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Misinformed and Unaware? Metacognition and the Influence of Inaccurate Information

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The current study investigated the role of metacognition with respect to the consequences of exposures to inaccurate information. Previous work has consistently demonstrated that exposures to inaccuracies can confuse people and even encourage reliance on the falsehoods. We specifically examined whether people are aware of their likelihood of being influenced by inaccurate information, and whether engaging in metacognitive reflection is effective at reducing this influence. In three experiments, participants read a story containing false assertions about the world. In Experiment 1, we compared participants' estimated resistance to inaccurate information against the degree to which their subsequent judgments actually reflected an influence of previously read inaccuracies. Participants were generally unaware of their susceptibility to inaccurate information, demonstrated by a lack of calibration between estimated and actual resistance. Their judgments consistently revealed an influence of previously read inaccuracies. In Experiment 2, we applied a metacognitive reflection task intended to encourage evaluation while reading. Participants who completed this task made fewer judgment errors after having read inaccurate statements than did participants who did not engage in reflection. Experiment 3 replicated these effects with a larger sample, and showed benefits of reflection for calibrations between people's estimated resistance and their actual performance. The accumulated findings highlight the importance of metacognitive considerations for understanding and addressing oft-reported, problematic effects of exposures to inaccuracies.

Keywords: text comprehension, metacognition, evaluation, inaccurate information

People regularly consult news reports, magazines, and textbooks to learn about the world. But learning is not restricted to experiences with expository materials; people learn from sources that were not explicitly created with the intention to educate or inform (Appel & Richter, 2007; Gerrig & Prentice, 1991; Prentice, Gerrig, & Bailis, 1997). For example, fiction, including movies, TV shows, and popular novels, often includes assertions and claims that could serve as fodder for informing everyday judgments and decisions, as offered through character discussions, narration, and unfolding events (Gerrig, 1993; Marsh & Fazio, 2007). These contents frequently include inaccurate statements and ideas, especially when creators prioritize entertainment over accuracy. People do not seem to consistently evaluate these inaccuracies, nor reflect deeply on the fact that they could be influenced by such information (Rapp & Braasch, 2014). As a consequence, fiction-embedded inaccuracies may influence judgments about reality.

A variety of empirical projects have indeed demonstrated that people encode and subsequently retrieve inaccurate information from fiction to complete postreading tasks, even when they should know better (Gerrig & Prentice, 1991; Hinze, Slaten, Horton, Jenkins, & Rapp, 2014; Marsh, Meade, & Roediger, 2003; Rapp, 2016; Rapp et al., 2014). One well-replicated method presents participants with stories that include a mixture of accurate and inaccurate statements. As one example, characters in a story might identify Oslo as the capital of Finland, when the capital is actually Helsinki (Marsh et al., 2003). After reading, participants are tasked with answering general knowledge questions, some of which relate to information in the story (e.g., "What is the capital of Finland?"). Participants are more likely to give inaccurate responses to questions after having read related inaccurate information than after having read related accurate statements or statements omitting names or identifiers that could be used to answer the questions. This occurs not only for participants who may not have known the correct answer prior to reading the text, and thus learned new, albeit incorrect information, but also for participants who possess relevant prior knowledge they could have used to discount the inaccuracies (Fazio, Barber, Rajaram, Ornstein, & Marsh, 2013; Rapp, 2008). These patterns have obtained for different kinds of falsehoods, including self-evident declarative statements (e.g., "Oslo is the capital of Finland") and assertions for which the preponderance of evidence supports a claim (e.g., "Toothbrushing causes gum disease"; Gerrig & Prentice, 1991; Rapp et al., 2014). The accumulated findings indicate that people exposed to inaccuracies exhibit behaviors associated with confusion, doubt, and

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reliance when subsequently asked to contemplate that information again (Rapp & Salovich, 2018). Simply possessing relevant knowledge seems insufficient to attenuate such effects, which suggests people may be unaware of, unprepared to, or unwilling to engage in the necessary evaluative behaviors to avoid being influenced by inaccurate claims.

Validation and Reliance on Inaccurate Information

One way that people could more effectively engage with information from familiar topics is by carefully evaluating the validity of claims and assertions as they read. *Validation* describes the evaluative processes necessary for detecting and encoding the consistency, congruence, and coherence of information (Richter, 2015; Richter & Rapp, 2014; Singer, 2013, 2019). Considering the accuracy of information involves comparing new information with previously acquired knowledge. This process depends on readers leveraging prior knowledge (*knowledge-based validation*) and/or the underlying logic of unfolding narratives (*consistency checking*) to detect inconsistencies and inform judgments about the accuracy of information (Richter & Schmid, 2010). For example, when reading "Oslo is the capital of Finland," a reader may recognize that the statement differs from other information presented in the same context and/or from prior knowledge. Any discrepancy detected from this competing, inconsistent information might be alleviated by judging the statement as false (Baker & Wagner, 1987; Braasch & Bråten, 2017). Validation therefore involves recognizing whether information is consistent or inconsistent with what is already known and deciding what to do after a discrepancy is detected.

Validation is considered essential for successful comprehension. Failure to validate information increases the likelihood that people exposed to inaccurate content will encode it as presented, making it available for retrieval on subsequent tasks (Brashier, Eliseev, & Marsh, 2020; Rapp, 2016; Richter & Rapp, 2014; Singer, 2019), and influencing judgments and behaviors (Gerrig & Prentice, 1991; Lewis & Anderson, 1976; Marsh et al., 2003; Prentice et al., 1997). Given the frequency with which fictional materials include false claims about the real world, validation is an important element of narrative comprehension, necessary for preventing falsehoods from affecting later judgments about reality (Marsh, Butler, & Umanath, 2012; Marsh & Fazio, 2007).

Recent work has provided evidence for the idea that validation is a routine part of comprehension (Richter, 2011, 2015; Richter, Schroeder, & Wöhrmann, 2009; Singer, 2006; see Isberner & Richter, 2014a for a review). Researchers who advocate for such accounts nevertheless acknowledge that routine validation is not without challenges or limitations, sometimes failing to resolve adequately for plausible inaccuracies such as semantic anomalies (e.g., the "Moses illusion"; Erickson & Mattson, 1981; also see Hinze et al., 2014) or inaccuracies embedded in narrative contexts (Rapp, 2016; Singer, 2019; but see Fazio, Dolan, & Marsh, 2015). Validation is also less likely if the false information is difficult to detect, such as when it is a subordinate rather than central idea of a sentence (Baker & Wagner, 1987). Fortunately, in addition to routine validation, people can also engage in strategic, effortful appraisals of information (Isberner & Richter, 2014a, 2014b; Richter & Schmid, 2010; Singer, 2019). We will refer to strategic validation of information as *evaluation* to avoid confusion with routine validation processes. Many examinations of people's reliance on inaccurate information have focused on evaluation, identifying a wide variety of situations in which people do not seem to apply the necessary strategies or practices to carefully validate what they read. Researchers have therefore attempted to characterize when people are likely to evaluate information, as well as how evaluation can be encouraged.

Fostering Strategic Evaluation to Reduce Reliance on Inaccuracies

Evaluation is more or less likely to occur depending upon the goals that readers hold and enact for comprehension (Brashier et al., 2020; Rapp et al., 2014; Richter & Rapp, 2014; but see Isberner & Richter, 2014b). Activities that directly encourage evaluation, such as instructions to edit text for accuracy, usefully reduce people's reliance on inaccurate content (Rapp et al., 2014). Successful editing reduces the likelihood of encoding false content, and/or affords tagging any encoded falsehoods in memory as problematic, both of which would reduce the influence of those inaccuracies on subsequent decisions. Explicit instructions to engage in evaluation have also been successful in reducing people's susceptibility to inaccuracies (Andrews, Salovich, & Rapp, 2020; Brashier et al., 2020; Hyman, Roundhill, Werner, & Rabiroff, 2014; Wiswede et al., 2012). The accumulating evidence suggests that evaluation, instantiated through instructions or predispositions, can be usefully leveraged to reduce the problematic effects of exposure to inaccurate information.

