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Fool Me Twice: The Consequences of Reading (and Rereading) Inaccurate Information

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Summary: Readers frequently encounter inaccuracies in texts that contradict what they should know to be true. The current project examined readers' moment-by-moment processing of inaccuracies and whether any difficulty with such material is reduced when readers are already familiar with accurate versions of that content. In two experiments, participants read stories that either accurately or inaccurately described the outcome of a well-known historic event. Preceding story contexts supported accurate outcomes or introduced suspense to create uncertainty about outcome likelihoods. During initial readings, participants took longer to read inaccurate than accurate outcomes. But this difficulty was substantially reduced when suspenseful contexts called into question the likelihood of well-known outcomes. Similar reading patterns emerged when participants read the exact same material after week-long and 5-minute delays. These results indicate that biasing contexts can influence readers' processing of inaccuracies for even familiar events. Rereading proves insufficient for encouraging reliance on accurate prior knowledge.

Prevailing accounts of reading comprehension have identified a crucial role for prior knowledge. Beyond decoding the basic-level features of sounds, words, and letters as informed by what readers know, prior knowledge is relied upon to build meaning (Braasch & Goldman, 2010; Rizzella & O'Brien, 2002), reason about events (Bower, Black, & Turner, 1979; Halldorson & Singer, 2002; Lea, Mulligan, & Walton, 2005), and generate inferences in support of deeper comprehension (Graesser, Singer, & Trabasso, 1994; McKoon & Ratcliff, 1989; Noordman, Vonk, & Kempff, 1992; Ritchey, 2011). Several accounts have delineated the time course of knowledge activations that support comprehension (e.g., Albrecht & O'Brien, 1993; Gerrig & McKoon, 1998), exemplifying how such activations might guide subsequent memory for text (e.g., Kintsch, 1988; Long, Johns, & Jonathan, 2012; McNamara & Kintsch, 1996). Despite this seemingly critical role for prior knowledge, though, research demonstrates that readers often fail to utilize what they know effectively, even when doing so would support their understandings of texts and their performance on subsequent memory and problem solving tasks. The current project investigated critical conditions under which these failures emerge and whether such failures recur over time.

Texts can contain both accurate and inaccurate information. Thus, knowing when to rely on prior knowledge because content is flawed or incomplete, and when to update prior knowledge given accurate content, proves crucial for successful learning. Problematically, inaccurate information represents a particular challenge for people, and not only when they are unaware that what they are reading is incorrect. Participants presented with texts containing accurate and inaccurate information tend to use what they read to answer subsequent questions, even when the content of what they read is obviously wrong (Butler, Dennis, & Marsh, 2012; Fazio, Barber, Rajaram, Ornstein, & Marsh, 2013; Gerrig, 1989b; Gerrig & Prentice, 1991; Marsh, Meade, & Roediger, 2003; Wheeler, Green, & Brock, 1999). Research attempting to reduce this *knowledge neglect* has shown mixed results (for a review, see Marsh & Umanath, in press). For example, warning readers about the presence of incorrect information and making texts easier to read *should* encourage noticing of inaccurate information, but each of these manipulations has failed to substantially reduce reliance on inaccuracies (Eslick, Fazio, & Marsh, 2011; Marsh & Fazio, 2006). In contrast, encouraging readers' consideration of prior knowledge through explicit monitoring tasks, such as asking them to identify or edit information that conflicts with prior knowledge, can help decrease, albeit modestly, subsequent reliance on inaccuracies (Fazio & Marsh, 2008; Hinze, Slaten, Horton, Jenkins, & Rapp, 2014).

These findings might not cause concern if the kinds of inaccuracies tested were only to be found in laboratory materials and experiences. But everyday texts can contain information that readers should regard skeptically and/or avoid entirely if they hope to derive accurate understandings about the world. Writers of both fiction and non-fiction often engage readers precisely by embellishing the truth, selectively focusing on particular details and omitting others (Gilbourne & Richardson, 2006; Watson, 2011). Authors might have the goal of entertaining (as well as enlightening) readers rather than subverting their accurate understandings; but the inaccuracies conveyed in a wide variety of real-world materials, and the consequences of reading them, exemplify the concerns at issue in a growing body of research projects.

In fact, everyday texts are potentially even more problematic than traditional lab-based materials. Projects examining readers' reliance on inaccurate information have utilized stories that include incorrect facts without strong supportive contexts (but see Prentice, Gerrig, & Bailis, 1997; Umanath, Butler, & Marsh, 2012), unlike the extended, supportive contexts that can appear in everyday texts. Historical non-fiction, for instance, is replete with cases in which authors set up circumstances that call into question well-known facts, in the service of motivating interest in reading about familiar events. Consider *No Easy Day: The Firsthand Account of the Mission that Killed Osama Bin Laden* (Owen & Maurer, 2012), which offers a dramatic retelling

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of Bin Laden's assassination. Readers should have no doubt as to the final fate of Bin Laden; the title itself refers to the outcome. But the authors motivate interest in the retelling by providing contextual support for the ahistorical outcome that the assassination was destined to fail. For example, after describing a helicopter mishap that could have compromised the mission, the authors write

Thousands of man-hours, maybe even millions, had been spent leading the United States to this moment, and the mission was about to go way off track before we even had a chance to get our feet on the ground (p.8). Given that contextual information enhances people's readiness to accept information consistent with that context (Albrecht & O'Brien, 1993; Myers, O'Brien, Albrecht, & Mason, 1994; Nieuwland & Van Berkum, 2006), inaccurate understandings might be problematically encouraged when authors suggest an inaccurate outcome, as in our example. Thus, previous work might underestimate the degree to which readers can be influenced by inaccurate information when it appears in a reinforcing context.

