ONE

Believing Things That Are Not True: A Cognitive Science Perspective on Misinformation

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One of these rather silly anecdotes is an actual news story: some newer Canadian hundred-dollar bills smell like maple syrup; England is considering issuing a coin featuring the pop band One Direction; the U.S. Treasury recently introduced Perry the Pyramid, a terrifying one-eyed mascot for the dollar. Choosing the real story was the task of a college student who called into the "Bluff the Listener" game on the National Public Radio program *Wait Wait . . . Don't Tell Me!* (Danforth, 2013). He won the game by correctly selecting the true but rather obscure story about scented Canadian currency. How did the listener make this choice, given it was unlikely he had the relevant information in mind to make that decision?

In this chapter, we review cognitive strategies and heuristics people use when deciding whether something is true. Our approach to understanding this issue is an experimental one, with the goal of isolating particular mechanisms that contribute to illusions of truth and the propagation of falsehoods. Many of the misconceptions covered in this volume are powerful precisely because they result from combinations of mental processes; there is not one simple trick to convincing people that Barack Obama was not born in the United States, that climate change is a hoax, or that other claims percolating through mass media are unsupported. Here, we consider how statements can be manipulated to seem more truthful than they are, why people unwittingly trust information from sources they initially knew to be unreliable, and how certain features of claims

and arguments increase their persuasiveness; our objective in revealing these processes is to inform our overall understanding of misinformation in and out of the laboratory.

An Assumption of Truth

We begin with a very basic issue, namely, that even the most skeptical people have a bias to accept what they hear as true. This partly comes out of a need to have successful conversations; to do so, a person shapes what she says to be understood by those around her and assumes others are doing the same. Thus people expect what others say to be truthful, relevant, informative but not overly so, and clear (Grice, 1975). While these guidelines can be stretched or even broken—for instance, through deception, comedy, tall tales, and long academic lectures—they describe what people expect from others in everyday discourse; violations can be noticed in children as young as three years old (Eskritt, Whalen, & Lee, 2008). Our focus here is on the expectation that speakers are truthful. While this assumption is cognitively efficient compared to a strategy of evaluating each and every claim that comes one's way, it can become problematic.

At issue is that people are often willing to be flexible in how they define "truth." We found evidence for this in a study in which Stanford undergraduates tracked instances when they shared their memories with others (Tversky & Marsh, 2000). Over the course of four weeks, students submitted more than a thousand reports of such conversations. Consistent with conversational norms not to tell more than the listener needs to know, more than a third of retellings were reported to be selective in some way. For example, a student sharing a story about an annoying dinner guest focused on the guest's criticisms of the cooking, omitting how the guest also "commented on how another one of my appetizers was tasty. . . . I mentioned everything except the positive comment [when sharing this story]. . . . I was already too annoyed to let it change my reaction." Intriguingly, this speaker also labeled this retelling "complete and accurate," presumably because the story was consistent with the overall theme of the event. In this study, a third of retellings containing distortions like omissions and elaborations were considered accurate by the teller. As Neisser (1981) has noted, truth and accuracy are not simple notions: something can be true on one level and inaccurate on another. This discussion of different levels of truth is meaningful beyond psychological theory. The legal testimony of John Dean, former counsel to President Nixon, was crucial to

prosecuting the cover-up at Watergate although large parts of what he said were factually inaccurate (Neisser, 1981). While Dean was inaccurate about many of the details, he was in another sense fundamentally right about the gist of the case and the key parties involved.

However, the problem runs deeper than people taking liberties with the truth. For example, people self-report lying in conversation at surprising rates (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). This problem is pervasive; politicians stretch the truth or lie outright, advertisements exaggerate claims, textbooks contain errors (Steuer & Ham, 2008), and people's own naïve beliefs about the world can be wrong (Markman & Guenther, 2007). People often have little knowledge to use when assessing incoming information (as in picking out the actual news story in "Bluff the Listener"), but even when they do, such monitoring may be superficial, and they miss errors that are "close enough," as described in partial match theory (Reder & Kusbit, 1991). People may fail to notice a problem with the question "How many animals of each kind did Moses take on the ark?" This is true even when those people otherwise demonstrate that they know the biblical ark was built by Noah, not Moses (Erickson & Mattson, 1981). Accepting close matches makes sense, as everyday speech is surprisingly error-filled (Fox Tree, 1995). Not surprisingly, however, people's tolerance for errors drops as errors become more blatant and further from the truth (Hinze, Slaten, Horton, Jenkins, & Rapp, 2014).

