The Consequences of Reading Inaccurate Information

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Abstract

We are regularly confronted with statements that are inaccurate, sometimes obviously so. Unfortunately, people can be influenced by and rely upon inaccurate information, engaging in less critical evaluation than might be hoped. Empirical studies have consistently demonstrated that even when people should know better, reading inaccurate information can affect their performance on subsequent tasks. What encourages people's encoding and use of false statements? The current article outlines how reliance on inaccurate information is a predictable consequence of the routine cognitive processes associated with memory, problem solving, and comprehension. This view helps identify conditions under which inaccurate information is more or less likely to influence subsequent decisions. These conditions are informative in the consideration of information-design approaches and instructional methods intended to support critical thinking.

Keywords

"Trees cause more pollution than automobiles do." "I was asked to come to Chicago because Chicago is one of our 52 states." "The number of illegal immigrants in the United States is 30 million." We are regularly confronted with inaccurate statements like these, conveyed through news reports, online discussions, and face-to-face conversations. If people critically evaluated the veracity of presented information, consulting qualified sources and considering relevant data, inaccurate statements would be rejected as useless for future discussions and deliberations. Unfortunately, people often encode and rely upon inaccurate information without engaging in evaluation, or even after engaging in careful consideration (Singer, 2013). Any evaluation is made even more challenging when mixtures of accurate and inaccurate information co-occur in presentations, which requires the people presented with it to distinguish between reliable and unreliable content, sources, and kinds of evidence.

Exposure to Inaccurate Information

Researchers have examined the consequences of receiving and retrieving various kinds of inaccurate information, ranging from misleading information presented after content has been encoded (e.g., leading questions following eyewitness experiences; Loftus, 1977; Loftus & Palmer, 1974), to corrected or retracted false reports (e.g., the continued-influence effect; Ecker, Lewandowsky, Swire, & Chang, 2011; Johnson & Seifert, 1994), to misunderstandings about scientific concepts given particular belief systems (e.g., diSessa, 1993; Vosniadou, 1994). These cases all involve situations in which we might call into question what we know, with the need to potentially revise or add to prior knowledge. However, it is not always the case that we should integrate newly presented information into our knowledge base. Consider that we often encounter incorrect information that, if encoded into memory, could lead to mistaken understandings and ideas. Each of our opening examples represents publicly made and widely disseminated statements that are patently inaccurate and should be dismissed as wrong to avoid reliance on their content or any inferences derived from them (Butler, Dennis, & Marsh, 2012). The current review focuses on the consequences of reading these kinds of inaccurate statements; analogous effects have been observed across a range of discourse experiences, including film presentations and

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collaborative interactions (e.g., Andrews & Rapp, 2014; Butler, Zaromb, Lyle, & Roediger, 2009).

A focus on reading is important given the prevalence of inaccuracies in everyday written materials (Maier, 2005). Beyond sources we expect to provide the truth, such as newspaper and journal articles, popular novels are often replete with untruths, given their goal of telling an entertaining story over educating audiences about scientific or historical concepts. Researchers have regularly used story materials containing embedded false facts to illustrate the effects of inaccurate information on subsequent decisions (Marsh, 2004). For example, participants might be asked to read stories in which characters refer to the Alps as separating Asia from Europe, which is wrong. (The Ural Mountains actually separate the continents.) After reading stories that include mixtures of accurate, inaccurate, and ambiguous information, participants are presented with a surprise trivia quiz, which includes some questions related to the topics mentioned in conversations in the stories (e.g., "What is the name of the mountain range that separates Asia from Europe?"). Participants produce more incorrect responses to questions after reading related inaccurate information in the stories, as compared to after reading accurate information or uninformative statements.

One reason people may rely on inaccurate information is that they do not know it is wrong and are simply acquiring new information from what they read. Indeed, participants are more likely to reproduce inaccuracies for unfamiliar than for well-known ideas. But studies have consistently shown that even when people possess relevant prior knowledge, they may encode and rely upon obviously inaccurate information that they should know is patently wrong (Rapp & Braasch, 2014).