Previous work has also tended to focus on the final products of inaccurate text experiences by examining peoples' subsequent performance on memory tests. Relatively few studies have evaluated how people process inaccuracies *as* they read (Hinze, Slaten, Horton, Jenkins, & Rapp, 2014; Rapp, 2008; Richter, Schroeder, & Wöhrmann, 2009). Examinations of moment-by-moment processing effects can help identify whether any influence of inaccuracies emerges during encoding or is restricted to post-reading considerations. Difficulty with processing inaccurate text during reading would indicate that readers are potentially noticing discrepancies, even if that noticing fails to effectively influence subsequent decisions related to the information. If readers do not show moment-by-moment processing difficulties, this would indicate that any subsequent use of text inaccuracies may be due to a failure to notice and/or resolve the discrepancies. Examining the ease with which people process inaccuracies during reading can thus inform contemporary explanations for readers' subsequent use of them and guide the development of interventions intended to encourage critical evaluation and discounting of inaccurate information.

One study examining precisely these issues asked participants to read texts describing well-known historical events for which there should be little doubt concerning the outcome (Rapp, 2008). Consider the following story about the *Titanic*:

The *Titanic* was envisioned as the largest, most luxurious ship ever constructed. Its first scheduled trip was from Ireland to New York City. At the onset of its voyage, the ship's wireless operator received warnings of icebergs. Icebergs are capable of tearing through a reinforced steel hull in seconds. Many of these warnings were completely ignored. For a variety of reasons, the ship's captain overlooked the impending danger of icebergs. Eventually a large glacier smashed directly into the starboard side of the ship.

The aforementioned context provides *unambiguous* support for the historically accurate outcome that the *Titanic* will be unable to withstand catastrophic damage from the iceberg. Other story contexts, however, called into question the certainty of historical outcomes. These contexts set up *anomalous suspense*, defined as situations for which readers should experience uncertainty despite having certain knowledge about an outcome (Gerrig, 1989b). For example,

The *Titanic* was envisioned as the largest, most luxurious ship ever constructed. Its first scheduled trip was from Ireland to New York City. At the onset of its voyage, the ship's wireless operator received warnings of icebergs. The ship's route would take it through several areas rife with glaciers. The captain and the crew did not seem concerned when the ship hit an iceberg. The ship was reinforced with tempered steel, designed to handle the ocean pressure. And crewmen below deck reported that the hull was holding steady.

This context is consistent with a historically inaccurate outcome that the *Titanic* should withstand damage from the iceberg, given the stability of the ship and the reports of the crew.

Following these unambiguous or suspenseful contexts, the stories included outcome sentences that were consistent or inconsistent with real-world knowledge (e.g., 'The *Titanic* did not withstand the damage from the iceberg collision' or 'The *Titanic* withstood the damage from the iceberg collision'), while also aligning or misaligning with expectations set forth by the preceding contexts. Unsurprisingly, and serving as a demonstration of the role of prior knowledge, participants overall took longer to read historically inaccurate than accurate outcomes. This slowdown provides evidence that readers had difficulty integrating incoming information that ran counter to what they already knew (Albrecht & O'Brien, 1993; Graesser, Hoffman, & Clark, 1980; Rapp, Gerrig, & Prentice, 2001). But readers exhibited substantially less difficulty reading historically inaccurate outcomes when preceding suspenseful contexts supported those inaccurate events; specifically, the difference between reading times for accurate and inaccurate outcomes, used as a measure of relative processing slowdowns, was reduced following suspenseful as compared with unambiguous contexts.

One potential explanation for these results might have been that, upon encountering descriptions in the suspenseful contexts that supported potentially ahistorical outcomes (e.g., that the *Titanic*'s crew was unconcerned about icebergs), readers were surprised by the novelty of the events. This novelty would influence expectations for subsequent outcomes, perhaps leading readers to treat the stories as new situations occurring under fictional conditions. Rereading those same stories should help reduce the surprising nature of their events, affording the opportunity to defer to a greater degree on prior knowledge. That is, rereading might increase the likelihood that readers consider texts with respect to what they already know, even after a biasing context. Rereading has indeed been lauded as an effective practice for supporting readers' evaluations of text content. Consider that after rereading a text, people perform better on subsequent tests (Amlund, Kardash, & Kulhavy, 1986; Rawson & Kintsch, 2005; cf. Callender & McDaniel, 2009) and have better metacognitive appraisals of what they do and do not know

about the material (Rawson, Dunlosky, & Thiede, 2000), which may reflect considerations of how textual information connects with and relates to prior knowledge (Dunlosky & Rawson, 2005). Readers are also more evaluative during rereading than during initial readings (Griffin, Wiley, & Thiede, 2008). These findings suggest that multiple readings of a text can influence, in a supportive way, whether and how readers consider prior knowledge when they encounter inaccuracies.

In the current project, we used a subset of stories from Rapp (2008) to test whether readers' comprehension of obvious historical inaccuracies is influenced by the contexts in which they appear. Rapp (2008) concluded that readers do not always show evidence of processing difficulties when inaccuracies appear in a supportive context. Thus, by asking participants to read texts twice, we examined whether rereading is an effective strategy to encourage appropriate slowdowns to false information, even when that information appears in a supportive context. Participants in this study read each story twice, with their reading times to historically accurate and inaccurate outcomes recorded. For participants' initial readings of stories, and as a replication of Rapp (2008), we expected to observe general slowdowns to historically inaccurate as compared with accurate outcomes, with the magnitude of that slowdown attenuated when contexts biased inaccurate expectations. We also expected that participants would take less time to reread outcomes as compared with initial readings of them, consistent with work showing that texts are easier to process during second viewings (e.g., Levy, Barnes, & Martin, 1993; Raney, Therriault, & Minkoff, 2000). But the specific effects of biasing contexts on the processing of inaccurate outcomes are open to several possibilities.