But in many circumstances, people are not motivated to engage in evaluation, even when doing so seems obvious and useful. For example, explicit warnings that a text contains inaccuracies, which could encourage careful evaluation, have often proven ineffective at reducing people's reliance on falsehoods (Ecker, Lewandowsky, & Tang, 2010; Marsh & Fazio, 2006). Warnings on their own are not always enough to encourage evaluation, at times needing to be paired with additional motivational instructions to obtain benefits (Andrews et al., 2020; Donovan & Rapp, 2020; Marsh & Fazio, 2006; Sparks & Rapp, 2011). More substantial prompting to contemplate accuracy, for example, can help reduce people's sharing of inaccurate information online (Fazio, 2020; Pennycook, Epstein, et al., 2020). But any prompts need to be carefully designed, as drawing attention to inaccuracies without encouraging an evaluative focus has also been shown to *increase* participants' subsequent use of inaccurate content (Eslick, Fazio, & Marsh, 2011). Many projects attempting to motivate evaluation through strategic considerations have thus relied on explicit instructions, prompts, and guidance.

How can people recognize the need to evaluate content without explicit guidance or instructions to do so? One potential factor to consider are people's thoughts and beliefs related to their susceptibility to inaccurate information, as well as the utility of evaluation during reading. *Metacognition*, defined as the ability to think about and monitor one's understanding and performance (Flavell, 1979), plays a crucial role in enacting processes and strategies that underlie, inform, and support comprehension (Hofer, 2004; Hofer & Pintrich, 2001; Kitchener, 1983; Richter, 2011). Metacognition is associated with numerous self-regulatory activities relevant to evaluation, including the ability to recognize and use productive learning strategies (Buehl & Alexander, 2005; Hofer & Sinatra,

2010; Schommer, Crouse, & Rhodes, 1992), and to resolve understandings when faced with conflicting information (Abendroth & Richter, 2020; Glenberg, Sanocki, Epstein, & Morris, 1987; Maki & Berry, 1984; Otero & Kintsch, 1992; Richter & Maier, 2017). Explanations for how and when inaccurate exposures affect comprehension and decision-making have begun to reflect on barriers to enacting evaluation, including factors such as a lack of motivation to consider relevant prior knowledge, alternate perspectives, or source characteristics (e.g., Britt, Rouet, Blaum, & Millis, 2019; Pennycook, Bear, Collins, & Rand, 2020; Rapp & Salovich, 2018; Vraga, Tully, Maksl, Craft, & Ashley, 2020). As intentional, goal-driven evaluation involves processes, resources, and knowledge beyond those involved in routine reading comprehension (Abendroth & Richter, 2020; Isberner & Richter, 2014a), people's considerations about their need to evaluate during reading may be a potential locus of intervention to encourage more careful considerations of the accuracy of text content.

Using Metacognitive Reflection to Encourage Evaluative Processing

Most studies have focused on the consequences of exposure to inaccurate information rather than on people's beliefs about the likelihood that they will be affected by such exposures. These metacognitive beliefs are likely far from trivial, as people tend to hold inaccurate self-assessments of their knowledge and ability (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999). The "miscalibration" between estimated and actual task performance occurs is not only found in assessments of domain-specific knowledge (e.g., knowledge about GMOs; Fernbach, Light, Scott, Inbar, & Rozin, 2019) and skills (e.g., English grammar; Kruger & Dunning, 1999), but also in susceptibility to cognitive biases (Pennycook, Ross, Koehler, & Fugelsang, 2017, see Pronin, 2007 for a review). If people are unaware of their susceptibility to inaccurate information, it suggests that they may not engage in the self-monitoring and reflection necessary to motivate the use of strategies like evaluation. It may also help explain why some individuals rely on falsehoods despite possessing the necessary prior knowledge to discount such claims, and why interventions such as warnings might be ineffective, as they do not address people's beliefs about needing to heed those warnings.

Metacognitive reflection can be encouraged through instructional supports to help people think about and monitor their understandings (Hofer & Sinatra, 2010). These efforts leverage people's individual beliefs and backgrounds to actively encourage recognition of when, why, and how certain strategies, like evaluation, are appropriate and useful (Bransford, Brown, & Cocking, 2000). One method involves *metacognitive prompting*, which asks people to reflect on experiences and abilities that they may not have otherwise considered (King, 1991, 1992; Wong, 1985; Zohar & Barzilai, 2013). Prompts that encourage reflection on past experiences with inaccurate information may help people recognize the important role evaluation has played, or could have played, in their personal experiences. This, in turn, can motivate consideration of the accuracy of information beyond what might usually emerge during routine comprehension.

These metacognitive possibilities motivated the current project. In three experiments, participants were asked to read a fictional text in which characters stated accurate (e.g., Toothbrushing prevents gum disease) and inaccurate (e.g., Toothbrushing causes gum disease) assertions. The assertions were not integral to the story plots, but parts of mundane conversations taking place in the story. After reading, participants were asked to judge individually presented statements as true or false, with critical statements related to the assertions appearing in the previously read text. In line with previous work, we predicted that participants would make more judgment errors after reading inaccurate than accurate assertions in the preceding text, indicating an influence of the falsehoods on subsequent decisions.

In Experiment 1, we investigated people's awareness of their susceptibility to being influenced by inaccurate information. We examined the relationship between people's estimated and actual ability to discount inaccurate statements, as related to their performance on the postreading, validity judgment task. In Experiment 2, we tested whether metacognitive prompts designed to encourage evaluation would reduce reliance on previously read inaccurate claims. Experiment 3 served to replicate the effects obtained in Experiments 1 and 2 with a larger sample. Together, these experiments suggest an important role for metacognitive beliefs in both understanding and reducing people's reliance on inaccurate information.

Experiment 1

In Experiment 1, we examined people's beliefs about their ability to detect and discount inaccuracies during reading. Participants read a fictional story that included a variety of accurate and inaccurate assertions, and subsequently judged the veracity of statements related to those assertions. They were also asked to independently estimate their ability to detect and discount inaccurate information relative to others. In line with previous work, we compared people's estimations with their actual task performance to examine metacognitive awareness of their susceptibility to inaccurate information (Dunning et al., 2003; Pennycook et al., 2017). If participants are aware of their susceptibility, then their estimates should accurately and informatively predict the degree to which they are influenced by inaccurate statements. If, however, participants are unaware of their susceptibility, then we would expect to find no such relationship, or potentially even an inverse relationship with estimates associated with a greater influence of inaccuracies on the postreading judgment task (e.g., Pennycook et al., 2017).

Method

This study was evaluated as exempt by Northwestern University's Institutional Review Board (STU00206561). Study materials can be found online at osf.io/3rq46/.

Participants. We recruited participants through Amazon's Mechanical Turk (https://www.mturk.com/) and chose a target N of 115 in order to have sufficient power (85%) to detect a moderate effect size ($r = .25$). One-hundred and 16 participants (51 female) between the ages of 19 and 60 ($M = 36$, $SD = 9.17$) completed the experiment. All participants completed a CAPTCHA verification to ensure they were real people. We also protected against bots, fake accounts, and multiple submissions by ensuring participants had an MTurk approval rating at or above 95%, had completed

more than 500 tasks, and were based in the United States. All participants met the eligibility requirements of being 18 years or older, native speakers of English, and citizens of the United States. They were compensated at a rate of $7.25/hr upon completion of the experiment in accordance with the United States minimum wage at the time of data collection.

Materials. All materials were presented via Qualtrics survey software (qualtrics.com).

Story. Participants read a 19-page fictional story entitled *The Kidnapping* (Gerrig & Prentice, 1991) about a college student who falls victim to a prank played by friends. Over the course of the story, characters discuss various topics, with their conversations containing accurate and inaccurate assertions. Sixteen critical assertions were presented in conversational paragraphs of up to six sentences either in their accurate (e.g., "Wearing a seatbelt can increase your chances of living through an accident") or inaccurate forms (e.g., "Wearing a seatbelt can reduce your chances of living through an accident"). There were two versions of the story to counterbalance the accuracy of the assertions presented across participants. Excerpts of the story appear in Appendix A, and full versions are publicly available at osf.io/3rq46/.

In a previous norming study (Rapp et al., 2014), 40 undergraduate participants who were presented with both inaccurate and accurate forms of each assertion topic successfully identified the accurate assertions over 90% of the time. Because the current project recruited participants from MTurk who may differ from undergraduates in background knowledge, we renormed the materials with a sample of 40 MTurk participants (none of whom participated in the actual experiment), matching the prior norming's sample size. Participants were presented with the accurate (e.g., "Wearing a seatbelt can increase your chances of living through an accident") or inaccurate form of each assertion (e.g., "Wearing a seatbelt can reduce your chances of living through an accident") and asked to indicate whether the statement was true or false. Assertion validity was counterbalanced across participants, with half judging the accurate and half judging the inaccurate form of a given assertion, but not both. Participants correctly judged the validity of the assertions 83.13% of the time. This falls below prior undergraduate norms, but nevertheless indicates that MTurk participants are aware of the validity of the relevant assertions. It also suggests we might observe overall higher error rates in the MTurk sample given they possessed less accurate background knowledge than did the samples recruited in prior norming.