Even knowing someone is violating conversational norms and speaking untruthfully, people seem to believe what they are processing automatically. Not believing a falsehood requires an active second step that occurs after initial belief, which can be disrupted (Gilbert, 1991). Evidence for this claim comes from a study in which participants read crime reports about robberies and were instructed to play the role of judge for these cases (Gilbert, Tafarodi, & Malone, 1993). The reports contained a mix of true and false statements—similar to what a judge might actually hear—and subjects were told that true statements were printed in black, while false statements were printed in red. In one report, the false statements exacerbated the crime, such as "The robber had a gun"; in the other report, the false statements made the crime less severe. Critically, half the participants were asked to complete a secondary task while reading these reports; this subjected them to the interruption condition. The results showed that participants who were interrupted were more likely to behave as if the false statements were true; interrupted would-be judges recommended longer prison sentences after reading exacerbating, untrue

statements like "The robber had a gun." This is worrisome, as it demonstrates that even explicitly false information can be used when making the kind of judgments regularly made in the real world by distracted individuals. Gilbert's work is supplemented by more recent neuropsychological evidence that the second step in unbelieving a claim can be localized to a region of the prefrontal cortex (ventromedial prefrontal cortex); patients with damage to this brain area show global increases in credulity (Asp et al., 2012).

Reliance on Credible Sources

One way to estimate truth is simply to assess the credibility of the source. It makes sense that people are more likely to believe or act on information when its source is perceived as credible (Pornpitakpan, 2004); if a source is trustworthy, one's own lack of knowledge is unimportant. Advertisers and businesses take advantage of this strategy, spending time and money to acquire celebrity endorsements or develop refer-a-friend models. To investigate this experimentally, Unkelbach and Stahl (2009) exposed participants to a mix of true and false trivia statements, such as "Europe's biggest glacier is the Vatnajökull on Iceland," read by two different voices. They told participants that statements read by the female voice were true and those read by the male voice were false, or vice versa. In these studies, participants were able to use their recollection of the source—whether the voice was male or female—to evaluate the claim by simply applying the credibility of the source to the claim. One would hope that people discount information from sources that are not credible or may have an agenda to deceive.

However, the story regarding belief and source is more complicated than it first appears. Source information is often forgotten, with the result that people frequently do not know where they learned information. While a person is likely to know that Washington, DC, is the capital of the United States and that Mark Twain is the author of *Huckleberry Finn*, he likely does not remember how, when, and where he learned these facts (Tulving, 1985). Some source information is never attended to in the first place; other source information is lost as time passes or as information is encountered in multiple settings (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997).

Even when people do have source information stored in memory, they often fail to apply that knowledge. This problem explains at least some in-

stances of cryptomnesia, unconscious plagiarism as documented in work by Marsh, Landau, and Hicks (1997). In that work, students were asked to generate 15 ways the university might be improved. Critically, subjects returned one week later and were divided into two groups. Subjects in one group took a test containing a list of old and new ideas and selected one of three options for each: "I generated it"; "Someone else generated it"; or "The solution is new." Subjects in the other group were simply asked to generate new ideas they had not given in the first session. Plagiarism was rare in the first testing condition, in which students were explicitly asked to consider the source of ideas, but much higher in the group asked to generate ideas without thinking about the ideas' sources. Similar effects have been found using other paradigms; for instance, eyewitness suggestibility is lessened when people must explicitly attribute information to a set of sources (Lindsay & Johnson, 1989). To the extent that a situation does not prompt people to specifically attribute source, they will act as if the source is forgotten.

For these reasons, discounting less credible sources is not a very powerful strategy; as people forget the source or do not think about where the information came from, they will be influenced by information from that source. This basic idea has a long history, dating to Hovland's classic work on the *sleeper effect* during World War II. A propaganda video affected the opinions and morale of U.S. soldiers more when their attitudes were measured nine weeks after watching the movie than five days after seeing it (Hovland, Lumsdaine, & Sheffield, 1949; for a review, see Kumkale & Albarracín, 2004). This is surprising, given that memory typically declines over time. The key insight is that source information is usually lost at a faster rate than the content of the communication; the persuasiveness of the message increases over time as the source and message become disassociated. This same effect can occur in very different situations. Eyewitnesses generally reject misinformation from a low-credibility source such as a child if tested immediately afterward but demonstrate more suggestibility as time passes (Underwood & Pezdek, 1998).