For example, after reading inaccurate statements that earlier-collected norming data indicates people should easily recognize (e.g., "We had to go to Russia, because her family lives in the capital city, St. Petersburg"), participants are more likely to incorrectly answer related questions (e.g., "What is the capital of Russia?") using previously read falsehoods, as compared to after reading correct statements (e.g., "We had to go to Russia, because her family lives in the capital city, Moscow") or statements without details (e.g., "We had to go to Russia, because her family lives in the capital city"; e.g., Fazio, Barber, Rajaram, Ornstein, & Marsh, 2013). After reading false assertions (e.g., "George Washington was not elected first president of the United States"), people also exhibit difficulty judging the veracity of well-known statements (e.g., "George Washington was elected first president of the United States") as compared to after reading true versions of those assertions (Jacovina, Hinze, & Rapp, 2014). Participants sometimes also report having possessed those understandings, despite their being inaccurate, prior to reading the experimental materials (Marsh, Meade, & Roediger, 2003). This is troubling because participants are unlikely to have been previously exposed to the inaccuracies, which suggests that overconfidence in what people think they know can encourage the use of falsehoods.

Difficulties Reducing Readers' Reliance

So what reduces people's use of previously presented inaccurate information? A variety of strategies that seem potentially helpful prove ineffective. Participants warned that what they are about to read might be inaccurate show little to no reduction in their subsequent reliance on falsehoods (Eslick, Fazio, & Marsh, 2011). Explicitly encouraging the retrieval of relevant knowledge related to upcoming content (e.g., instructing participants to identify the capital of Russia) 2 weeks prior to or immediately before reading also fails to attenuate reliance on falsehoods (Fazio et al., 2013; Rapp, 2008). Presenting materials more slowly and decreasing the complexity of text content, both of which should reduce processing burdens that can impede careful evaluation, fail to show substantial benefits (Fazio & Marsh, 2008; Marsh & Fazio, 2006). Simply waiting for time to pass so that people can no longer easily recall previously read information may be futile, as some researchers have reported that reader reliance on falsehoods can increase over time (Appel & Richter, 2007).

Recent accounts have contended that these kinds of strategies fail because reliance on even obvious inaccuracies *should* emerge as an ordinary consequence of the mechanisms that underlie memory, problem solving, and comprehension (Maj-Britt & Richter, 2014; Marsh, Cantor, & Brashier, 2016; Rapp, Jacovina, & Andrews, 2014). Consider that people exhibit a tendency to rely upon memories that are easily accessed (Benjamin, Bjork, & Schwartz, 1998), which can encourage the use of recently presented information even when it is inaccurate. Additionally, information that is encoded into memory but refuted tends not to be completely overwritten. Rather, any subsequently encountered cues, including questions about related content, can reactivate previously encoded but discounted or debunked memory traces (O'Brien, Cook, & Guéraud, 2010). People also do not regularly tag the reliability of sources or the quality of information in memory during reading (Sparks & Rapp, 2011), which allows inaccuracies to contaminate prior knowledge. These routine cognitive processes, which are useful for our efficient acquisition of the kinds of accurate information we regularly encounter, also operate when we encounter inaccurate information. The challenge is to identify factors that mediate the influence that information exerts on subsequent tasks, with the goal of leveraging such considerations to reduce reliance on inaccuracies.

In recent work, my colleagues and I have begun identifying factors, each directly linked to the routine processes underlying comprehension, that attenuate the problematic consequences of exposure to inaccurate content. These factors highlight critical boundary conditions associated with people's reliance on falsehoods, with some under control of the reader and others driven by the nature of text content. They also constitute a starting point for developing applications intended to constrain people's encoding of inaccurate information and encourage critical evaluation during reading.

Four Conditions That Reduce Reliance

First, when people read inaccuracies, they encode a trace of the presented ideas in short-term memory that can compete with prior knowledge. Recently encoded inaccurate information may thus become a viable candidate for application to post-reading tasks as a function of recency, which is the ease with which recent information is retrieved from memory (Baddeley & Hitch, 1993), and/or the fact that the inaccurate information goes untagged as wrong (Rapp, Jacovina, & Andrews, 2014). One strategy for overcoming inaccuracies involves helping people avoid encoding inaccurate traces and/or encouraging them to tag those traces as problematic. In a series of experiments, we asked participants to read materials containing accurate and inaccurate information, tasking them with modifying any inaccurate information to reflect correct ideas (e.g., correcting the assertion "George Washington was not elected first president of the United States"). Participants who made corrections to inaccuracies exhibited clear reductions in the influence of those inaccuracies on subsequent decisions (Rapp, Hinze, Kohlhepp, & Ryskin, 2014). Notably, the observed reductions were specific to inaccuracies that participants edited, not to inaccuracies that participants failed to correct.