Validity judgment task. After reading the story, participants judged 32 single-sentence statements as either true or false. Sixteen of the statements pertained to the assertions in the story, and the other 16 were fillers. The validity of the critical statements was manipulated within-subjects, with eight statements presented in their accurate forms (e.g., "Wearing a seatbelt can increase your chances of living through an accident," true or false?) and eight statements in their inaccurate forms (e.g., "Wearing a seatbelt can reduce your chances of living through an accident," true or false?).

Ability estimation task. To measure estimated ability, participants were presented the following instructions:

> People encounter inaccurate information on a daily basis (in the news, from books, from one another, etc.). In the following questions, please rate your ability to detect, discount, or ignore inaccurate information that you encounter relative to the following social groups (0 = everyone is better than me, 100 = everyone is worse than me).

In this study, we only used participants' responses relative to the entire American population (i.e., "all Americans").[1] Their responses were recorded using a slider bar along a 0 to 100 continuous scale. For example, dragging the bar to 75 would indicate they believed they were superior to 75% of individuals in the American population at resisting inaccurate claims. Past research has emphasized that susceptibility to misinformation is better assessed using relative judgments (how one fares as compared with others) rather than absolute judgments (how one fares on a given task) for identifying people's acuity to detect and resist misinformation (e.g., French, Garry, & Mori, 2011). Thus, we intentionally asked participants to position themselves with a relative ranking of their ability to resist inaccurate information as compared with the population of interest.

Design. The experiment followed a fully within-subjects 2 (story assertion: accurate vs. inaccurate) × 2 (test statement: accurate vs. inaccurate) design. There were two versions of the story, each including 16 critical assertions. Eight assertions appeared in their accurate and eight in their inaccurate forms in one version, and vice versa in the other version. Assertion order was the same within and across the two story versions, which totaled 7,197 and 7,099 words, respectively. There were also two versions of the validity judgment task, which contained 16 test statements (along with 16 filler items). Eight of the critical test statements were phrased in their accurate forms (with the correct answer "true") and eight in their inaccurate forms (with the correct answer "false") in one version, and vice versa in the other version. Test statements were presented one at a time in a different random order for each participant. A Latin square design was used to create four different sets of materials with each participant presented one set.

Procedure. Each participant completed the experiment individually at their own pace. Participants were told that they would first read a story one sentence at a time, and to press the continue arrow when they were ready to begin. Participants clicked on the arrow to move from one sentence to the next. After reading the story, participants completed math problems for 7.5 min to prevent rehearsal before proceeding. Participants were then given the validity judgment task, asked "to decide whether each statement is true or false . . . according to whether or not the statement is true in everyday life." Participants selected either "TRUE" or "FALSE" by clicking on the word corresponding to their judgment. They were required to respond to all validity judgment statements before proceeding. After completing the judgment task, participants were given the ability estimation task. We asked participants for these estimates near the end of the experiment as past work suggests confidence judgments can change subsequent processing strategies and performance (Double & Birney, 2019). Asking after the judgment task was completed helped to avoid encouraging special strategies that could emerge after con-

[1] Participants were also asked to compare themselves to their peers, their family, all Republicans, and all Democrats. Because we were interested in how participants believed they would perform as compared with the larger population from which the current sample was drawn, we restrict our analyses here to the American population comparison group. Estimations made relative to the other four social groups will not be discussed further.

sidering one's ability. Finally, participants completed a demographic questionnaire and were debriefed.

Results

To examine the influence of the story content on the validity judgment task, we analyzed participants' accuracy in judging each of the 16 critical assertions as a function of the information they read in the story. Incorrect judgments were defined as instances in which participants marked inaccurate test statements as true and accurate test statements as false. As we were particularly interested in judgment errors, incorrect judgments were coded as 1 and correct judgments as 0. Analyses were conducted using mixed effect modeling in the R packages lme4 (Bates, Maechler, Bolker, & Walker, 2015) and lmertTest (Kuznetsova, Brockhoff, & Christensen, 2017) with subjects and assertions as random intercepts. This simultaneously accounted for variance due to random selection of participants and random selection of items, precluding the need to run separate analyses (Richter, 2006). Assertion accuracy was contrast coded −.5 for true assertions and .5 for false assertions, as we predicted participants would make more incorrect judgments after reading false versus true assertions.

Influence of story content on judgment errors. Error rates for statement judgments are summarized in Table 1. On average, participants made incorrect judgments 23.98% of the time (SD = 17.05). Replicating previous findings, participants made approximately three times as many incorrect judgments after having read inaccurate assertions (M = 35.99%, SD = 19.93) as compared with after reading accurate assertions (M = 11.96%, SD = 14.22), b = 1.58, $z(1856)$ = 12.18, $p < .0001$.

Estimated resistance to inaccurate information. We next examined whether participants' relative judgments of their susceptibility to inaccurate information were related to their actual performance on the validity judgment task. Participants' estimated susceptibility to inaccurate information was captured through their self-reported percentile rank of their ability to detect, discount, and ignore inaccurate information as compared with all other Americans. On average, participants estimated that they would be better than 70.26% (SD = 13.33) of all Americans at discounting inaccuracies. We ran a generalized linear mixed model (GLMM) using estimated resistance to predict judgment errors made after viewing inaccurate assertions in the narrative. As opposed to judgment errors in general, errors made after exposure to inaccuracies specifically indexes people's reliance on inaccurate information. Interestingly, higher estimated resistance to inaccurate information was actually related to more inaccurate responses, b = .01, $z(928)$ = 1.76, p = .08. That is, people who estimated they would be better at detecting and discounting inaccurate information actually made more judgment errors after reading false content than those who reported lower self-estimates.

Table 1
Mean Error Rates for Experiments 1, 2, and 3

Experiment	Accurate in story	Inaccurate in story
Experiment 1	.12 (.14)	.36 (.20)
Experiment 2		
Reflection	.13 (.13)	.16 (.13)
No-reflection	.12 (.13)	.36 (.23)
Experiment 3		
Reflection	.18 (.19)	.24 (.20)
No-reflection	.27 (.22)	.33 (.21)

Note. Numbers in parentheses are standard deviations.

Discussion

Participants' judgments were influenced by the inaccurate information they previously read in the story. They made three times as many judgment errors after reading the inaccurate version of an assertion as compared with after reading the accurate version, offering a direct replication of previous findings using the same materials (Donovan, Theodosis, & Rapp, 2018; Gerrig & Prentice, 1991; Rapp et al., 2014; Salovich, Donovan, Hinze, & Rapp, 2020).

Moving beyond this necessary replication, we examined participants' self-appraisals of their ability to detect, discount, or ignore inaccurate information, and related this to their performance on the judgment task. Overall, people overwhelmingly believed that they would be better than the average American at detecting and resisting the influence of inaccurate information; out of 116 respondents, only five reported that they would be below the 50th percentile (over 95% believing they are above average for Americans). This finding could be a demonstration of the "better-than-average" (BTA) effect, wherein most people believe that they are better and that they do better than the average person (Brown, 1986; Krueger & Mueller, 2002). It is important to note, however, that our sample could in fact be "better than average" on this task; MTurkers do differ in noteworthy ways from the general American population (e.g., are on average younger; Ross, Irani, Silberman, Zaldivar, & Tomlinson, 2010). So while it is logically impossible for *most* people to be better than the average person (and, consequentially, could be interpreted as a sign of overconfidence), many are indeed above average, and our sampled participants could potentially be drawn from that group. Thus, we found it more appropriate to assess people's awareness on this task by comparing their estimated susceptibility to inaccurate information with the actual amount of errors they produced on the validity judgment task. This allowed for calibration to be compared within subjects rather than to a predicted population parameter.

Based on this analysis, people did not demonstrate awareness of their susceptibility to inaccurate information, as their self-estimates were not calibrated with their performance on the judgment task. If anything, participants who were most confident in their resistance to inaccurate claims were the most likely to be influenced by those claims. This pattern of results suggests that participants lack metacognitive awareness of their ability to avoid the problematic effects of exposures to inaccurate content. It highlights the possibility that people may not be effectively monitoring and/or contemplating their susceptibility to inaccurate information, and as related, the utility of engaging in evaluation while reading. This could directly relate to the failures reported in many efforts to reduce people's reliance on false information.