Rather than the quality of a source, another possibility is to look at the number of sources providing the same information, with the assumption that something is more likely to be true if multiple people are saying it. Such a heuristic would be a valuable one, as there is evidence to support "the wisdom of crowds" (Surowiecki, 2005); averaging over a group of responses is more likely to approach the actual truth than is relying on any one individual's response. However, the problem here, again, is that

people's relative insensitivity to source information extends to the number of sources making a claim. People treat a repeated claim from the same source as similar to a claim repeated by different sources: "a repetitive voice can sound like a chorus" (Weaver, Garcia, Schwarz, & Miller, 2007). Results of a large-scale study with high school and college students indicate that students' ability to discern reliable from unreliable sources is "bleak" even when explicitly probed, as measured by tasks such as discerning ads from news stories on website homepages and evaluating claims on Twitter (Stanford History Education Group, 2016). This work suggests that even initial evaluations of sources may be lacking; future work might examine general population performance beyond the classroom on similar tasks.

Ease of Processing as Heuristics for Truth

On average, easy processing or *fluency* is interpreted as evidence of truth (Alter & Oppenheimer, 2009). One is less likely to believe another who is hard to understand, such as a speaker with a foreign accent (Lev-Ari & Keysar, 2010), or speech containing disfluencies like "uh" and "um" (Brennan & Williams, 1995). We rate a high-contrast, bolded statement (e.g., ***Osorno is in Chile***) as truer than a hard-to-read, low-contrast version (*Osorno is in Chile*) (Reber & Schwarz, 1999). Rhyming aphorisms ("What sobriety conceals, alcohol reveals") are judged to be more accurate than similar but nonrhyming versions ("What sobriety conceals, alcohol unmasks") (McGlone & Tofighbakhsh, 2000).

Fluency is a feeling that is interpreted. Depending on the circumstances, it can be taken as evidence of liking (Bornstein & D'Agostino, 1992; Zajonc, 1968), fame (Jacoby, Kelley, Brown, & Jasechko, 1989), intelligence (Alter & Oppenheimer, 2008), confidence (Alter, Oppenheimer, Epley, & Eyre, 2007; Simmons & Nelson, 2006), and other domain-specific judgments. Our focus here is on the interpretation of fluency as evidence for truth. Unkelbach (2007) argues that this heuristic reflects our knowledge of a natural correlation in the world between fluency and truth. That is, on average, any one true statement is more likely to have been encountered before than any of the infinite possible falsifications of that statement. Something repeated is easier to process than something novel (Jacoby & Whitehouse, 1989). For example, it is easy to process "Washington, DC, is the capital of the United States" for someone who has heard and read this statement many times, and it is not arbitrary that it is heard more

often than any of the following false statements: "Lompoc is the capital of the United States"; "Nashville is the capital of the United States"; "El Paso is the capital of the United States." It is important to note that while repetition often drives fluency—it gets easier and easier to read the same statement—it is not a requirement; fluent processing can also result from easy-to-read fonts, from rhymes, and from other variables.

Fluency is not limited to what is easy to process but also can refer to ease of understanding (*conceptual fluency*). Whittlesea (1993) compares the processing of the word "BOAT" in the sentence "The stormy seas tossed the BOAT" as compared to the sentence "He saved up his money and bought a BOAT." Both sentences make sense, but the former is more fluent because the earlier part of the sentence is related to the concept of a BOAT. This eased processing through *priming* (for example) can be interpreted as evidence for prior presentation (Whittlesea, 1993). Parks and Toth (2006) used a similar manipulation and found that people rated claims as more true after being primed by a related paragraph.

Similar explanations involving conceptual fluency have been offered to explain why people are more likely to rate a claim as true if it is accompanied by a photograph that provides no additional support for that claim (Newman, Garry, Bernstein, Kantner, & Lindsay, 2012). The statement "Macadamia nuts are in the same evolutionary family as peaches" is rated more true when it appears with a picture of macadamia nuts than without. Critically, the photo of macadamia nuts provided no new evidence with which to assess the claim about peaches, but it may nevertheless help process the claim. The effect does not occur when a random picture is paired with a statement (Newman et al., 2015), presumably because an unrelated photo causes conceptual disfluency. Newman and colleagues (2015) dubbed this effect of nonprobative photos a "truthiness" effect (p. 1337), borrowing a term from the comedian Stephen Colbert to describe "truth that comes from the gut, not books" (p. 1338) . Colbert (2005) was lampooning the tendency for people to rely on whether claims felt true rather than evaluating them based on evidence—which is, in fact, just what people do when they rely on fluency heuristics, although it is an adaptive strategy in most cases.

Scientific Window Dressing as Evidence of Truth

We have already discussed how people sometimes interpret credible sources as evidence for truth and how claims that are easier to process

perceptually and conceptually seem truer. Now we turn to the influence of symbols that are commonly associated with truth to examine if such trappings of science as formulas, graphs, brain images, irrelevant neuroscience references, and pictures of scientists can affect belief even if they do not add information.