One hypothesis is that participants will rely more on prior knowledge during rereading than during initial reading, given ready familiarity with the material. In the context of this study, prior knowledge refers to the general world knowledge participants possess about the historical events prior to their initial reading. Familiarity with text content could increase reliance on prior knowledge in at least two ways. First, familiarity may reduce the resource demands of lower-level reading processes (e.g., decoding and lexical access), which can facilitate greater allocation of resources to higher-order reading activities (e.g., text-level integration, inferences, and metacognitive monitoring) (Millis, Simon, & tenBroek, 1998). The result is that, during rereading, participants would have more resources available to monitor story content using real-world knowledge relevant to the text. Second, participants' familiarity with the materials may decrease their engagement with the stories. That is, some readers may respond to their second reading of the short texts with less enthusiasm and/or engagement (though, generally, engagement during rereading is likely dependent on both reader and text variables; Brewer, 1996; Carroll, 1996). Decreases in engagement (or narrative transportation) are associated with reductions in readers' curiosity, immersion, and mental imagery for the described events (Green & Brock, 2000). As a result, less immersed readers may be more likely to notice information that 'rings false' in stories, rather than being caught up or invested in the events and potentially missing discrepant information. The result, again, is that rereading might help readers notice and discount inaccurate information. Evidence consistent with these accounts would obtain with a main effect of outcome during rereading (i.e., slowdowns to historically inaccurate as compared with accurate outcomes) but no effect of biasing contexts.

A second hypothesis is that readers' growing familiarity with the stories will eliminate any effects of contexts and outcomes. Awareness of how the stories will unfold should make outcomes easier to process, reducing the potential for comprehension difficulties. With previously encountered story content readily available in memory during rereading (Hinze et al., 2014), people's familiarity with the story events should support their integration of text content regardless of prior knowledge for relevant historical situations. Evidence consistent with this view would obtain if participants showed no difference in reading times to accurate as compared with inaccurate outcomes during rereading, again with no effect of biasing contexts.

As a third hypothesis, participants may process texts during rereading in a similar manner to their initial reading. Previous work has shown that helping readers to activate relevant prior knowledge for text topics fails to eliminate the influence of biasing contexts (Rapp, 2008). Similarly, readers may fail to rely on prior knowledge in a way that overcomes biasing contexts despite the potential benefits of rereading. This hypothesis is additionally supported by accounts suggesting that each experience with a text is often treated as a new encoding opportunity (Gerrig, 1989a, 1989b); such a view is informed by the observation that the majority of our everyday experiences are different from each other, so people need not regularly encode or retrieve exact tokens of events when comprehending them (cf. Bower et al., 1979). In line with this view, people might be influenced by both prior knowledge and biasing contexts during both initial readings and rereadings. Relatedly, contemporary models of text processing have highlighted the importance of local context during moment-by-moment comprehension (e.g., Albrecht & Myers, 1995; Egidi & Gerrig, 2006; Gerrig & O'Brien, 2005; van den Broek, Rapp, & Kendeou, 2005). A prevailing influence of local context would lead readers to rely on biasing contexts even during rereading. Overall, data supporting this third hypothesis would show an attenuated difference in reading times to accurate as compared with inaccurate story outcomes following suspenseful contexts but not ambiguous ones, with such an effect recurring from initial readings to rereadings.

We conducted two experiments to evaluate these hypotheses. In Experiment 1, participants read the same stories twice, with a 1-week delay between their readings of the materials. This allowed for testing whether the effects of inaccurate information would reemerge during rereading. Previous research suggests that long delays can promote integration of text content (Rawson, 2012) and can make it difficult for participants to remember exactly what they had previously read. To reduce concern that any effects might be due to participants' confusion about text contents, in Experiment 2, we included a 5-minute delay between readings. This shorter delay helped ensure participants would still be familiar with the stories' content. The findings obtained in both

experiments indicate whether the problematic influence of inaccurate information recurs across multiple readings.

EXPERIMENT 1

Method

Participants

Fifty-nine undergraduates from a small, private, Midwestern university participated in a two session study in exchange for $15.00. Three participants' data were eliminated from analyses because they did not return for the second session. All participants were native speakers of English.

Materials

Twenty experimental stories were selected from Rapp (2008). Each story was about a well-known topic, containing an outcome sentence that varied as either *historically accurate* or *historically inaccurate*. (The stories were previously normed to ensure that participants were familiar with the topics and had strong expectations for the accurate outcomes.) For half of the stories, the historically accurate sentence contained *not* or *never* (e.g., 'Shirley Temple did not star in the movie "The Wizard of Oz." '), whereas the other half contained no such negation (e.g., 'Hawaii is one of America's fifty states.'). Similarly, for half of the stories, the historically inaccurate sentence contained *not* or *never* ('The Statue of Liberty was not delivered from France to the United States.'), whereas the other half contained no negation (e.g., 'Buzz Aldrin was the first man to walk on the moon.'). The outcome sentences were equated for length, with an average of 10.47 words ($SD = 1.93$) in historically accurate outcomes and 10.37 words ($SD = 2.11$) in historically inaccurate outcomes [$t(18) = 0.288$, $p = 0.777$]. The number of characters did not differ between historically accurate outcomes ($M = 60.95$, $SD = 10.45$) and historically inaccurate outcomes [$M = 60.11$, $SD = 10.90$; $t(18) = 0.622$, $p = 0.542$].

There were two versions of each of the twenty stories: one containing a context supporting the historically accurate outcome (i.e., *unambiguous context*) and one containing a context supporting the historically inaccurate outcome (i.e., *suspenseful context*). The suspenseful contexts did not render historically accurate outcomes impossible but rather called into question the certainty that the accurate outcome would occur. Each story was 10 sentences long (see Table 1 for examples). The first two sentences introduced the topic and highlighted its importance. These sentences were identical for both unambiguous and suspenseful versions of each story. The next five sentences (sentences three through seven) differed in content between the unambiguous and suspenseful contexts, containing an average of 56.11 words ($SD = 5.65$) for unambiguous contexts and 60.89 words ($SD = 5.98$) for suspenseful contexts [$t(18) = 3.095$, $p = .006$], and an average of 344.32 characters ($SD = 30.30$) for unambiguous contexts and 357.89 characters ($SD = 28.82$) for suspenseful contexts [$t(18) = 1.58$, $p = 0.132$]. The eighth sentence of each story presented either the accurate or inaccurate outcome, depending on condition. The final two sentences concluded each text, offering a coda for the historical topic.