With this in mind, we next assessed whether prompting metacognitive reflection could be effective at reducing the influence of inaccurate text content. Individuals who engage in more regular reflections of their knowledge and abilities are more likely to enact efficient and effective processing strategies to support judgments and decisions (Dunlosky & Lipko, 2007; King, 1992; Nelson &

Dunlosky, 1991). In the context of the current project, reflecting on one's susceptibility to inaccurate information may lead to greater evaluation of the accuracy of text content. This could encourage people to discount inaccuracies when they encounter them, or avoid considering that information on subsequent, related tasks. In Experiment 2, we examined whether metacognitive reflection could benefit performance on the judgment task used in Experiment 1 and in previous work.

Experiment 2

People appear to be unaware of their susceptibility to inaccurate information. In Experiment 2, we attempted to encourage metacognitive reflection about their susceptibility to inaccurate information as a means of supporting evaluation. To do this, we appealed to research in metacognition in which participants are prompted to reflect on their abilities and understandings to motivate the use of effective processing and evaluation strategies.

The purpose of metacognitive prompts is to encourage self-reflection and self-monitoring that may not otherwise occur. Reflection before or during cognitive tasks can support contemplations about when and how to adopt useful learning goals and strategies (Baker & Brown, 1984; King, 1991, 1992; Wong, 1985). This has proven effective in a variety of situations and domains including but not limited to math and problem solving (e.g., Zohar & Barzilai, 2013). One recent study, for example, showed that metacognitive reflection can help readers recognize and overcome biases associated with evaluating the accuracy of information, thus improving comprehension of multiple, conflicting texts (Abendroth & Richter, 2020). Metacognitive reflection has not yet, however, been tested with respect to people's exposures to inaccurate information.

In Experiment 2, we presented participants with metacognitive reflection prompts asking them to contemplate instances in which they have encountered and used inaccurate information in their own lives. We also asked them to generate ideas about how they could be more evaluative when reading to avoid being influenced by inaccuracies in the future. The goal was to encourage participants to consider past experiences that would motivate them to engage in evaluation while reading. To test the results of these encouragements, we used the same text and judgment task as in Experiment 1, with a new sample of participants, half of whom were assigned to engage in metacognitive reflection. This reflection required participants to answer open-ended, task-specific metacognitive prompts prior to text exposure (e.g., When was the last time you remember relying on inaccurate information while reading?), coupled with metacognitive reminders to consider prior knowledge while reading (e.g., Sparks & Rapp, 2011). Given its previous success in motivating task-related learning strategies, we predicted that participants who received metacognitive reflection prompts and reminders would make more accurate validity judgments than would participants who did not.

Method

Participants. Based on the size of past samples used to test the effectiveness of interventions with these same materials (e.g., Donovan et al., 2018; Rapp et al., 2014), 76 participants (34 female, one did not disclose), aged 20 to 56 (M = 33.78, SD = 8.77) completed the experiment via Amazon Mechanical Turk, none of whom participated in Experiment 1. They were randomly assigned to one of two groups, either receiving metacognitive prompts prior to and during reading, or not receiving any prompts. All participants were adult, native-English speakers naïve to the purpose of the experiment, and recruited based on the same criteria as in Experiment 1.

Materials. The same materials were used as in Experiment 1. Participants assigned to the no-reflection group completed the same task as in Experiment 1. Participants assigned to the metacognitive reflection group were presented five prompts prior to reading the text, designed to guide thinking about their experiences with inaccurate information (see Appendix B). They were instructed to provide an open-response answer to each prompt (two to three sentences; 100 minimum characters required). They were also interrupted during reading with reminders to consult their prior knowledge (i.e., "Remember to consult what you already know while reading!") via a textbox that appeared on the screen, and required to press a button ("Okay!") to return to the story. These reminders were interspersed across the text, always presented immediately before the critical assertions but without interrupting the current character's dialogue. We again asked participants to estimate their abilities to detect and discount inaccuracies as compared to all Americans, with the phrasing of instructions identical to Experiment 1.

Procedure. The procedure was identical to Experiment 1 with the following change: Participants specifically assigned to the metacognitive reflection group also completed the metacognitive reflection prompts prior to reading, presented in a vertical list format in the same order (see Appendix B). A blank text box was positioned beneath each prompt for subjects to enter their response. These responses were not analyzed. Participants in the metacognitive reflection condition also received periodic interruptions with the reminder detailed above.

Design. The experiment used a 2 (story assertion: accurate vs. inaccurate) × 2 (test statement: accurate vs. inaccurate) × 2 (reflection: metacognitive reflection vs. no-reflection) mixed design, with assertion and statement manipulated within-subjects, and reflection manipulated between-subjects. Each participant was presented one of the four counterbalanced sets of materials.

Results

Participants' accuracy on the judgment task was examined using the same GLMM equation and coding scheme as Experiment 1. We added the between-subjects predictor of "reflection condition" contrast coded as .5 for the no-reflection condition and −.5 for the reflection condition, in accordance with a predicted reduction in error rates for the latter group. We also included the story accuracy by reflection condition interaction term as a fixed effect.

Influence of story content on judgment errors. Error rates for statement judgments are summarized in Table 1 and Figure 1. Overall, participants made incorrect judgments 19.48% of the time (SD = 16.92). Participants again made more judgment errors after reading inaccurate (M = 26.38%, SD = 21.00) than accurate assertions (M = 12.56%, SD = 12.84), b = 1.02, $z(1196)$ = 5.92, $p < .0001$. Participants also overall made more judgment errors in the no-reflection (M = 24.01%, SD = 12.63) as compared with the reflection condition (M = 14.80%, SD = 9.43), b = .52,

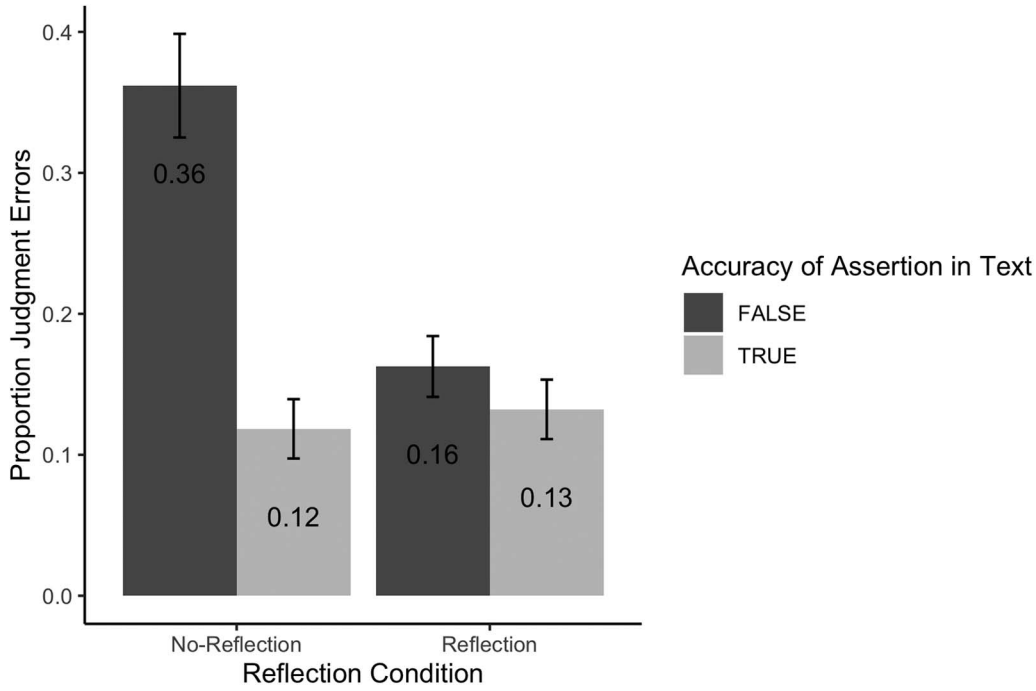

Figure 1. Proportion of incorrect judgments to test statements after reading related accurate or inaccurate assertions in the text in Experiment 2. Error bars represent standard error.

$z(1196) = 2.66$, $p = .008$. These effects were qualified by a story accuracy by reflection interaction, $b = 1.54$, $z(1196) = 4.47$, $p < .0001$, with the difference in judgment errors observed after reading inaccurate versus accurate story assertions attenuated in the reflection condition, *Mean Difference* = .24, $b = .43$, $z(588) = 1.11$, $p = .27$, as compared with the no-reflection condition, *Mean Difference* = .03, $b = 1.62$, $z(608) = 6.20$, $p < .001$.