The short answer to this question is yes—certain types of scientific references appear to affect belief in the science. Adding meaningless mathematics such as an irrelevant equation to a scientific abstract tends to encourage higher quality ratings (Eriksson, 2012). . References to brain areas (e.g., "the frontal lobe brain circuitry") increased people's satisfaction with scientific explanations even though the references added nothing to the logic of the explanations (Weisberg, Keil, Goodstein, Rawson, & Gray, 2008; see also Fernandez-Duque, Evans, Christian, & Hodges, 2015). Estimates of a drug's longevity increased when the chemical formula ($C_{21}H_{29}FO_5$) was included in addition to the information that the compound is "carbon-oxygen-helium-and-fluorine based" (Tal & Wansink, 2016).

One open question involves whether ostensibly scientific pictures like graphs and brain images are powerful above and beyond images described as having a truthiness effect. Some data suggest that a graph increases belief even when the same results are presented in the text (Tal & Wansink, 2016). Without a control condition with an image that is not a graph, however, we cannot be sure whether the effect is driven by the graph or the inclusion of an image, that is, its truthiness. At a minimum, the Tal and Wansink effect appears related to scientific images in that the effect was stronger in participants who agreed with the statement "I believe in science." More controversial are the effects of brain images. Initial results of another study indicate that undergraduates who read scientific texts paired with brain images were more likely to rate the articles as making more sense than articles without images (McCabe & Castel, 2008), but more recent work has failed to replicate this finding (Michael, Newman, Vuorre, Cumming, & Garry, 2013).

Features of Stories as Promoting Belief

Often one must evaluate information structured as narratives rather than as one-off claims about macadamia nuts or Icelandic glaciers. As with other types of claims, however, people are not very good at discerning honest narratives from misleading ones (Ekman & O'Sullivan, 1991). The

question we consider here is whether there is anything different about evaluating a story compared to a claim. The fact-checking website Snopes presents variations on an urban legend that goes like this: "Drugged travelers awaken in ice-filled bathtubs only to discover one of their kidneys has been harvested by organ thieves" (Mikkelson, 2008). A 1997 version of the tale posted to Snopes begins, "I wish to warn you about a new crime ring that is targeting business travelers." It proceeds through grim details of a lone traveler being slipped a drug and awakening in an ice-filled bathtub to discover that, preposterously, not one but both kidneys have been removed. A note instructs the victim call 911, whose dispatchers "have become quite familiar with this crime." The tale concludes with the assurance "This is not a scam or out of a science fiction novel, it is real" and the warning "If you travel or someone close to you travels, please be careful" (in Mikkelson 2008).

There are many differences between the statement and story. For one, the story is longer and contains additional information, two features that are likely to affect how truthfulness is perceived. Presenting information as a story is known to afford the extraction of gist (McDaniel, Einstein, Dunay, & Cobb, 1986). Moreover, this gruesome tale and other urban legends tend to be of high interest, and interesting information may take less attention to process, thus freeing up cognitive resources to allow "more flexible, increased processing" (McDaniel, Waddill, Finstad, & Bourg, 2000). And the very form of a story may have properties that render information "sticky" (Heath & Heath, 2007); it can guide remembering by providing a "story schema" for people to follow (Mandler & Johnson, 1977). Furthermore, predictable patterns constrain the information and make stories more stable as they pass from one person to another (Wallace & Rubin, 1991).

A key feature particular to stories is that they have the ability to transport the reader. While experiencing stories, one can feel emotionally involved and as if being swept away as a participant (Green & Brock, 2000). There is some evidence that being transported into a story requires a suspension of disbelief; enjoying *Jurassic Park* or a Harry Potter tale may involve putting aside what one knows about the world that contradicts the story (Gerrig, 1989). A story that suggests an unexpected outcome ("George Washington declined the nomination to become the first president of the United States") results in readers being slower to verify well-known facts ("George Washington was elected first president of the United States"). This suspension of disbelief may make one less likely to spot problems in

a narrative, as illustrated by a study in which participants read a story and circled any "false notes" or parts that did not make sense (Green & Brock, 2000). Green and Brock refer to this method as "Pinocchio circling": just as the puppet's nose signaled when he told a falsehood, authors also leave clues when they are being untruthful. But readers who were more transported by the story spotted fewer "Pinocchios," consistent with the idea that people are less likely to doubt highly transporting stories.

The Roles of Motivation and Emotions

While our approach draws heavily on cognitive psychology, the present discussion would be incomplete without at least briefly considering the role of affective processes in shaping belief, particularly the role of existing worldviews and political positions. Misconceptions such as "Tax cuts increase government revenue" and "President Bush banned stem cell research" are evaluated differently by Republicans and Democrats, and such biases are likely to limit some of the effects discussed thus far—a fluency manipulation will is highly unlikely to swing someone to the opposite position.