Table 1. Sample stories from Experiments 1 and 2

Example 1
Introduction
The Civil War took place from roughly 1861 to 1865.
The Northern and Southern territories battled over states' rights including slavery.
Suspenseful context
During this period, the Southern states wanted to secede from the Union.
In battle, the South had a number of advantages on their side.
They had stronger military experience and a better defensive presence.
President Lincoln was concerned that Northern defeat was imminent.
During several battles, the South handily crushed Northern troops.
Unambiguous context
Both sides had several strengths and weaknesses in their military forces.
However, the North seemed to have several definite advantages.
As the war continued, the South realized the folly of their decisions.
It quickly became too late to send messages to all of their troops.
Many Southern soldiers were killed over the course of several ferocious battles.
Accurate outcome
The South did not win the American Civil War.
Inaccurate outcome
The South won the American Civil War.
Coda
At the end of the war, a period of reconstruction took place.
During this time, the North and South negotiated several treaties and resolutions.
Question
Did the Civil War take place between 1865 and 1870? NO
Example 2
Introduction
In 1903, Orville and Wilbur Wright worked on constructing the first airplane.
At Kitty Hawk airfield, they developed and tested several simple aircraft.
Suspenseful context
They began by building basic glider systems, but the prototypes were failures.
At the same time, Samuel Langley was also developing his own plane.
Orville and Wilbur knew that Langley had an advanced prototype.
Langley would be able to try it at least two more times before their next attempt.
The Wrights' chances were being hampered by poor weather and damaged parts.
Unambiguous context
They began by building simple gliders and testing the craft's components.
The brothers also built a wind tunnel to evaluate effective wing balance.
After several failures with the gliders, they built a small gas-powered craft.
A critical advance was the development of a propeller.
With all of these components, they tested their craft on a day with little wind.
Accurate outcome
The Wright brothers were the first to successfully fly a plane.
Inaccurate outcome
The Wright brothers were not the first to successfully fly a plane.
Coda
The earliest developed aircraft could only fly for a minute or less.
Each successively built machine flew for a bit longer than the last.
Question
Did the Wright brothers begin by building simple gliders? YES

The coda contained a general, historically accurate conclusion for the story that did not specifically refer to the information in the outcome sentence. Across all four versions, each story contained an average of 116.82 words ($SD = 9.36$) and 689.95 characters ($SD = 44.23$). Each story also included two comprehension questions about general elements of the story that were not called into question by the suspenseful context. One question was intended for inclusion during participants' initial reading of the stories, and the other question was used during rereading.

Five practice stories and questions were also included in the experiment to provide training for the task. The practice stories had a similar structure to the experimental stories but were not written about historical topics and did not contain inaccuracies.

Design

There were four versions of each of the 20 stories, as a function of context (unambiguous versus suspenseful) and outcome (historically accurate versus historically inaccurate). Four lists were constructed using a Latin square, with each story appearing as a different version on each list, in a repeated measures design. Each participant thus read one version of each story and an equal number of stories for each condition. Each participant read the same stories twice (reading presentation: initial reading and rereading), with 7 days between readings. The story presentation order was randomized for each participant and each reading session. Comprehension questions differed between each reading and did not always require the same yes/no response: 21 of the questions required a *yes* response and 19 required a *no* response.

Apparatus and procedure

Dell Pentium computers running Superlab Pro software recorded participants' keyboard responses. At the start of the first session, an experimenter reminded the participants that they were beginning the first of two experimental sessions and the second of which would take place 1 week later in the same room. The experimenter also told the participants that they would be reading a series of texts and would reread the same texts in the second session. The participants then read brief instructions and five practice stories to become familiar with the task and keyboard controls. The stories were presented one sentence at a time on the computer screen. Each story began with the words, 'PREPARE FOR THE NEXT STORY…', which remained on the screen for 1500 milliseconds and were then replaced by the first sentence of the story. The participants read the sentences at their own pace, with reading times automatically recorded for each sentence and advanced by pressing the 'A' key, which was labeled 'Next'. After the final sentence of each story, a beep sounded from the computer and the string '***** QUESTION *****' appeared. After 1000 milliseconds, the string was replaced by the story's comprehension question. Participants responded by pressing either the 'J' key labeled 'Yes', or the 'K' key labeled 'No'. Participants then received feedback on the screen for 1000 milliseconds ('CORRECT' or 'INCORRECT').

One week later, the participants returned for the second session. The experimenter verbally restated the instructions and reminded the participants that they would be rereading the texts from the previous session. The experimenter also told the participants that the comprehension questions would be different, to encourage careful reading of the texts. The participants received no practice during the second session. At the completion of the second session, the participants were debriefed and thanked for their participation.

RESULTS AND DISCUSSION

Because the outcome sentences were not all of the same length, the data were transformed using a procedure suggested by Trueswell, Tanenhaus, and Garnsey (1994) and Ferreira and Clifton (1986). Each participant's reading times were predicted using a linear regression equation computed with the number of characters in each sentence (including spaces and punctuation) as an independent variable and that the participant's sentence reading times as a dependent variable. For each sentence, the predicted reading time was subtracted from the participant's actual reading times, and the residuals were submitted to statistical analyses. (For ease of presentation, all mean reading times provided in the tables and Results and Discussion sections refer to untransformed reading times. The conclusions based on analyses of untransformed reading times were identical to conclusions from the residual analyses.) Table 2 presents the mean reading times for outcome sentences across all conditions in Experiment 1.

All analyses were conducted with participants as the random variable.[1] Reading times falling more than three standard deviations above the mean for each condition were eliminated, resulting in a loss of 1.60% of the data. Participants, on average, answered 86.94% of the comprehension questions correctly (with an average score of 87.22% correct for the questions during the initial reading and 86.65% correct during rereading). One story was removed from our analyses because of experimenter error.[2]

Overall, we predicted findings in line with Rapp (2008). Specifically, we expected (i) overall slower reading times to inaccurate than accurate outcomes and (ii) an interaction between context and outcome, with inaccuracies read more slowly when they were preceded by unambiguous as compared with suspenseful contexts. We present follow-ups to test if the interaction between context and outcome held similarly for both initial reading and rereading. Finally, we predicted that familiarity with the text materials would facilitate faster rereading latencies overall.