Estimated resistance to inaccurate information. As in Experiment 1, participants were overall confident in their ability to resist inaccurate information, estimating they would better on average than 69.20% of all Americans at detecting and discounting inaccurate information. Similar estimates emerged across conditions: Participants in the metacognitive reflection condition reported they would be better than 68.19% (*SD* = 20.09) of all Americans, and participants in the no-reflection condition reported they would be better than 69.66% (*SD* = 13.88) of all Americans at discounting inaccuracies, $p > .05$.

We were again interested in how participants' estimated ability to resist inaccuracies related to the actual influence of previously read inaccuracies on subsequent judgments, and whether calibration differed between the reflection conditions. We used a GLMM to predict people's incorrect judgments after exposure to inaccuracies by reflection condition (contrast coded), estimated resistance, and the interaction term as fixed effects. Neither reflection condition, $b = -.05$, $z(599) = -.05$, $p = .96$, nor estimated resistance $b = .01$, $z(599) = 1.65$, $p = .10$, was related to judgment errors. The reflection condition by estimated resistance interaction also was not significant, $b = .02$, $z(599) = 1.13$, $p = .26$ (see Figure 2).

Discussion

Replicating Experiment 1, participants made more postreading judgment errors after reading inaccurate as compared with accurate assertions. This pattern, though, was not uniform across all participants. Participants who received metacognitive prompts, intended to encourage consideration of previous experiences with inaccurate information and the need to carefully evaluate what was read, showed clear differences in their judgment errors (a mean of 14.80% for participants in the metacognitive reflection condition as compared to a mean of 24.01% for participants in the no-reflection condition). This difference was even more robust when considering errors made specifically after reading corresponding inaccurate assertions in the text (a mean of 16.27% in the metacognitive reflection condition as compared to a mean of 36.18% in the no-reflection condition). Participants who received prompts made less than half as many judgment errors as participants who did not. This is noteworthy given that attempts to reduce people's reliance on inaccurate information have often proven ineffective (e.g., Donovan et al., 2018; Eslick et al., 2011; Marsh & Fazio, 2006). Unlike previous projects, targeting people's thoughts and beliefs about their susceptibility to inaccurate information reduced the influence of falsehoods on subsequent judgments. These results demonstrate the importance of metacognitive considerations for people's responses to, and with respect to the influence of, inaccurate information.

At the same time, the relationship between participants' estimated and actual resistance to inaccurate information was less straightforward. Overall, neither reflection condition nor participants' self-estimates were related to judgment errors when con-

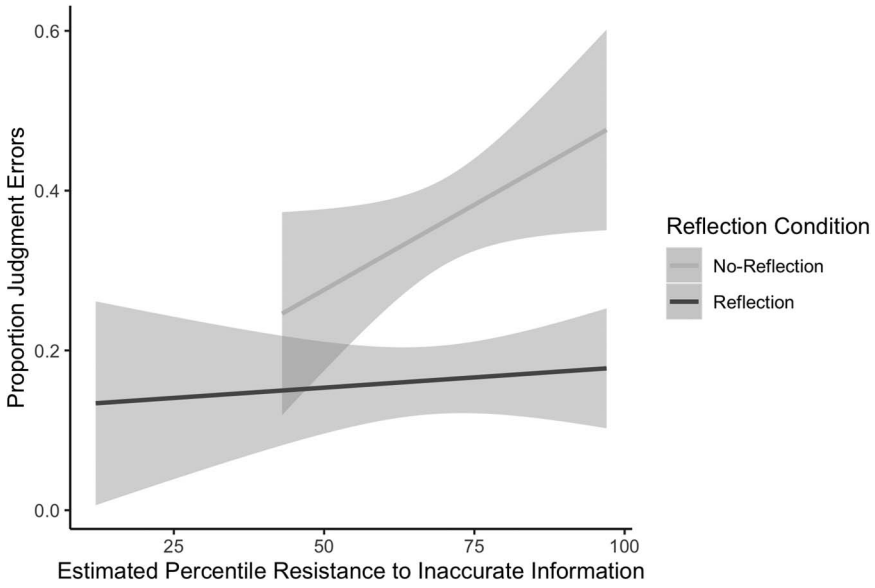

Figure 2. Relationship between participants' estimated relative resistance to inaccurate information and the proportion of incorrect judgments made at test as a function of reflection condition in Experiment 2. The two lines represent the reflection conditions.

trolling for the other condition and estimates, respectively. While metacognitive reflection was effective at encouraging evaluation (thus, resulting in fewer judgment errors), it is unclear whether reflection improved people's metacognitive awareness of their susceptibility to inaccuracies. Despite Experiment 2 being sufficiently powered to measure the effect of the intervention, it was underpowered with respect to detecting the correlational effects previously observed in Experiment 1. In Experiment 3, we substantially increased the number of participants to suitably examine the effect of metacognitive reflection on the calibration between estimates and actual performance, and as an additional test of the benefits associated with the reflection task.

Experiment 3

A power analysis assuming $r = .19$, $\alpha = .05$, and power = .85 indicated that a replication of the relationship between estimated and actual ability obtained in Experiment 1 required a sample size of 246 participants. However, unlike Experiment 1, Experiment 3 utilized two reflection conditions (as in Experiment 2), and thus we doubled the sample size and recruited 495 participants. This allowed us to examine differences in judgment errors between reflection conditions, and further test for differences in the relationship between estimated and actual ability as a result of those conditions.

Participants in Experiment 2 not only received metacognitive prompts prior to reading, but also intermittent reminders to consider their prior knowledge while reading the text. Recent research suggests that intermittent interruptions during reading do not, on their own, reduce the consequences of exposures to inaccuracies (Donovan et al., 2018). Also, explicit instructions to draw upon prior knowledge before reading has failed to reduce reliance on inaccuracies (Fazio et al., 2013; Rapp, 2008). As such, in an effort to isolate the effects of metacognitive reflection *prior* to reading, we removed the intermittent reminders.

We predicted that participants in the metacognitive reflection condition would make fewer postreading judgment errors than would participants in the no-reflection condition, as observed in Experiment 2. We also aimed to more thoroughly investigate the effects of metacognitive reflection on calibrating people's estimated and actual susceptibility to inaccurate information. If the metacognitive intervention targets people's understandings of their susceptibility to inaccurate information, participants in the reflection condition should be more aware of their susceptibility to inaccurate information than would participants in the no-reflection condition. In other words, estimates would be more accurately predictive of actual errors produced for those who have reflected on past experiences with inaccuracies versus those who had not.

Method

Participants. Four-hundred and 95 participants (194 female, three did not disclose, two reported another gender), aged 18 to 70 ($M = 34.79$, $SD = 9.83$), were recruited from Amazon Mechanical Turk, none of whom participated in the previous experiments. Participants were randomly assigned to either the reflection or no-reflection condition. All were adult, native-English speakers naïve to the purpose of the experiment, recruited based on the same criteria as in the previous experiments.

Materials, procedure, and design. The same materials, procedure, and design were used as in Experiment 2, except participants in the reflection condition were not presented intermittent reminders to consider prior knowledge while reading.

Results

Participants' accuracy on the judgment task was examined using the same GLMM equation and coding scheme as in Experiment 2.

Influence of story content on judgment errors. Error rates for statement judgments are summarized in Table 1 and Figure 3.