The Truth We Want to Exist

Prior beliefs affect how people process and evaluate incoming information. "Motivated reasoning" describes a set of findings showing that people's goals and predispositions influence how they interpret information (Kunda, 1990); or, in Colbert's words, we sometimes find "the truth we want to exist" (as cited in Sternbergh, 2006, p. 2). People tend to look for and remember information that is consistent with what they already believe; this is *confirmation bias* (Nickerson, 1998). People also subject information inconsistent with what they already believe to more scrutiny and rate them less favorably; this tendency is called *disconfirmation bias* (Edwards & Smith, 1996). In one study, participants were chosen so that half supported capital punishment and the other half opposed it (Lord, Ross, & Lepper, 1979). Before the experiment began, both groups believed most of the relevant research supported their respective positions; proponents of capital punishment believed it had a deterrent effect on crime, while opponents believed the opposite. Each person read about two research studies on capital punishment, one supporting the efficacy of the death penalty in bringing down crime and the other discrediting the death

penalty's deterrent effect. Not only did participants rate the facts that confirmed their existing beliefs to be more convincing and accurate than ones that contradicted their existing beliefs, but exposure to this mixed evidence actually polarized people's beliefs more. This *motivated skepticism* has also been found in studies when people evaluate other controversial issues such as affirmative action and gun control (Taber, Cann, & Kucsova, 2009; Taber & Lodge, 2006). Taber and colleagues (2009) argue that people are powerfully motivated to confirm their own beliefs while rejecting arguments that challenge prior positions and that these processes happen automatically.

Another line of research examines how political affiliation affects the ways retractions of information are handled. Media coverage of the beginning of the U.S.-Iraq war in 2003 provided Lewandowsky and colleagues (2005) fertile ground for testing these ideas, as corrections and retractions of earlier information occurred frequently. They found that American participants were more likely than German participants to rely on information that had been later retracted, such as the existence of weapons of mass destruction in Iraq, even when they had heard and confidently knew about the retraction (Lewandowsky, Stritzke, Oberauer, & Morales, 2005). The authors argue that these differences occurred because American and German participants held different beliefs about reasons for the war; while Americans listed "destroying weapons of mass destruction" as the most important reason for the war (on average), Germans did not consider this very important. Another study shows that Republicans were less likely than Democrats to correct the misconception that weapons of mass destruction were found in Iraq when the United States invaded (Nyhan & Reifler, 2010). In fact, such retractions may actually further cement the mistaken belief.

The Effect of Emotions

Emotions play a critical role in shaping how information is processed and evaluated. Anecdotally, examples include children saying nice things to their parents before asking favors and advertising strategies and political campaigns eliciting fear or hope. While we cannot cover all of the effects of emotion here, we simply note that the effects are powerful and have consequences that can extend to real-world contexts such as courtrooms. Images that provoke emotion—gruesome photos of a victim's injuries or from a crime scene—can lead jurors to award more damages to accident

victims (Edelman, 2009; Thompson & Dennison, 2004) or make it more likely for jurors to find a defendant guilty (Bright & Goodman-Delahunty, 2006; Douglas, Lyon, & Ogloff, 1997).

Our focus here is on the effects of emotion on the transmission of misinformation. Many studies have shown how misinformation can spread when one person reproduces false information in conversation with another (*social contagion*) (Roediger, Meade, & Bergman, 2001). Emotion may play a key role in that people are more likely to share emotional stories. In a diary study with Stanford undergraduates, retellings were more likely to involve emotional memories than neutral ones (Tversky & Marsh, 2000); another study shows that people who are more physiologically aroused (disgusted, amused, anxious, angered) are more likely to share information (Berger, 2011). This can be seen anecdotally, as urban legends often elicit high arousal, like the story about the ring of organ thieves or other false rumors about KFC serving a fried rat or people hiding razor blades in children's Halloween candy. Heath and colleagues argue that *emotional selection* helps determine what ideas get passed on and survive (Heath, Bell, & Sternberg, 2001). Their participants rated the emotional content of a sample of stories and urban legends, as well as their willingness to pass them along. People reported being more willing to pass on stories that are more disgusting. A follow-up study by Heath and Heath (2007) shows that urban legends containing disgust-inducing motifs are distributed more widely online.