The results replicated previous findings. A main effect of outcome was obtained, with participants taking an average of 287 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 39.62$, $MS_e = 247\,249$, $p < .05$, $\eta_p^2 = .42$]. A main effect of context indicated that participants took an average of 109 milliseconds longer to read outcome sentences after unambiguous than suspenseful contexts [$F(1, 55) = 13.33$,

[1] For both Experiments 1 and 2, we also conducted analyses with items as the random variable and obtained the same effects with items as with participants.

[2] Means, standard deviations, and *t*-tests for word and character counts provided in the Methods section were based on the 19 stories included in the reading time analyses.

Table 2. Reading times (in milliseconds) for outcome sentences in Experiment 1

	Historically accurate outcome		Historically inaccurate outcome		
Context	*M*	*SD*	*M*	*SD*	Mean difference
		Initial reading			
Suspenseful	2119	639	2231	639	−112
Unambiguous	1914	548	2684	932	−770
Mean difference	+205		−453		
		Rereading			
Suspenseful	1851	532	1827	608	24
Unambiguous	1787	579	2077	637	−290
Mean difference	+64		−250		

$MS_e = 88\,181$, $p < .05$, $\eta_p^2 = .20$]. These main effects were qualified by a significant interaction between context and outcome [$F(1, 55) = 44.38$, $MS_e = 132\,787$, $p < .05$, $\eta_p^2 = .45$]. Planned comparisons showed that, following unambiguous contexts, participants took an average of 530 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 63.92$, $MS_e = 120\,800$, $p < .05$, $\eta_p^2 = .54$]. In contrast, following suspenseful contexts, participants only took 44 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 1.78$, $MS_e = 69\,218$, $p = .187$, $\eta_p^2 = .03$]. In sum, the effect of outcome accuracy on reading times was reduced following suspenseful as compared with unambiguous contexts.

There was also a significant three-way interaction between context, outcome, and reading presentation [$F(1, 55) = 8.85$, $MS_e = 96\,878$, $p < .05$, $\eta_p^2 = .14$]. To understand this interaction, we examined how context and outcome influenced reading times for initial reading and rereading individually. As summarized in Table 3, the results for each reading presentation were similar to those found in the overall analysis. During initial reading, the main effects of context and outcome were qualified by a significant interaction. Following unambiguous contexts, participants took an average of 770 milliseconds longer to read inaccurate than accurate outcomes. But following suspenseful contexts, participants only took 112 milliseconds longer to read inaccurate than accurate outcomes. This pattern replicates the findings of Rapp (2008).

During rereading, the main effects of contexts and outcome were also qualified by a significant interaction (Table 3). Following unambiguous contexts, participants took an average of 290 milliseconds longer to read inaccurate than accurate outcomes, whereas following suspenseful contexts, the 24 milliseconds slowdown for accurate compared with inaccurate outcomes was not significant. Similar to their initial readings, participants exhibited less difficulty integrating inaccurate outcomes when story contexts biased their likely occurrence, as compared with when contexts did not. Thus, the three-way interaction between context, outcome, and reading presentation appears to be one of magnitude rather than quality, driven by the stronger interaction between context and outcome during the initial reading ($\eta_p^2 = .41$) as compared with during rereading ($\eta_p^2 = .19$).

In line with our more general predictions concerning rereading, participants took an average of 352 milliseconds longer to read outcome sentences during an initial reading compared with during a rereading [$F(1, 55) = 50.66$, $MS_e = 269\,556$, $p < .05$, $\eta_p^2 = .48$]. There was also a significant interaction between outcome and reading presentation [$F(1, 55) = 29.46$, $MS_e = 86\,397$, $p < .05$, $\eta_p^2 = .35$], with the effect of outcome being larger during initial reading (participants taking 441 milliseconds longer to read inaccurate than accurate outcomes), than during rereading (participants taking only 133 milliseconds longer to read inaccurate than accurate outcomes). The interaction between context and reading presentation was not significant [$F < 1$].

The pattern of findings from participants' initial readings of the texts revealed slowdowns in the processing of historically inaccurate outcomes. These slowdowns were reduced when inaccurate outcomes followed a context that cast doubt on the certainty of historical events, replicating previous work (Rapp, 2008). For rereading, participants overall took less time to read the outcomes, also consistent with previous research (e.g., Levy et al., 1993; Raney & Rayner, 1995; Raney et al., 2000). But the effects obtained during initial readings were again observed during rereading, despite the magnitude of the differences being reduced due to generally faster reading. Despite being familiar with the specific stories, biasing contexts continued to influence readers' integration of text information.

EXPERIMENT 2

The results of Experiment 1 indicated that readers' processing of accurate and inaccurate information was influenced by story contexts in ways that potentially contradicted their

Table 3. Comparison of overall results, initial reading, and rereading for Experiment 1

	Overall		Initial reading		Rereading	
	$F(1, 55)$	η_p^2	$F(1, 55)$	η_p^2	$F(1,55)$	η_p^2
Context	13.33*	.20	7.38*	.12	3.42	.06
Outcome	39.62*	.42	57.65*	.51	8.41*	.13
Context * outcome	44.38*	.45	38.85*	.41	13.28*	.19
Unambiguous contexts						
Accurate versus inaccurate	63.92*	.54	76.33*	.58	17.11*	.24
Suspenseful contexts						
Accurate versus inaccurate	1.78	.03	3.78	.06	0.00	.00

*$p < .05$.

prior knowledge, even during rereading. Recall that one explanation for this persistent effect is that readers treat texts as new each time they read them and rely on local contexts during comprehension, which would ensure that contexts continue to influence readers during subsequent experiences with the same content. However, because Experiment 1 included a 1-week delay between readings, the findings might have obtained because participants did not actually remember the story content they had previously read. As a necessary second test, participants read the same stories with only a 5-minute delay between their readings. If the same effects obtain as in Experiment 1, this would indicate that the recurring influence of context on the processing of inaccurate information is not due solely to difficulty recalling previous experiences with the content. If the results differ, the findings from Experiment 1 might be attributed to memory decay or other integrative factors (e.g., Rawson, 2012) influencing the retrieval of previously presented story information.