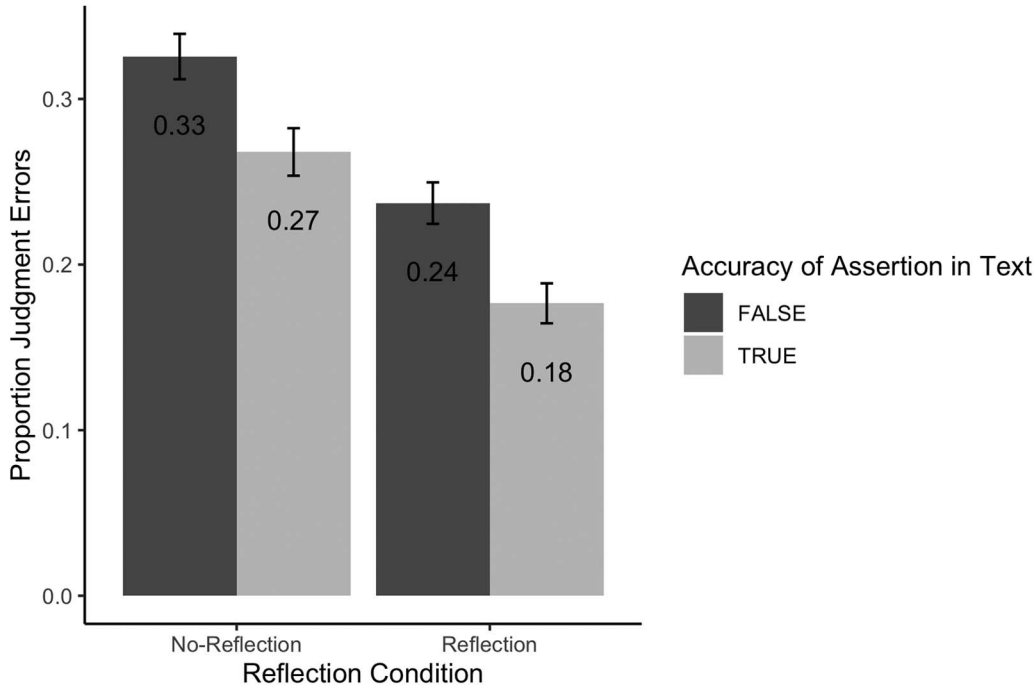

Figure 3. Proportion of incorrect judgments to test statements after reading related accurate or inaccurate assertions in the text in Experiment 3. Error bars represent standard error.

Participants made incorrect judgments 25.10% of the time (SD = 21.17). They again made more judgment errors after reading inaccurate (M = 28.06%, SD = 21.07) as compared with accurate (M = 22.15%, SD = 21.26) information in the text, b = .39, $z(7920)$ = 6.84, $p < .0001$. Also replicating Experiment 2, participants in the reflection group (M = 20.68%, SD = 15.68) made fewer judgment errors than did participants in the no-reflection group (M = 29.68%, SD = 18.60), b = .55, $z(7920)$ = 5.87, $p < .0001$. There was no interaction, $b = -.10$, $z(7982) = -.88$, p = .38.

Estimated resistance to inaccurate information. Participants in Experiment 3 reported being on average better than 67.88% of all Americans. A related intriguing finding suggestive of reflection benefits was that the estimates of participants in the no-reflection condition were significantly higher (M = 69.94%, SD = 20.78) than those of participants in the reflection condition (M = 65.81%, SD = 21.12), $t(492.79) = 2.20$, $p = .02$.

We next examined the relationship between people's estimated and actual reliance on previously read inaccuracies, and whether calibration differed between the reflection conditions. We ran a GLMM predicting people's incorrect judgments after reading inaccuracies with reflection condition (contrast coded), estimated resistance, and the interaction term as fixed effects. Overall, greater estimated resistance to inaccurate information resulted in fewer judgment errors, $b = -.004$, $z(7920) = -2.13$, $p = .03$. This was qualified by a significant reflection by estimated resistance interaction $b = .02$, $z(3960) = 2.72$, $p = .007$. Participants in the reflection condition were significantly more accurate in estimating their resistance to inaccurate information, $b = -.01$, $z(2016) = -20.24$, $p < .001$, than were participants in the no-reflection condition, $b = 0.00$, $z(1944) = 1.04$, $p = .30$, in which no relationship between estimated and actual performance was observed (see Figure 4).

Discussion

As in Experiments 1 and 2, participants' postreading judgments reflected an influence of previously encountered inaccurate information. Overall, participants made more errors on the validity judgment task after reading inaccurate as compared with accurate assertions. But participants who engaged in metacognitive reflection made fewer judgment errors than did participants in the no-reflection condition, as previously observed in Experiment 2. This replicates the finding that metacognitive reflection prior to reading effectively reduces reliance on inaccurate information, this time without the use of intermittent reminders.

While participants in both conditions reported that they would be better than the average American as resisting inaccurate information, participants in the reflection condition offered more conservative estimates. One possible interpretation of this finding is that engaging in reflection may have helped participants realize they are more susceptible to being influenced by inaccuracies than they might have otherwise thought. More importantly, calibration between estimated and actual resistance to inaccurate information was greater in the reflection condition than in the no-reflection condition. In fact, rather than an inverse relationship between estimated resistance and judgment errors as was found in Experiment 1, Experiment 3 revealed *no* relationship in the no-reflection condition between participants' estimates and their actual reliance on inaccuracies. It is entirely possible that Experiment 3 simply failed to replicate the inverse relationship between estimated and actual resistance obtained in Experiment 1. However, we take the

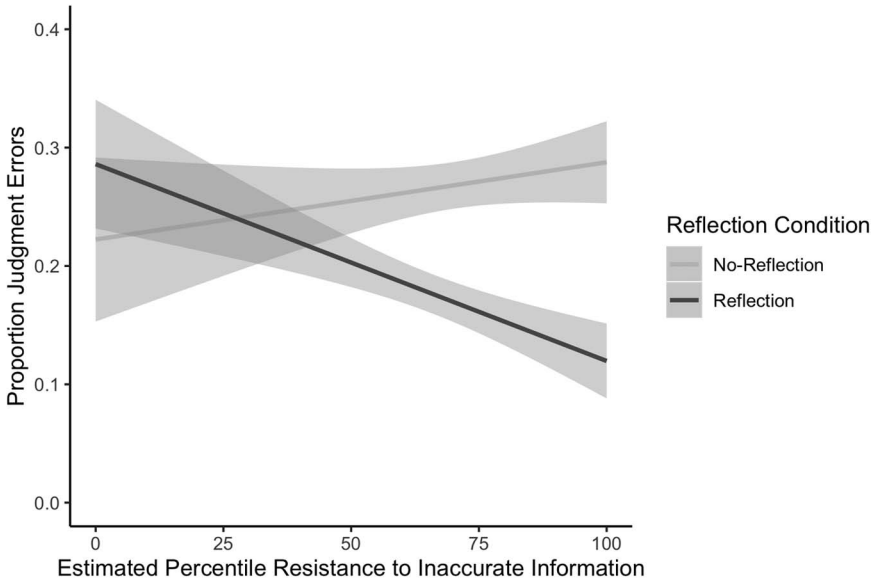

Figure 4. Relationship between participants' estimated relative resistance to inaccurate information and the proportion of incorrect judgments made after reading inaccurate statements in Experiment 3. The two lines represent the reflection conditions.

greater power associated with the findings of Experiment 3 to suggest that if such a relationship exists, it may be weak, and that there is greater evidence to conclude that people more generally are unaware of their susceptibility to the influence of inaccurate content. Only after engaging in metacognitive reflection were participants' estimates calibrated with performance, suggesting reflection made them aware of their susceptibility to inaccuracies.

General Discussion

Previous research has consistently demonstrated the problematic consequences of exposure to inaccurate information for people's subsequent judgments. The current project investigated the role of metacognitive considerations in reliance on and resistance to inaccurate information. Across three studies, participants made more errors in judging validity of statements after previously reading inaccurate as compared with accurate assertions related to those statements. The experiments provide a direct replication of past research demonstrating the influence of false information on people's judgments and beliefs (Appel & Richter, 2007; Donovan et al., 2018; Gerrig & Prentice, 1991; Marsh et al., 2003; Rapp et al., 2014; Salovich et al., 2020). We additionally examined people's awareness of their susceptibility to inaccurate information by comparing their self-reported estimated resistance to the actual effects that exposure to inaccuracies had on postreading judgments. In Experiment 1, participants inaccurately predicted the degree to which they would be influenced by falsehoods. There was actually a slight inverse relationship between estimates and actual performance, with people who were most confident making more rather than fewer judgment errors after inaccurate exposures.

As participants appeared to less than effectively identify their susceptibility to inaccuracies, in Experiment 2 we introduced metacognitive prompts to help readers reflect on their past experiences with inaccuracies and the benefits of evaluation. The prompts drew participants' attention to previous instances in which they had been influenced by inaccurate information, and to the need to consult prior knowledge to scrutinize what is read. Contemplating these prompts was intended to encourage reflection and evaluation during reading. Postreading judgments were again influenced by previous exposure to inaccuracies, but the prompts improved performance. Participants who received metacognitive prompts were less likely to make judgment errors after reading inaccuracies than were participants who did not receive prompts.