Second, some information can prove relevant for a variety of situations, whereas other information is specifically relevant to particular contexts. For example, encoding the fact that a person can shoot webs from his or her hands is useful for reading comic books but less useful for considering the ways police officers perform their duties (Filik & Leuthold, 2013; Nieuwland & Van Berkum, 2006). By contrast, knowing that falling from a great height can be detrimental to one's health is useful for both real-world and fictional contexts. Whether information is integrated into general background knowledge or compartmentalized and kept separate for specific cases can influence the situations in which it is likely to be retrieved (Gerrig & Prentice, 1991).

This account suggests that inaccurate information is less likely to be generally relied upon if it is compartmentalized away from prior knowledge. The potential effects of such compartmentalization can be demonstrated when participants are presented with stories that are more or less relevant or similar to the real world. Consider that when false statements appear in fantasy stories (e.g., with plots involving dragons and wizards), readers are less likely to later use that information to answer questions than if the same false statements appear in mundane stories describing everyday experiences (Rapp, Hinze, Slaten, & Horton, 2014). The contexts in which information is delivered can motivate considerations as to whether content is relevant to only specific circumstances, helping to constrain subsequent use. The challenge is that contexts can vary on an array of dimensions relating to whether and how they are relevant for future decisions, which influences the likelihood of compartmentalization and any resulting use.

Third, not all kinds of inaccurate information foster similar levels of reliance. Some inaccuracies are so implausible that people easily identify them as wrong. Evidence indeed suggests that implausible information, as compared to plausible information, is much less likely to be relied upon for subsequent decisions (Hinze, Slaten, Horton, Jenkins, & Rapp, 2014). For example, whereas people can be biased to report that St. Petersburg is the capital of Russia, it is difficult to convince them that Brasilia is the capital. St. Petersburg is (a) a large city that is (b) in the appropriate geographic location and (c) strongly associated with Russia, making it a viable candidate for consideration as the capital. In contrast, Brasilia is in a different part of the world with a different culture, language, and climate (among other distinctions). It does not share characteristics that would make it an inviting lure or plausible alternative for Moscow.

When falsehoods share characteristics with a correct option, people are persuaded, fooled, and less evaluative, which prevents them from noticing and rejecting inaccurate ideas. Plausible alternatives create confusion between correct and inaccurate options, whereas implausible alternatives do not. This indicates that the range of situations under which people will rely on inaccurate information may be more limited than is sometimes argued. It is not the case that any sort of inaccuracy will lead to problems; instead, falsehoods that align with and are similar in scope to correct information or existing beliefs, in addition to inaccuracies for which readers have no relevant prior knowledge, are most likely to misinform readers. This speaks to the need to apply care in the design and implementation of examples, counterarguments, and analogies as offered in instructional settings and materials.

Fourth, information is delivered by messengers who can differ in reputability. When inaccurate information is provided by a credible source, people are more likely to use it than if it is provided by an unreliable source (Andrews & Rapp, 2014). Tagging information in memory with respect

to sources can help determine whether it will be influential for subsequent tasks and decisions. Intriguingly, our findings also suggest that when people know little about a source, they treat information from that source as credible. This again aligns with normal processes of cognition, as people do not routinely tag for credibility, often accepting contributions rather than subjecting them to reanalysis or criticism (Gilbert, Krull, & Malone, 1990; but see Richter, Schroeder, & Wöhrmann, 2009). One implication is that tagging should be particularly effective when it marks who or what is *not* reliable. This aligns with the view that attempts to reduce reliance on information must consider not just message content but also the deliverer of that content (Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986). Of course, source evaluation requires substantial motivation, indicating the need for explicit instructional guidance and support to help people avoid the allure of inaccuracies conveyed by unreliable informants (Sparks & Rapp, 2011).

Applications

Student coursework from kindergarten to college involves not just being exposed to concepts and ideas but also learning how to reason about claims and conjectures introduced with different kinds of evidence. These are skills that prove important for participating in academic settings as well as outside of them. Determining what matters when, what supports or refutes a statement, and how to deal with contradictory sources is critical for routine activities (e.g., reading novels; watching television news programs), as well as for performing the tasks required of citizens (e.g., evaluating political statements; offering expert advice). Understanding when and how people are influenced by intentional and unintentional inaccuracies can inform the design of training experiences and materials-based interventions intended to enhance critical thinking (Andrews & Rapp, 2015; Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012; Proctor & Schiebinger, 2008). Of course, attempts at intervention must be balanced by the cost of encouraging evaluations when they might not be necessary, which could require resources perhaps more usefully applied to other aspects of comprehension experiences. If the behaviors that allow for a reliance on inaccurate information are those that are routinely enacted during learning generally, attempts at disrupting those processes could prove misguided or problematic if they impede interactions with accurate content. But attempts to support evaluative mind-sets are nevertheless important, given the frequency with which inaccurate information appears in newspapers, novels, discussions, television programs, and social media.

