	0.32	-0.69	0.42	-0.47	0.42	0.83 **	0.31	0.59	0.43	0.26	0.45
Recognize Source (USA Today)	0.68 *	0.31	-0.01	0.40	-0.01	0.41	-0.33	0.32	-0.38	0.44	-0.52	0.46
Recognize Source (Scientific American)	1.13 ***	0.32	0.58	0.41	0.83 *	0.42	0.95 **	0.27	1.12 **	0.38	1.07 **	0.39
Knowledge of Climate Change	0.17 ***	0.04	0.20 ***	0.05	0.20 ***	0.05	0.14 ***	0.04	0.07	0.05	0.09	0.05
Positive Feelings Toward Facebook	0.26 ***	0.03	0.42 ***	0.04	0.40 ***	0.04	0.15 ***	0.03	0.34 ***	0.04	0.34 ***	0.05
Female	0.29	0.18	0.03	0.23	0.02	0.23	-0.23	0.16	-0.13	0.22	-0.62 **	0.23
Age	0.01	0.01	0.02 *	0.01	0.01	0.01	0.00	0.01	0.00	0.01	-0.01	0.01
Education	0.05	0.06	-0.25 **	0.08	-0.22 **	0.08	0.06	0.06	0.00	0.08	-0.07	0.08
Conservatism	-0.26 **	0.09	-0.47 ***	0.12	-0.16	0.12	-0.28 ***	0.07	-0.25 *	0.10	-0.20	0.10
R-squared	0.19		0.22		0.18		0.16		0.13		0.13	
<i>F</i> (df1, df2)	12.12 (13, 666)		14.55 (13, 666)		10.97 (13, 666)		9.56 (13, 659)		7.34 (13, 659)		7.89 (13, 659)	

Signif. codes: \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

### *Participants Shown Real News*

Linear regression analyses for the posts based on real news (Table 3) showed that, when controlling for other covariates, believers of climate change who were exposed to the Guidelines condition were more likely to trust ( $\eta^2 p = 0.017$ ) posts based on real climate news. Exposure to the Guidelines or Enhanced Guidelines conditions had no effect on doubters of climate change.

Participants’ ability to recognize the sources of posts based on real news once again influenced their responses to the dependent measures (Table 3). For both climate change doubters and believers, recognizing the source of a post based on real news was associated with a greater likelihood to trust, like, or share the post almost half of the time.

When controlling for other covariates, higher levels of domain-specific knowledge about climate change (Table 3) led doubters to report higher levels of trust, and a higher likelihood of liking and sharing posts based on real news. For believers, higher scores on the scale measuring domain-specific knowledge led to higher levels of trust in posts based real climate news.



As was the case with posts based on fake news, the more positive a doubter's or believer's attitude toward Facebook (Table 3), the more likely they were to trust, like, and share posts based on real news. And, in terms of political orientation, doubters and believers who self-reported higher levels of conservatism were less likely to trust and like posts based on real climate news.

## DISCUSSION

Our study tested the effect of exposure to guidelines (for evaluating the credibility of news online) on a person's likelihood to trust, like, or share real and fake news about climate change on Facebook. We tested two conditions and a control. Those in our Guidelines condition read guidelines for evaluating news online while participants in our Enhanced Guidelines condition read the same guidelines and rated them in terms of how important each guideline would be for evaluating news online. The control group was not exposed to guidelines at all. Participants were asked to evaluate either a fake or real Facebook news post about climate change. We hypothesized that simply reading guidelines would not be a powerful enough intervention to influence a person's likelihood to trust, like, and share news online; we anticipated that the additional rating task would be needed to help participants process the guidelines more deeply, in turn making them less likely to trust, like, and share fake news compared to the control. We predicted that these interventions would *not* negatively impact real climate news, i.e., these interventions would not make participants less likely to trust, like, and share real news.

As hypothesized, our results show that participants that saw enhanced guidelines were less likely to trust, like, or share fake climate news. Contrary to our hypothesis, participants who only read the guidelines were also less likely to trust, like, or share fake news. Both conditions had consistently small effect sizes for each dependent variable – trusting, liking, and sharing – meaning neither condition was more effective than the other. Encouragingly, these interventions did not reduce a participant's likelihood to trust, like, or share real climate news.

Prior research has found that those with better analytical thinking capabilities are better able to recognize fake news. Pennycook and Rand (2018) found that individuals who scored highly on a reworded version of the Cognitive Reflection Test (CRT) (Frederick 2005, Shenhav et al. 2012) as well as a non-numeric cognitive reflection test (Thomson and Oppenheimer 2016) were better able to distinguish between fake and real news headlines, independent of political ideology. Furthermore, Bronstein et al. (2019) also used the same two sets of CRT questions to measure the association between analytical thinking and assessment of fake news and found that higher analytical reasoning scores were positively correlated with the ability to discern between real and fake news.