Experiment 3 replicated these results with a larger sample, and helped clarify the effects of metacognitive reflection on calibration between estimated and actual performance. As in Experiment 2, participants prompted to engage in metacognitive reflection made fewer judgment errors than did participants who did not receive such prompting. As expected, participants in the no-reflection condition showed no relationship between their estimated and actual resistance to inaccurate information. However, participants in the reflection condition showed better calibration between their estimated and actual resistance, as higher estimated resistance was now associated with fewer judgment errors.

The benefits associated with the reflective prompts suggest metacognitive considerations can play an important role in people's experiences with inaccurate content. Asking participants to reflect on their past experiences with inaccurate information reduced the problematic effects of exposures, with participants making fewer judgment errors as compared to when reflection was not prompted. Reflection also helped participants calibrate the estimated effects and actual consequences of inaccurate exposures, as shown in Experiment 3. Appealing to people's metacognitive considerations appears to motivate more careful consideration of the accuracy of information, and also potentially increase awareness of potential effects of inaccurate exposures.

Theoretical Implications

A growing body of work demonstrates that evaluation is integral for overcoming the influence of inaccurate information. For example, activities that explicitly require people to consider the validity of statements and claims, such as tasking participants to correct text content as they read, or requiring them to explicitly judge whether information is true as they read it, reduce the likelihood that false information will affect later judgments (e.g., Brashier et al., 2020; Rapp et al., 2014; Richter & Rapp, 2014). Without explicit instructions and guidance, evaluation does not seem to occur routinely during comprehension, or if enacted, does not necessarily resolve effectively (Isberner & Richter, 2014a; O'Brien & Cook, 2016; Richter, 2015; Singer, 2006, 2019; Weil, Schul, & Mayo, 2020). Deliberate, motivated intentions and supports for contemplating the validity of information are necessary to overcome the effects of inaccurate exposures (Donovan & Rapp, 2020), given that people may not regularly enact such evaluations.

Several accounts acknowledge potential differences in how deeply people engage with information while reading. For example, the standards or goals that readers might establish for comprehension can help direct whether sufficient understanding has been achieved before continuing through a text (O'Brien & Cook, 2016; van den Broek, Risden, & Husebye-Hartman, 1995; van den Broek, Bohn-Gettler, Kendeou, Carlson, & White, 2011). A reader with *low* standards of coherence, for example, may not prioritize the detection or resolution of text inconsistencies (Albrecht & O'Brien, 1993), or effectively resolve discrepancies between text content and prior knowledge (Rapp, 2008; Rapp & Salovich, 2018). Likewise, people may or may not adopt the explicit goal of evaluating the accuracy of information based on factors such as the source of the claims or the context in which the information is presented (Andrews & Rapp, 2014; Hinze et al., 2014; Maier & Richter, 2016; Richter & Schmid, 2010; Sparks & Rapp, 2011). People clearly vary in both the depth and frequency with which they evaluate content, and not just as a function of potential processing predilections or differences, but also as a function of the contingencies and goals of their diverse information experiences.

The current project provides additional considerations for these accounts, demonstrating that people generally lack awareness of their susceptibility to inaccurate information. Across all three experiments, participants who were not tasked with reflection were less accurate at estimating the extent to which they would be influenced by reading false information. Additionally, participants generally reported they would be better than the average American at detecting and discounting inaccuracies while reading, adding to the already large number of contexts in which people perceive themselves to be better than average at various skills and aptitudes (Brown, 1986; Krueger & Mueller, 2002). Whether or not the sampled participants here were actually above average at this task, these responses align with the growing number of documented cases wherein people view themselves as less susceptible to biases as compared with others (for review, see Pronin, 2007). The effects reported here also align with studies that suggest comprehension processes and outcomes benefit from metacognitive awareness and reflection (Glenberg et al., 1987; Maki & Berry, 1984; Nelson & Dunlosky, 1991; Otero & Kintsch, 1992; Richter & Maier, 2017). Asking people to consider how inaccurate exposures could have problematic consequences for their own performance, and how evaluation might support performance, was useful for overcoming the effects of reading false claims.

Models that outline the processes underlying readers' detection and evaluation of inaccurate information (e.g., D-ISC, Braasch & Bråten, 2017; RIVal, -Cook & O'Brien, 2014) have largely disregarded or underplayed people's metacognitive considerations with respect to the likelihood they will engage in such behaviors. These models have tended to focus on text features and prior knowledge as crucial for detecting and acting on inaccuracies and discrepancies. The current findings emphasize the crucial role that beliefs about ability, skill, and learning practices also play in considering when and whether people scrutinize information. There is general agreement that people's beliefs underlie the approaches and practices they apply during comprehension, although work has focused less on how these beliefs might guide the application of comprehension processes and goals (e.g., O'Brien & Cook, 2016; Singer, 2019; van den Broek et al., 2011). A focus on metacognitive considerations affords one way for beliefs to usefully inform accounts of the ways in which readers process, evaluate, and use text content.

Furthermore, the benefits of metacognitive reflection that were obtained in Experiments 2 and 3 suggest a potential explanation for why previous attempts to reduce reliance on inaccuracies have often been ineffective (Donovan et al., 2018; Eslick et al., 2011; Fazio et al., 2013; Jalbert, Newman, & Schwarz, 2019; Marsh & Fazio, 2006; Rapp, 2008). These interventions may have failed to sufficiently motivate readers to engage in strategic, effortful evaluations of content (Andrews et al., 2020; Richter, 2015). People may not only need to acknowledge the potential for inaccuracies and possess the knowledge to detect them, but also realize that it is useful and necessary to monitor and evaluate information. Merely warning readers about inaccurate content can prove ineffective precisely because people may not elect to heed those warnings, or to value them as beneficial for engaging with information (e.g., Fazio et al., 2013). This is in contrast to the metacognitive prompts used here which required participants to reflect on their own experiences with inaccurate information, which may offer more convincing motivation to enact goals and strategies aligned with evaluation.

While the current experiments provide a basis for understanding the role of metacognition with respect to the influence of inaccurate information, future work is needed to test and corroborate these findings. For example, more research is needed to elucidate the mechanisms by which metacognitive factors might influence people's reliance on inaccurate content. One possibility is that metacognitive cues, such as the reflection prompts here, could serve as directive instructions to consider the accuracy of information, without necessarily impacting people's beliefs about their own evaluative predilections and susceptibilities. Another possibility is that the benefits of metacognitive reflection could engage people's beliefs about their susceptibility to inaccurate information, with resulting effects on their decisions about when and how to evaluate information. The findings discussed here leave open the possibility of whether benefits are due to metacognitive prompts directly influencing evaluation, or influencing evaluation through considerations of how one has and should respond to inaccuracies. The benefits observed as a function of the prompts

suggest these mechanistic possibilities should be foregrounded and contrasted in future work.

In addition to the correlational relationships between people's actual and estimated resistance to inaccuracies examined here, projects should attempt to identify causal relationships between confidence and reliance on false content. Direct manipulations of people's beliefs about their susceptibility would allow for stronger conclusions about the effects of metacognitive considerations, and help rule out other factors that could explain any observed effects (e.g., differences in actual knowledge). To do this, participants could receive direct feedback with respect to their susceptibility to inaccurate information on a different, prereading task. Depending on the direction of the feedback (i.e., positive or negative), people may be more or less inclined to adopt evaluative goals while reading. This would help establish whether judgments of confidence are directly linked to people's interactions with and responses to inaccuracies, as is intriguingly suggested by the associations present in the current findings.

Future work should also consider how metacognitive judgments affect not just the offline consequences of reading false content, but also online measures including reading times (Rapp, 2008) or validation tasks (e.g., Isberner & Richter, 2014b). These methods could reveal the moment-by-moment mechanisms involved in processing, recognizing, and integrating inaccurate contents into mental representations as derived from discourse contexts and real-world understandings (Rapp & Mensink, 2011). All of these possible projects would help refine accounts of the metacognitive considerations that underlie diverse comprehension experiences but that, again, have been largely ignored with respect to inaccurate information experiences (but see Salovich et al., 2020, for an empirical examination involving different materials, contexts, and tasks as related to considerations of metacognitive control).