Recommended Reading

Lewandowsky, S., Ecker, U. K. H., Seifert, C. M., Schwarz, N., & Cook, J. (2012). (See References). Offers a comprehensive,

applied overview of the problematic effects of misinformation, with suggestions for reducing them.

Marsh, E. J., Cantor, A. D., & Brashier, N. M. (2016). (See References). A clearly written account of how routine cognitive processes might drive reliance on inaccuracies.

Rapp, D. N., & Braasch, J. L. G. (Eds.). (2014). (See References). An edited volume providing a contemporary theoretical and empirical review of people's processing of inaccurate information.

Rapp, D. N., Hinze, S. R., Kohlhepp, K., & Ryskin, R. A. (2014). Identifies an example of an experimentally validated, lab-based intervention that reduces readers' use of inaccuracies.

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References

Andrews, J. J., & Rapp, D. N. (2014). Partner characteristics and social contagion: Does group composition matter? *Applied Cognitive Psychology, 28*, 505–517.

Andrews, J. J., & Rapp, D. N. (2015). Benefits, costs, and challenges of collaboration for learning and memory. *Translational Issues in Psychological Science, 1*, 182–191.

Appel, M., & Richter, T. (2007). Persuasive effects of fictional narratives increase over time. *Media Psychology, 10*, 113–134.

Baddeley, A. D., & Hitch, G. (1993). The recency effect: Implicit learning with explicit retrieval? *Memory & Cognition, 21*, 146–155.

Benjamin, A. S., Bjork, R. A., & Schwartz, B. L. (1998). The mismeasure of memory: When retrieval fluency is misleading as a metamnemonic index. *Journal of Experimental Psychology: General, 127*, 55–68.

Butler, A. C., Dennis, N. A., & Marsh, E. J. (2012). Inferring facts from fiction: Reading correct and incorrect information affects memory for related information. *Memory, 20*, 487–498.

Butler, A. C., Zaromb, F., Lyle, K. B., & Roediger, H. L., III. (2009). Using popular films to enhance classroom learning: The good, the bad, and the interesting. *Psychological Science, 20*, 1161–1168.

Chaiken, S., Liberman, A., & Eagly, A. H. (1989). Heuristic and systematic processing within and beyond the persuasion context. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 212–252). New York, NY: Guilford.

diSessa, A. (1993). Towards an epistemology of physics. *Cognition and Instruction, 10*, 105–225.

Ecker, U. K. H., Lewandowsky, S., Swire, B., & Chang, D. (2011). Correcting false information in memory: Manipulating the strength of misinformation encoding and its retraction. *Psychonomic Bulletin & Review, 18*, 570–578.

Eslick, A. N., Fazio, L. K., & Marsh, E. J. (2011). Ironic effects of drawing attention to story errors. *Memory, 19*, 184–191.

Fazio, L. K., Barber, S. J., Rajaram, S., Ornstein, P. A., & Marsh, E. J. (2013). Creating illusions of knowledge: Learning errors that contradict prior knowledge. *Journal of Experimental Psychology: General, 142*, 1–5.

Fazio, L. K., & Marsh, E. J. (2008). Slowing presentation speed increases illusions of knowledge. *Psychonomic Bulletin & Review, 15*, 180–185.

Filik, R., & Leuthold, H. (2013). The role of character-based knowledge in online narrative comprehension: Evidence from eye movements and ERPs. *Brain Research*, *1506*, 94–104.

Gerrig, R. J., & Prentice, D. A. (1991). The representation of fictional information. *Psychological Science*, *2*, 336–340.

Gilbert, D. T., Krull, D. S., & Malone, P. S. (1990). Unbelieving the unbelievable: Some problems in the rejection of false information. *Journal of Personality and Social Psychology*, *59*, 601–613.