Consistent with this work, our study again found critical thinking to be an important factor in regard to a person's likelihood to trust, like, and share fake news. However, differences in methodology between prior research and our study allow ours to support this theory from another angle. Preceding work measured an individual's innate ability to use critical thinking, and thus examined this ability's influence on detection of fake news. Our study, rather, did not look at innate ability, but instead imposed critical thinking on a group of people by asking them to engage in a critical thinking task. Independent of a person's education level, if a person engaged in one of our interventions (compared to the control group) they were less likely to trust, like, or share fake news. This, in combination with findings from other studies, provides compelling reason to consider the role of critical thinking in a person's likelihood to recognize fake news.

However, the small effect sizes of the critical thinking interventions in our study are important to note. Since the interventions only accounted for a small amount of variation in our model, this suggests other factors, in addition to critical thinking, or a lack of critical thinking, may be leading some individuals to recognize false information and others to accept it. One of these factors may be a person's tendency to engage in motivated reasoning. Again, prior research has established that when a person is confronted with information that is inconsistent with their political beliefs, they may be motivated to reject that information, but accept information that is aligned with their political beliefs (Taber and Lodge 2006). Our study found that the more conservative a person was, the more likely they were to trust fake climate news and reject real climate news. It is possible that more conservative participants found the fake climate news to be consistent with their views of climate change and the real climate news to be incongruent with their views, which may have led them to engage in motivated reasoning.

### ***Limitations***

It is again necessary to highlight the small effect sizes of our interventions, this time as a limitation. The effect sizes signal to us that exposure to guidelines will not be enough to eliminate the spread of fake news in its entirety. However, even if exposure to guidelines only has a small chance of reducing a person's likelihood to trust, like, or share fake news, that small probability could still provoke meaningful behavior change if a population as massive as all U.S. internet users were to experience our interventions. Additionally, influencing only a small number of people is significant due to the pyramid structure of "sharing" on social media – preventing even one person from sharing a fake news post in turn prevents many other social media users from encountering the fake news post in the first place.

Certain aspects of our sample could also be considered a limitation of our study, in that our sample may not completely reflect those who typically engage in the spread of fake news. For example, prior research

has found that those ages 65 and up share fake news at a higher rate than younger internet users. Although our study included many participants over the age of 65 (n = 313), our study did not find an association between age and susceptibility to fake news. It is possible that older participants that sign up to take online surveys may be technologically savvier than the typical 65-plus social media user.

Other limitations are related to our study's design. First, participants were exposed to guidelines immediately before they were shown a fake or real news post, so we cannot assume the guidelines would have still been influential if time had passed between the intervention and the stimulus. Second, our study utilized a limited number of stimuli that may not be representative of the broader category of fake news regarding climate change. Moreover, our study only exposed participants to news regarding climate change which is not representative of all fake news posts which can cover any topic. Although the guidelines we tested did not intend to inoculate internet users against just one form of fake news, i.e. the guidelines were not specific to one fake news topic, further research should be conducted to discover if our findings could be generalized to other fake news topics as well.

Finally, the hypothetical nature of conducting a study about fake news on social media *off* of a social media platform may not have completely captured the actions a participant would have taken in reality. To address this, future work could assess the effects of embedding these guidelines within an existing social media platform.

### ***Conclusion***

With evidence that exposure to guidelines for evaluating the credibility of news online can help to reduce a person's likelihood to trust, like, and share fake climate news on Facebook, without negatively impacting legitimate climate news, further research on these guidelines should be considered. In particular, it may be beneficial to explore pathways to bring these guidelines forth to those who are not currently seeking them out. Even if these guidelines were successfully shown to the majority of internet users, there are still other factors that would need attention in order to effectively fight against fake news about climate change, and fake news in general. Two of these factors were included in our study as covariates.

First is the role of an individual's knowledge of climate change in relation to their susceptibility to anti-climate messaging and willingness to accept legitimate climate news. In our study, climate believers with a greater knowledge of climate change concepts were even less susceptible to fake climate news (compared to climate believers that were not as knowledgeable), and climate doubters were more accepting of real climate news (compared to other climate doubters). Although there are many recent



examples where objective facts related to politicized issues are discounted or ignored (Beck 2017), our results show that in the context of climate change, understanding relevant facts is influential even when they conflict with a person's beliefs. Or, even though some participants doubted climate change, if they had some accurate knowledge about climate change, they were more likely to accept legitimate climate news. This suggests that it is important to continue to explore the role of climate education in terms of addressing the disinformation that still surrounds this global issue.