Practical Implications

The results of Experiments 2 and 3 suggest that targeting people's understandings about their ability to evaluate, and elucidating the benefits of engaging in evaluations, can usefully reduce the effects of inaccurate exposures on subsequent judgments. This is timely given increasing concern over the intuitive allure and popular coverage of inaccurate information. Falsehoods propagated by media outlets, friends, and even educators can have real, negative consequences. People have been shown to reproduce false claims delivered across a range of discourse experiences, including film presentations (Butler, Zaromb, Lyle, & Roediger, 2009), collaborative interactions (Andrews & Rapp, 2014), and news reports (Pennycook, Cannon, & Rand, 2018). Determining methods for encouraging critical evaluation of information proves crucially important, as false information appears to spread faster and wider than real news (Vosoughi, Roy, & Aral, 2018).

At the same time, completely eliminating false information from our everyday lives would be an impossible task, and even undesirable from the perspective of entertainment industries like film production and popular fiction. This necessitates the development and testing of practical approaches to help people routinely engage in evaluation, as explicit prompts to evaluate content may not always be feasible or available. Social media platforms and supporting organizations have introduced warning labels with the goal of tagging potential misinformation, although in some instances the warnings have encouraged shares and likes (Gao, Xiao, Karahalios, & Fu, 2018; Lyons, 2017). Similar effects have been demonstrated in empirical projects (Marsh & Fazio, 2006), sometimes even having effects on untagged, proximal information (Pennycook, Bear, et al., 2020). Self-monitored, metacognitive prompting may provide a more useful tool for supporting information gathering behaviors (Baker & Brown, 1984; Hodgin & Kahne, 2018; Zohar & Barzilai, 2013). Advocates have also called for integrating metacognitive approaches into media literacy education, with specific applications to combat exposures to mis- and disinformation (Hodgin & Kahne, 2018; Vraga et al., 2020). Experiments 2 and 3 empirically demonstrate that encouraging evaluative practices can be beneficial in this vein.

The current project exposed participants to inaccuracies in a fictional context. We chose this design given the regularity with which inaccuracies appear in stories, and more practically, as a means of including multiple inaccurate and accurate assertions in a single experimental session (Gerrig, 1993; Rapp, 2008). These materials differ from the expository texts and presentations traditionally invoked in popular discussions about misinformation and "fake news." The genre difference here is worth acknowledging, but we argue it nevertheless foregrounds an important general set of effects, considering that research on metacognitive interventions using expository materials (e.g., biology and physics curricula) has demonstrated broad success in traditional learning environments (e.g., Wong, 1985; Zohar & Barzilai, 2013). So while the metacognitive considerations offered here exhibited success with stories, we believe it reasonable to expect similar benefits would emerge across a range of text types. The general issue involves determining how to encourage evaluation when it is relevant and useful.

Nevertheless, future work should evaluate the utility of metacognitive interventions for different kinds of discourse experiences, as well as identify precisely which aspects of the interventions are required to elicit benefits. For example, recent projects indicate that asking participants to pause and explain why a news headline is true or false reduced their intentions to share false information (Fazio, 2020). Pauses on their own have not proven particularly effective at reducing inaccurate reproductions (Donovan et al., 2018), but seem more useful when paired with guidance for evaluative contemplation. Using interruptions to motivate reflection or consideration of one's own knowledge and ability may be usefully implemented in future investigations, including tests of when they should be delivered for optimal benefit.

We also believe it would be useful to characterize how metacognitive considerations are related to people's diverse decisions about how they use information, including conveying it to others (Fazio, 2020; Pennycook & Rand, 2019). For example, metacognitive reflection may prove useful in addressing people's inclinations to repeat and disseminate inaccurate facts and assertions, even when doing so is not intended to inform but rather to entertain (e.g., retweeting a false claim because it is ridiculous; posting or sharing inaccurate content to gain likes). The long-term effects of potential interventions also need to be examined. The current findings suggest that reflections intended to encourage evaluation may curb the detrimental effects of exposures to inaccuracies as measured in the short-term. Helping people understand the importance of evaluation while reading can prove useful, particularly if

it encourages the continued use of strategies that support deliberate, thoughtful interactions with information.

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(*Appendices follow*)

Appendix A

Sample Assertions and Questionnaire Items from Experiments 1 and 2

Sample Item 1: Tooth Brushing and Gum Disease

Accurate story version:

"That's unfortunate," said Abrams. "Americans don't brush their teeth nearly enough—in the long-run it's going to do us a great deal of harm." "Is this another part of your doctor's new fitness regime?" Brad asked, with more than a hint of sarcasm. "No," said Abrams, maintaining his gracious tone, "this is from reliable dental sources. It was widely reported. There was a big article in the newspaper a couple of weeks ago. Do you ever read the paper?" Dane grinned, and Brad groaned. "I did when I was a free man. But I don't remember any toothbrushing article. What did it say?" "Well it turns out that most people aren't brushing often enough, and even fewer are flossing like they should. Americans brush their teeth on average 1.3 times a day, when it's recommended that you should brush your teeth after every meal. That's why so many people are having problems with their gums. Anyway, that was the point of the article: frequent toothbrushing prevents gum disease."

Inaccurate story version:

"It's just as well," said Abrams. "Americans brush their teeth too much—in the long-run it's going to do us more harm than good." "Is this another part of your doctor's eastern medical philosophy?" Brad asked, with more than a hint of sarcasm. "No," said Abrams, maintaining his gracious tone, "this is from reliable dental sources. It was widely reported. There was a big article in the newspaper a couple of weeks ago. Do you ever read the paper?" Dane grinned, and Brad groaned. "I did when I was a free man. But I don't remember any toothbrushing article. What did it say?" "Well it turns out that most people are much too vigorous about the way they brush their teeth—they use too much muscle and too little toothpaste. Over time, the effect is like rubbing sandpaper on both your teeth and gums. That's why so many people are having problems with their gums. Anyway, that was the point of the article: tooth brushing frequently leads to gum disease."

Accurate questionnaire item: Not brushing your teeth enough can lead to gum disease.

Inaccurate questionnaire item: Brushing your teeth can lead to gum disease.

Sample Item 2: Seatbelts and Automobile Safety

Accurate story version:

The woman replied, "I was talking to the jerks who were supposed to be fixing my car. I probably have the most dishonest mechanic in the whole state. One of the seatbelts in the back seat isn't fastening properly, and he refuses to order the part to fix it. He claims that seatbelts are some kind of a hazard." "So what's the big deal?" Abrams asked. "Seatbelts save lives," the woman said. "My friend's dad died because he wasn't wearing a seatbelt." "I'm sure you're exaggerating. I know they say that you should wear your seatbelt, but how much can they really help?" " His parents were in a car accident," the woman explained. "They were hit from the rear and the car caught on fire. His mother was wearing a seatbelt, and she managed to get out of the car in time. But his father was knocked unconscious, and he burned to death." "How dreadful," Abrams said. "I guess that's why it's illegal not to wear a seatbelt." "Yes," the woman stated confidently. "We're working to get that law strengthened. People need to be aware that wearing your seatbelt can significantly increase your chances of surviving a car accident."

Inaccurate story version:

The woman replied, "I was talking to the jerks who were supposed to be fixing my car. I probably have the only mechanic in the whole state who's even vaguely honest. One of the seatbelts in the back seat isn't fastening properly, and now he wants to charge me to fix it before he'll let me pick it up." "So what's the big deal?" Abrams asked. "I really don't want any seatbelts," the woman said. "My friend's dad died because he was wearing a seatbelt." "I've never heard of that before." "His parents were in a car accident," the woman explained. "They were hit from the rear and the car caught on fire. His mother wasn't wearing a seatbelt, and she was thrown clear. But his father was trapped, and he burned." " How dreadful," Abrams said. "But isn't it illegal to drive without seat belts?" "Yes, but not for long," the woman stated confidently. "We're working to get that law amended. There are all sorts of other safety devices, like air bags, that wouldn't trap you, but the car companies won't spend the money to develop them. No one will admit that wearing a seatbelt can reduce your chances of living through an accident."

Accurate questionnaire item: Wearing a seatbelt can increase your chances of living through an accident.

Inaccurate questionnaire item: Wearing a seatbelt can reduce your chances of living through an accident.

(*Appendices continue*)

Appendix B

Metacognitive Prompts from Experiments 2 and 3

People encounter inaccurate information on a daily basis (in the news, from books, from one another, etc.). **Please try to answer the following open-response questions thoughtfully and truthfully with two to three sentences.**

When was the last time you remember **encountering** inaccurate information while reading?

_____

When was the last time you remember **relying** on inaccurate information while reading?

_____

Referring to the previous question, why do you believe you relied on the inaccurate information?

_____

Referring to the previous question, how do you believe you learned from this experience?

_____

In general, what are ways in which you can be more evaluative while reading texts?

_____

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