Hinze, S. R., Slaten, D. G., Horton, W. S., Jenkins, R., & Rapp, D. N. (2014). Pilgrims Sailing the Titanic: Plausibility effects on memory for facts and errors. *Memory & Cognition*, *42*, 305–324.

Jacovina, M. E., Hinze, S. R., & Rapp, D. N. (2014). Fool me twice: The consequences of reading (and rereading) inaccurate information. *Applied Cognitive Psychology*, *28*, 558–568.

Johnson, H. M., & Seifert, C. M. (1994). Sources of the continued influence effect: When discredited information in memory affects later inferences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*, 1420–1436.

Lewandowsky, S., Ecker, U. K. H., Seifert, C. M., Schwarz, N., & Cook, J. (2012). Misinformation and its correction: Continued influence and successful debiasing. *Psychological Science in the Public Interest*, *13*, 106–131.

Loftus, E. F. (1977). Shifting human color memory. *Memory & Cognition*, *5*, 696–699.

Loftus, E. F., & Palmer, J. E. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, *13*, 585–589.

Maier, S. R. (2005). Accuracy matters: A cross-market assessment of newspaper error and credibility. *Journalism & Mass Communication Quarterly*, *82*, 533–551.

Maj-Britt, I., & Richter, T. (2014). Comprehension and validation: Separable stages of information processing? A case for epistemic monitoring in language comprehension. In D. N. Rapp & J. L. G. Braasch (Eds.), *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the educational sciences* (pp. 245–276). Cambridge, MA: MIT Press.

Marsh, E. J. (2004). Story stimuli for creating false beliefs about the world. *Behavior Research Methods, Instruments, & Computers*, *36*, 650–655.

Marsh, E. J., Cantor, A. D., & Brashier, N. M. (2016). Believing that humans swallow spiders in their sleep: False beliefs as side effects of the processes that support accurate knowledge. In B. H. Ross, (Ed.), *Psychology of Learning and Motivation* (Vol. 64), pp. 93–132.

Marsh, E. J., & Fazio, L. K. (2006). Learning errors from fiction: Difficulties in reducing reliance on fictional stories. *Memory & Cognition*, *34*, 1141–1149.

Marsh, E. J., Meade, M. L., & Roediger, H. L. (2003). Learning facts from fiction. *Journal of Memory and Language*, *49*, 519–536.

Nieuwland, M. S., & Van Berkum, J. J. (2006). When peanuts fall in love: N400 evidence for the power of discourse. *Journal of Cognitive Neuroscience*, *18*, 1098–1111.

O'Brien, E. J., Cook, A. E., & Guéraud, S. (2010). Accessibility of outdated information. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *36*, 979–991.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to persuasion*. New York, NY: Springer-Verlag.

Proctor, R. N., & Schiebinger, L. (Eds.). (2008). *Agnotology: The making and unmaking of ignorance*. Stanford, CA: Stanford University Press.

Rapp, D. N. (2008). How do readers handle incorrect information during reading? *Memory & Cognition*, *36*, 688–701.

Rapp, D. N., & Braasch, J. L. G. (Eds.). (2014). *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the educational sciences*. Cambridge, MA: MIT Press.

Rapp, D. N., Hinze, S. R., Kohlhepp, K., & Ryskin, R. A. (2014). Reducing reliance on inaccurate information. *Memory & Cognition*, *42*, 11–26.

Rapp, D. N., Hinze, S. R., Slaten, D. G., & Horton, W. S. (2014). Amazing stories: Acquiring and avoiding inaccurate information from fiction. *Discourse Processes*, *1–2*, 50–74.

Rapp, D. N., Jacovina, M. E., & Andrews, J. J. (2014). Mechanisms of problematic knowledge acquisition. In D. N. Rapp & J. L. G. Braasch (Eds.), *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the educational sciences* (pp. 181–202). Cambridge, MA: MIT Press.

Richter, T., Schroeder, S., & Wöhrmann, B. (2009). You don't have to believe everything you read: Background knowledge permits fast and efficient validation of information. *Journal of Personality and Social Psychology*, *96*, 538–558.

Singer, M. (2013). Validation in reading comprehension. *Current Directions in Psychological Science*, *22*, 361–366.

Sparks, J. R., & Rapp, D. N. (2011). Readers' reliance on source credibility in the service of inference generation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *37*, 230–247.

Vosniadou, S. (1994). Capturing and modeling the process of conceptual change. *Learning and Instruction*, *4*, 45–69.