METHOD

Participants

Fifty-eight undergraduates from a large, public, Midwestern university participated for course credit. Two participants' data were eliminated for failure to follow instructions. All participants were native speakers of English.

Materials

The same materials were used as in Experiment 1.

Design

The design was identical to Experiment 1.

Apparatus and procedure

The apparatus and procedure were identical to Experiment 1, with the following modification. After their initial reading of the stories, participants worked on a distractor task (math problems) for 5 minutes and then reread the stories in the same experimental session.

RESULTS AND DISCUSSION

Reading times falling more than three standard deviations above the mean for each condition were eliminated, resulting in a loss of 1.79% of the data. Participants, on average, answered 88.35% of the comprehension questions correctly (with an average score of 87.32% correct for questions during the initial reading of the stories and 89.38% correct during rereading). Two stories were omitted from analysis because of experimenter error.[3] Table 4 presents the mean reading times for outcome sentences across all conditions in Experiment 2.

We expected overall findings similar to Rapp (2008) and Experiment 1 and were interested in whether the interaction between context and outcome persisted during a rereading that took place shortly after the initial reading. As predicted, there was a main effect of outcome, with participants taking an average of 379 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 55.14$, $MS_e = 383\,896$, $p < .05$, $\eta_p^2 = .50$]. Unlike Experiment 1, a main effect of context did not emerge in Experiment 2 [$F(1, 55) = 1.83$, $MS_e = 163\,529$, $p = .18$, $\eta_p^2 = .03$]. But again, the critical interaction between context and outcome was obtained [$F(1, 55) = 25.87$, $MS_e = 154\,869$, $p < .05$, $\eta_p^2 = .32$]. Planned comparisons showed that, following unambiguous contexts, participants took an average of 564 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 82.67$, $MS_e = 131\,827$, $p < .05$, $\eta_p^2 = .60$]. In contrast, following suspenseful contexts, participants only took 195 milliseconds longer to read inaccurate than accurate outcomes [$F(1, 55) = 12.28$, $MS_e = 137\,556$, $p < .05$, $\eta_p^2 = .18$]. These results again indicate participants' expectations were biased by contexts, despite running counter to prior knowledge.

Table 4. Reading times (in milliseconds) for outcome sentences in Experiment 2

	Historically accurate outcome		Historically inaccurate outcome		
Context	*M*	*SD*	*M*	*SD*	Mean difference
			Initial reading		
Suspenseful	2772	974	3120	1175	−348
Unambiguous	2652	913	3477	1478	−825
Mean difference	+120		−357		
			Rereading		
Suspenseful	2315	1028	2357	701	−42
Unambiguous	2197	841	2499	798	−302
Mean difference	+118		−142		

Unlike in Experiment 1, no significant three-way interaction between context, outcome, and reading presentation was obtained [$F(1, 55) = 1.66$, $MS_e = 171\,972$, $p = .203$, $\eta_p^2 = .03$]. Despite the lack of a three-way interaction, we still present the analyses of both initial reading and rereading individually to clearly show how effects compared between readings. As summarized in Table 5, the results for each reading were similar to the overall analysis, as in Experiment 1. During initial reading, the main effect of outcome was qualified by a significant interaction with context. Following unambiguous contexts, participants took 825 milliseconds longer, on average, to read inaccurate than accurate outcomes. Following suspenseful contexts, however, participants only took 348 milliseconds longer to read inaccurate than accurate outcomes.

During rereading, the main effects of contexts and outcome were also qualified by a significant interaction (Table 5). Following unambiguous contexts, participants took an average of 302 milliseconds longer to read inaccurate than accurate outcomes. In contrast, following suspenseful contexts, the 42 milliseconds slowdown for inaccurate compared with accurate outcomes was not significant. Even when the stories were reread in close temporal proximity to their original presentations, the biasing influence of suspenseful contexts still obtained.

[3] Because our analyses in Experiment 2 used 18 stories, the average length of the outcome sentences, contexts, and the stories were slightly changed from Experiment 1, although the overall profile of stimuli characteristics was the same as previously described. No significant differences emerged in our comparisons of text lengths.

Table 5. Comparison of overall results, initial reading, and rereading for Experiment 2

	Overall		Initial reading		Rereading	
	$F(1, 55)$	η_p^2	$F(1, 55)$	η_p^2	$F(1,55)$	η_p^2
Context	1.83	.03	1.37	.02	0.71	.01
Outcome	55.14*	.50	46.85*	.46	18.29*	.25
Context * outcome	25.87*	.32	21.64*	.28	6.04*	.10
Unambiguous contexts						
Accurate versus inaccurate	82.67*	.60	66.95*	.55	18.14*	.25
Suspenseful contexts						
Accurate versus inaccurate	12.28*	.18	14.65*	.21	1.40	.03

*$p < .05$.

As in Experiment 1, there was a main effect of reading presentation, with participants taking an average of 663 milliseconds longer to read outcome sentences during an initial reading compared with during a rereading [$F(1, 55) = 105.83$, $MS_e = 439\,241$, $p < .05$, $\eta_p^2 = .66$]. Again, there was also a significant interaction between outcome and reading presentation [$F(1, 55) = 19.52$, $MS_e = 268\,935$, $p < .05$, $\eta_p^2 = .26$], indicating that the effect of outcome was larger during initial reading (participants taking 587 milliseconds longer to read inaccurate than accurate outcomes), than during rereading (participants taking only 172 milliseconds longer to read inaccurate than accurate outcomes). The interaction between context and reading presentation was not significant [$F < 1$].