Stored Knowledge Is Insufficient

Are people susceptible to misinformation even when they know better? Conversations with stubborn family members and overall difficulty counteracting sticky falsehoods in mass media suggest that the answer is yes. While we have alluded to the role of knowledge, it is worth stating explicitly that heuristics are not limited to cases of ignorance. People rely on heuristics for truth even when they have the option of retrieving the relevant information in memory that would enable them to avoid endorsing errors; knowledge affords limited protection from misinformation. There are many cases of people failing to use their knowledge logically. One is the common belief that the Great Wall of China is one of the only man-made objects that is visible from space. While the Great Wall is indeed quite long, it is not particularly wide. If it is visible from space, so would be other large structures including wide multilane freeways. And while

most people could identify H_20 as the chemical notation for water, some are nevertheless susceptible to hoaxes and pranks involving the dangers of a colorless and odorless chemical compound; two radio DJs were suspended for eliciting a minor panic on April Fool's Day when they joked that "dihydrogen monoxide" was coming out of county residents' taps (Braun, 2013).

The problem is not limited to logical extensions of knowledge. People can have the exact information necessary stored in memory and still fail to bring it to bear. In the Moses illusion, people fail to notice an incorrect reference to Moses even though they demonstrate that they know the biblical reference should be to Noah. In our experiments investigating knowledge and illusions of truth, we find that repetition affects the rated truth of statements even when they contradict well-known facts. Prior exposure to falsehoods like "A sari is a short pleated skirt worn by Scots" increases ratings of truth later on, just as is observed for statements for which people have little knowledge, such as "The Arno is the river that runs through Rome" (Fazio, Brashier, Payne, & Marsh, 2015).

Moreover, such effects are not simply a matter of failing to notice the error and reading over it. We know the errors are processed because people later repeat them despite having the correct information stored in memory as well. In one study, we asked people general questions such as "What is the largest ocean?" two weeks before exposing them to misinformation such as "The Atlantic is the largest ocean" (Fazio, Barber, Rajaram, Ornstein, & Marsh, 2013). Some of the people who gave the correct answer "Pacific" switched to "Atlantic" two weeks later. And this same effect occurs even if people demonstrate their knowledge just 10 minutes before reading the stories (Mullet, Umanath, & Marsh, 2014). Similar effects occur with films. Reading a veridical passage about how Mozart was respectful and polite as a child does not prevent the viewer from later relying on an incorrect movie clip from *Amadeus* that shows the young Mozart as childish and eccentric (Butler, Zaromb, Lyle, & Roediger, 2009; Umanath, Butler, & Marsh, 2012). In our studies we reliably find that people are susceptible to influence from misinformation even if it blatantly contradicts what they already know. These effects do not depend on forgetting the source of the information. In our experiments, people claimed they knew the Atlantic was the largest ocean before coming into the laboratory, demonstrating evidence of prior knowledge (Marsh, Meade, & Roediger, 2003). We also find that repeating the misinformation makes it more likely to persist (Barber, Rajaram, & Marsh, 2008). In other words,

sharing the error will not only propagate it to others but also make it more likely to be remembered by the teller.

As an example of these ideas in the real world we can revisit the study on media retractions on coverage of the Iraq War (Lewandowsky et al., 2005). Critically, after measuring whether people's beliefs were in line with the retractions, the researchers asked people whether they remembered reading retractions of the errors. Remembering a retraction did not guarantee an effect on belief; people could have knowledge of the retraction stored in memory and yet act as if they did not know it. Our experimental work shows that people use heuristics to evaluate truth even when knowledge is available in memory. However, such relatively neutral trivia stimuli are unlikely to provoke motivated reasoning by which people more actively interpret information to be consistent with their worldviews. The limitations of knowledge in preventing errors may be even starker for more partisan contexts, as in the case of the Iraq War (see Nyhan, 2016, for related open questions).

Conclusion

Chris Yamas was the caller who successfully chose the correct news story about Canadian currency out of two similarly silly distractors on the NPR game "Bluff the Listener" (Danforth, 2013). He explains his reasoning on air as follows: "You know, I dated a lovely Canadian girl, and I have many Canadian friends, and I know they're a bunch of maple-loving loonies. So I'm going to go with A [the Canadian $100 bill smelling like maple syrup]." While it is impossible to know exactly how Chris came to his decision—it could easily have been a lucky guess—we have discussed several strategies he may have relied on in making his correct decision. Chris could have recollected a conversation with his ex or a friend from Canada as reliable sources in discussing their currency's curious scent. And even if he could no longer remember when or how he heard the story previously, prior exposure would have generated a feeling of fluency that Chris could take as a heuristic for truth. In either case, Chris would have used a proxy for truth instead of directly retrieving knowledge from memory, a strategy people commonly use when evaluating claims. This reliance on heuristics normally works, as it did for Chris, but it can also lead people astray. A casual listener tuning in to the radio program could have been distracted, making the listener less likely to take the active second step

necessary to unbelieving the falsehoods after understanding them. And perhaps a reader, forgetting that she originally read the stories about One Direction on British coins and Perry the Pyramid from this text, will one day misconstrue these made-up stories for truth and circulate them in conversation.