Second is the role of a person's attitude toward Facebook – regardless of whether a participant was a doubter or believer of climate change, or saw real or fake news, if they had positive feelings toward Facebook, they were more likely to trust, like, and share whatever information they were shown. Although an intuitive finding, this suggests that Facebook users are not being as critical of the information they encounter if they like the platform. Further research may seek to understand how to encourage healthy skepticism toward the platform.

Overall, this study highlights the potential of guidelines to play an important role in combating fake news online. And additionally, this study suggests many opportunities to further explore other factors that influence a person's likelihood to detect fake news. Although this progress is meaningful, fully eliminating fake news from social media will likely require a solution far grander than simply reading or interacting with guidelines for evaluating news online, and future research should pursue solutions far more creative than what has been done before.

## References

- Allcott, H., and M. Gentzkow. 2017. Social media and fake news in the 2016 election. *Journal of Economic Perspectives* **31**:211-236.
- Beck, J. 2017. This Article Won't Change Your Mind. *The Atlantic*.
- Bessette, D. L., R. S. Wilson, and J. L. Arvai. 2019. Do people disagree with themselves? Exploring the internal consistency of complex, unfamiliar, and risky decisions. *Journal of Risk Research*:1-13.
- Bronstein, M. V., G. Pennycook, A. Bear, D. G. Rand, and T. D. Cannon. 2019. Belief in fake news is associated with delusionality, dogmatism, religious fundamentalism, and reduced analytic thinking. *Journal of Applied Research in Memory and Cognition* **8**:108-117.
- Farrell, J., K. McConnell, and R. Brulle. 2019. Evidence-based strategies to combat scientific misinformation. *Nature Climate Change* **9**:191-195.
- Frederick, S. 2005. Cognitive reflection and decision making. *The Journal of Economic Perspectives* **19**:25-42.
- Gregory, R., T. Satterfield, and A. Hasell. 2016. Using decision pathway surveys to inform climate engineering policy choices. *Proceedings of the National Academy of Sciences of the United States of America* **113**:560-565.
- Grinberg, N., K. Joseph, L. Friedland, B. Swire-Thompson, and D. Lazer. 2019. Fake news on Twitter during the 2016 U.S. presidential election. *Science* **363**:374-378.
- Guess, A., B. Nyhan, and J. Reifler. 2018. Selective exposure to misinformation: Evidence from the consumption of fake news during the 2016 U.S. presidential campaign. Working Paper.
- Kunda, Z. 1990. The case for motivated reasoning. *Psychological Bulletin* **108**:480-498.
- Lazer, D. M. J., M. A. Baum, Y. Benkler, A. J. Berinsky, K. M. Greenhill, F. Menczer, M. J. Metzger, B. Nyhan, G. Pennycook, D. Rothschild, M. Schudson, S. A. Sloman, C. R. Sunstein, E. A. Thorson, D. J. Watts, and J. L. Zittrain. 2018. The science of fake news. *Science* **359**:1094.
- Nir, L. 2011. Motivated reasoning and public opinion perception. *Public Opinion Quarterly* **75**:504-532.
- Pennycook, G., and D. G. Rand. 2018. Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition* **In press**.
- Shearer, E., and J. Gottfried. 2017. News Use Across Social Media Platforms 2017. Pew Research Center.
- Shenhav, A., D. G. Rand, and J. D. Greene. 2012. Divine intuition: cognitive style influences belief in God. *Journal of experimental psychology. General* **141**:423-428.
- Shi, J., V. H. M. Visschers, and M. Siegrist. 2015. Public perception of climate change: The importance of knowledge and cultural worldviews. *Risk Analysis* **35**:2183-2201.
- Shi, J., V. H. M. Visschers, M. Siegrist, and J. Arvai. 2016. Knowledge as a driver of public perceptions about climate change reassessed. *Nature Climate Change* **6**:759-762.

Taber, C. S., and M. Lodge. 2006. Motivated skepticism in the evaluation of political beliefs. *American Journal of Political Science* **50**:755-769.

Thomson, K. S., and D. M. Oppenheimer. 2016. Investigating an alternate form of the cognitive reflection test. *Judgment and Decision Making* **11**:99-113.

Tobler, C., V. H. Visschers, and M. Siegrist. 2012. Consumers' knowledge about climate change. *Climatic Change* **114**:189-209.