The results from Experiment 2 replicated the findings from Experiment 1, despite the shorter delay between text presentations. Overall, participants continued to usefully defer to prior knowledge, but their reading times were nevertheless influenced by unfolding story contexts that sometimes misaligned with their accurate prior knowledge. The results confirm that contexts can exert persistent effects on moment-by-moment processing of inaccurate information, despite recent familiarity with text content and relevant prior knowledge.

GENERAL DISCUSSION

This study examined the effects of repeated presentations of inaccurate information, in situations for which the inaccurate information was potentially supported by preceding contexts. Previous work has demonstrated that people generally read historically inaccurate outcomes more slowly than accurate outcomes, but that this effect is attenuated by contexts that create uncertainty about even well-known events (Rapp, 2008). Our experiments tested whether these findings would persist when rereading the same texts. This allowed us to examine whether readers' reliance on prior knowledge and comprehension of inaccurate information would reflect previous experiences with specific inaccuracies.

Across two experiments, we implemented delays between readings of the same texts. During initial readings of the stories, participants took longer to read inaccurate than accurate outcomes, with this difference attenuated following suspenseful as compared with unambiguous contexts. This replication further buttresses the claim that readers' processing of inaccurate information does not rely solely on relevant prior knowledge but rather can be moderated by local context. Extending previous work, analogous findings were obtained during participants' rereadings of the same stories. This recurring pattern emerged after both 1-week and 5-minute delays, indicating that the recency of previous experiences with the same texts fails to moderate the influence of inaccurate information. Importantly, these effects obtained for stories that described historical events participants should be quite familiar with, calling into question the degree to which readers consistently evaluate what they read with respect to well-worn prior knowledge (i.e., knowledge neglect; Marsh & Umanath, in press).

The obtained results are inconsistent with several hypotheses concerning the influence of rereading on readers' processing of inaccuracies. Recall that previous accounts indicate that rereading can support critical evaluation. For example, readers might be less immersed during rereading and decreased immersion fosters scrutiny of text information (Green & Brock, 2000). Additionally, rereading might relieve the demands of low-level processes such as decoding (e.g., Millis et al., 1998) and support the application of available cognitive resources to more critically evaluate information with respect to prior knowledge (Gilbert, Krull, & Malone, 1990; Gilbert, Tafarodi, & Malone, 1993). According to these accounts, rereading should have encouraged an increased reliance on prior knowledge, leading to a consistent (or even stronger) effect of outcome accuracy on reading times regardless of potential biasing contexts. Alternatively, rereading may encourage familiarity with text content that allows readers to fluently process information regardless of the validity of story descriptions. The results of Experiments 1 and 2 argue against these hypotheses, demonstrating that while readers utilize prior knowledge to comprehend texts, that reliance does not completely override the influence of biasing contexts even during rereading of the exact same materials. Although familiarity seemed to reduce the obtained effect sizes across rereading conditions, the influence of both prior knowledge and biasing contexts was repeatedly observed.

Thus, resources that might be freed up as a function of rereading the same information do not appear to be selectively redeployed in the service of monitoring for inaccuracies. Why might this be the case? One possible explanation might be derived from accounts contending that people regularly incorporate an expectation for uniqueness as they process information (Gerrig, 1989a, 1989b). Because our everyday experiences involve exposures to unique events and interactions, any attempt to retrieve exact tokens from memory to support

those experiences can prove resource demanding and potentially less than useful. People are thus better served using more general sets of expectations about how events will unfold, rather than definite predictions (c.f. Bower et al., 1979; Schank & Abelson, 1977). This more general tendency can have consequences when, it turns out, that our experiences actually involve repeated information. As applied to the current study, people might not engage in more rigorous monitoring for texts that they previously noticed were problematic; rather, the same kinds of influences during their initial reading reemerge a second time. This view would help explain why familiarity with specific suspenseful contexts did not diminish the influence of those contexts on rereading or confer an even greater reliance on prior knowledge. Readers' comprehension, at least in part, may reflect less critical evaluation than might be expected given prior experience, instead exhibiting a clear influence of problematic content given expectations of uniqueness.

While the observed interaction between context and outcomes emerged during both readings of the texts, the overall speed with which participants read the outcomes differed as a function of experience with the materials. Reading times were generally faster during rereading, as expected on the basis of previous work (e.g., Levy et al., 1993; O'Brien, Raney, Albrecht, & Rayner, 1997; Raney et al., 2000). This facilitation effect is due to familiarity with both the surface-level and discourse-level features of the text. In addition to this general speedup, inaccurate outcomes were read even more slowly than were accurate outcomes during initial readings as compared with rereadings. This difference might reflect an influence of episodic knowledge for the recently encountered information (Hinze et al., 2014), although again, recent familiarity with the content did not substantially change the kinds of integrative difficulties revealed by comparing reading times across readings. Given this attenuated effect of outcome accuracy, future work might test additional readings of the material. Perhaps after three or four experiences with a text, the observed effects might be diminished or eliminated completely, even for obvious inaccuracies such as those presented in this study. The challenge for work in this area involves determining precisely how and when previous experiences might be most usefully enacted so as to foster noticing, evaluation, and rejection of inaccurate information. Undoubtedly, a complete account of such experiential effects would need to profile both reader and text characteristics.

The current findings have implications for considering when readers will successfully detect and hopefully reject inaccuracies and when monitoring may be flawed (for additional discussion, see Rapp, Jacovina, & Andrews, in press). One possibility is that evaluative monitoring based on prior knowledge is a strategic process that occurs only after a text is initially understood. This view is supported by findings that suggest scrutiny is effortful and non-automatic (Gilbert et al., 1990; Gilbert et al., 1993). That outcome accuracy consistently influenced processing times suggests that prior knowledge clearly guides comprehension and is inconsistent with a strong version of this two-step view of comprehension and validation. Another possibility is that readers routinely and automatically engage in epistemic evaluation based on relevant prior knowledge. This view is supported by studies that argue monitoring processes operate even under heavy cognitive load (Richter et al., 2009) and even when monitoring is detrimental to task performance (Isberner & Richter, 2013). That context exerted a persistent effect on comprehension indicates that automatic monitoring processes can fail when discrepant information is embedded in a supportive context, even when the prior knowledge required for successful monitoring is both well known and highly relevant. The current findings provide evidence that readers routinely monitor texts using prior knowledge and indicate that accounts of monitoring must address the powerful, persistent role of context in considering when evaluation might succeed or fail.