In our experimental work, we find that creating situations in which people fail to notice or repeat misinformation is relatively easy, even when they should know better. Such errors matter, as they form the bases for confusions that are propagated through people and the media while being shaped by emotions and preexisting motives. Correcting such beliefs can prove challenging. In an ideal world, we would advocate for such errors to be unbelieved immediately upon encountering them rather than needing correction after they have been believed and shared with others. However, this kind of online detection is a real challenge, given that people's goals in life often mismatch with a monitoring focus; they consume media to be entertained, to have beliefs confirmed, and to be distracted from other things. We know that people can sometimes be encouraged to bring their knowledge to bear, through explicit instructions to mark errors (Green & Brock, 2000; Marsh & Fazio, 2006), or to take the perspective of a proofreader (Rapp, Hinze, Kohlhepp, & Ryskin, 2014), but these laboratory studies not do suggest realistic interventions. Future research should focus on this early stage of belief, before the development of large misconceptions that require massive interventions to correct.

References

Alter, A. L., & Oppenheimer, D. M. (2008). Effects of fluency on psychological distance and mental construal (or why New York is a large city, but New York is a civilized jungle). *Psychological Science*, *19*(2), 161–167.

Alter, A. L., & Oppenheimer, D. M. (2009). Uniting the tribes of fluency to form a metacognitive nation. *Personality and Social Psychology Review*, *13*(3), 219–235.

Alter, A. L., Oppenheimer, D. M., Epley, N., & Eyre, R. N. (2007). Overcoming intuition: Metacognitive difficulty activates analytic reasoning. *Journal of Experimental Psychology: General*, *136*(4), 569–576.

Asp, E., Manzel, K., Koestner, B., Cole, C., Denburg, N. L., & Tranel, D. (2012). A neuropsychological test of belief and doubt: Damage to ventromedial prefrontal cortex increases credulity for misleading advertising. *Decision Neuroscience*, *6*, 100.

Barber, S. J., Rajaram, S., & Marsh, E. J. (2008). Fact learning: How information accuracy, delay, and repeated testing change retention and retrieval experience. *Memory*, *16*(8), 934–946.

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Berger, J. (2011). Arousal increases social transmission of information. *Psychological Science*, *22*(7), 891–893.

Bornstein, R. F., & D'Agostino, P. R. (1992). Stimulus recognition and the mere exposure effect. *Journal of Personality and Social Psychology*, *63*(4), 545.

Braun, M. (2013, April 2). DJs' April Fools' prank leads to small-scale panic. *USA Today*. Bonita Springs, FL. Retrieved from http://www.usatoday.com/story/news/nation/2013/04/02/florida-water-prank/2046639

PQ: When a URL ends a reference entry, periods are missing. Intentional?

Brennan, S. E., & Williams, M. (1995). The feeling of another's knowing: Prosody and filled pauses as cues to listeners about the metacognitive states of speakers. *Journal of Memory and Language*, *34*, 383–398.

Bright, D. A., & Goodman-Delahunty, J. (2006). Gruesome evidence and emotion: Anger, blame, and jury decision-making. *Law and Human Behavior*, *30*(2), 183–202.

Butler, A. C., Zaromb, F. M., Lyle, K. B., & Roediger, H. L. (2009). Using popular films to enhance classroom learning: The good, the bad, and the interesting. *Psychological Science*, *20*(9), 1161–1168.

Colbert, S. (Producer). (2005, October 17). "The Word—Truthiness." [Television series clip]. *Colbert Report*. New York, NY: Comedy Central.

Conway, M. A., Gardiner, J. M., Perfect, T. J., Anderson, S. J., & Cohen, G. M. (1997). Changes in memory awareness during learning: The acquisition of knowledge by psychology undergraduates. *Journal of Experimental Psychology: General*, *126*(4), 393.

Danforth, M. (Producer). (2013, June 1). *Wait wait . . . don't tell me!* [Radio broadcast]. Chicago, IL: National Public Radio. Retrieved from http://www.npr.org/templates/story/story.php?storyId=187762247

DePaulo, B. M., Kashy, D. A., Kirkendol, S. E., Wyer, M. M., & Epstein, J. A. (1996). Lying in everyday life. *Journal of Personality and Social Psychology*, *70*(5), 979.