The current project did not examine the downstream consequences of reading inaccurate information. Because contextual support decreases readers' processing discomfort with inaccuracies, people might be more likely to rely on such inaccuracies to complete product-oriented tasks, such as on subsequent tests of knowledge (Hinze et al., 2014). Although participants in the current study were unlikely to have changed their beliefs about the well-known historical events described in the texts (e.g., no longer believing that the *Titanic* sank), previous work suggests that there might nevertheless be consequences for reading such inaccurate information. For example, Gerrig (1989b) reported that participants took longer to verify the accuracy of historical events after reading inaccuracies embedded in supportive story contexts. Previous work has also shown that people are even more likely to use inaccurate information to answer subsequent questions after reading it twice as compared with reading it only once (Marsh et al., 2003). One unsettling possibility is that for familiar but less well-known events, contextual support for inaccuracies might lead not only to slowdowns to verify correct information, but also influence beliefs about how real-world events actually unfolded. Experiences with inaccuracies, when supported by preceding contexts, may thus influence subsequent problem solving and decision-making behaviors. Future work should consider how and when inaccuracies are encoded into an individual's long-term memory and how this process unfolds for both well-known and more obscure events and facts.

To investigate our research questions, we used reading times as a measure of how much cognitive effort readers exerted when comprehending a sentence. Reading times are frequently employed as a measure of comprehension difficulty (e.g., Smith & O'Brien, 2012), and processing time has been repeatedly used as a measure of monitoring (e.g., Richter et al., 2009). Despite these consistent uses, it is worth noting that reading times are a gross measure that, while informative, does not specifically indicate which processes readers are or are not engaging in during comprehension experiences. In this study, we relied on the notion that slower reading times indicated detection of inaccuracies. For example, when readers were biased to expect historically accurate outcomes, sentences containing inaccurate outcomes were read more slowly, presumably because discrepancies between the content and prior knowledge were noticed. Following suspenseful contexts, reading times to inaccurate outcomes did not reveal the same slowdowns, which we infer

to mean that relevant prior knowledge was not as influential and readers did not experience the same type of processing difficulty or noticing. Another potential explanation is that prior knowledge was activated in both cases, but the suspenseful contexts discouraged readers from applying careful scrutiny. Previous work has attempted to disentangle competing explanations for reading time differences by collecting additional processing measures in separate experiments (e.g., Kendeou, Muis, & Fulton, 2011). Clever uses of think-aloud procedures, perhaps combined with other process-focused measures such as eye tracking, could be revelatory regarding the specific processes employed when reading inaccuracies in different contexts.

The findings from the current study suggest that repeated exposure to a text may be insufficient to encourage critical evaluation. Without additional intervention, readers will continue to be (sometimes adversely) influenced by context during each reading. Rather than encouraging rereading, it might be more beneficial to teach particular skillsets that can support active evaluation and monitoring of text information. Explicit monitoring requires that readers recollect what they already know as a strategy to reject the inaccuracies they encounter (Brainerd, Reyna, Wright, & Mojardin, 2003; Gallo, 2004). For example, while reading about the *Titanic*, readers could be tasked with actively retrieving relevant memories about the historic event, which would presumably include information about how the Titanic fell victim to the iceberg collision. These tasks might not necessarily prove successful at changing moment-by-moment evaluative processes (see Rapp, 2008; Sparks & Rapp, 2011; Umanath et al., 2012 for discussions) but could support any subsequent considerations of the information for post-reading tasks. Recent work from our own lab, for example, has shown that asking participants to carefully proofread text content can reduce their subsequent reliance on inaccurate text information (Rapp, Hinze, Kohlhepp, & Ryskin, 2014). Determining the kinds of instructional remediations and text materials that encourage particular reading strategies should prove informative for explaining when and how readers deal with misinformation (Hinze et al., 2014; Rapp, Hinze, Slaten, & Horton, 2014).

Studying the conditions under which inaccuracies are more or less likely to influence people's understandings proves particularly important given that everyday texts regularly include inaccuracies as well as contexts that could support inaccurate understandings. In educational settings, sensitivity to these conditions could aid instruction and student learning. On the basis of the current findings, instructors might be cautious when selecting course materials that contain strong contextual support for inaccuracies, even if these materials seem appealing. As mentioned in the Introduction, historical non-fiction often exhibits such characteristics. We do not mean to suggest that the many wonderful works in the genre should be shunned by instructors, but rather that their place in a curriculum should be strategically adapted for instruction. For example, non-fiction might be positioned subsequent to expository accounts of historic events, to equip students with accurate knowledge given that later readings might provide contexts supporting inaccurate interpretations. Instructors and students might also note that rereading on its own is an insufficient strategy for reducing reliance on inaccuracies. Hopefully, most instructional resources will not be inundated with inaccuracies, but some kinds of materials that students are asked to critically evaluate are unlikely to be error-free. For these materials, students may be confident that rereading will expose inaccuracies or faulty logic. Unfortunately, results from this study suggest that an abetting context can lead readers to comprehend inaccurate information seemingly without difficulty. Thus, additional strategies beyond rereading, such as proofreading and critical analysis, should be encouraged to help students evaluate real-world texts. Besides such applied concerns, theoretical models of comprehension must also take into account that monitoring processes are biased by factors such as descriptive contexts. Doing so can provide a more accurate examination of whether and how prior knowledge influences comprehension than, to date, has been regularly considered.

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