Douglas, K. S., Lyon, D. R., & Ogloff, J. R. P. (1997). The impact of graphic photographic evidence on mock jurors' decisions in a murder trial: Probative or prejudicial? *Law and Human Behavior*, *21*(5), 485–501.

Edelman, B. (2009). The impact of graphic injury photographs on liability verdicts and non-economic damage awards. *The Jury Expert: The Art and Science of Litigation Advocacy*, *21*(5), 1–4.

Edwards, K., & Smith, E. E. (1996). A disconfirmation bias in the evaluation of arguments. *Journal of Personality and Social Psychology*, *71*(1), 5.

Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist*, *46*(9), 913.

Erickson, T. D., & Mattson, M. E. (1981). From words to meaning: A semantic illusion. *Journal of Verbal Learning and Verbal Behavior*, *20*, 540–551.

Eriksson, K. (2012). The nonsense math effect. *Judgment and Decision Making*, *7*(6), 746.

Eskritt, M., Whalen, J., & Lee, K. (2008). Preschoolers can recognize violations of the Gricean maxims. *British Journal of Developmental Psychology*, *26*(3), 435–443.

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), 1–5.

Fazio, L. K., Brashier, N. M., Payne, B. K., & Marsh, E. J. (2015). Knowledge does not

protect against illusory truth. *Journal of Experimental Psychology: General*, *144*(5), 993–1002.

Fernandez-Duque, D., Evans, J., Christian, C., & Hodges, S. D. (2015). Superfluous neuroscience information makes explanations of psychological phenomena more appealing. *Journal of Cognitive Neuroscience*, *27*(5), 926–944.

Fox Tree, J. E. (1995). The effects of false starts and repetitions on the processing of subsequent words in spontaneous speech. *Journal of Memory and Language*, *34*, 709–738.

Gerrig, R. J. (1989). Suspense in the absence of uncertainty. *Journal of Memory and Language*, *28*(6), 633–648.

Gilbert, D. T. (1991). How mental systems believe. *American Psychologist*, *46*(2), 107–119.

Gilbert, D. T., Tafarodi, R. W., & Malone, P. S. (1993). You can't not believe everything you read. *Journal of Personality and Social Psychology*, *65*(2), 221.

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology*, *79*(5), 701–721.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan, *Syntax and semantics: Vol. 3. Speech acts* (pp. 41–58). New York, NY: Academic Press.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: the case of urban legends. *Journal of Personality and Social Psychology*, *81*(6), 1028.

Heath, C., & Heath, D. (2007). *Made to stick: Why some ideas survive and others die*. New York, NY: Random House.

Hinze, S. R., Slaten, D. G., Horton, W. S., Jenkins, R., & Rapp, D. N. (2014). Pilgrims sailing the Titanic: Plausibility effects on memory for misinformation. *Memory & Cognition*, *42*(2), 305–324.

Hovland, C. I., Lumsdaine, A. A., & Sheffield, F. D. (1949). *Studies in social psychology in World War II: Vol. 3. Experiments on mass communication*. Princeton, NJ: Princeton University Press.

Jacoby, L. L., Kelley, C., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology*, *56*(3), 326.

Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious perception. *Journal of Experimental Psychology: General*, *118*(2), 126.

Kumkale, G. T., & Albarracín, D. (2004). The sleeper effect in persuasion: A meta-analytic review. *Psychological Bulletin*, *130*(1), 143–172.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, *108*(3), 480–498.

Lev-Ari, S., & Keysar, B. (2010). Why don't we believe non-native speakers? The influence of accent on credibility. *Journal of Experimental Social Psychology*, *46*(6), 1093–1096.

Lewandowsky, S., Stritzke, W. G. K., Oberauer, K., & Morales, M. (2005). Memory for fact, fiction, and misinformation: The Iraq War 2003. *Psychological Science*, *16*(3), 190–195.

Lindsay, D. S., & Johnson, M. K. (1989). The eyewitness suggestibility effect and memory for source. *Memory & Cognition*, *17*(3), 349–358.

Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology*, *37*(11), 2098.

Mandler, J. M., & Johnson, N. S. (1977). Remembrance of things parsed: Story structure and recall. *Cognitive Psychology*, *9*(1), 111–151.

Markman, K. D., & Guenther, C. L. (2007). Psychological momentum: Intuitive physics and naive beliefs. *Personality and Social Psychology Bulletin*, *33*(6), 800–812.

Marsh, E. J., & Fazio, L. K. (2006). Learning errors from fiction: Difficulties in reducing reliance on fictional stories. *Memory & Cognition*, *34*(5), 1140–1149.

Marsh, E. J., Meade, M. L., & Roediger, H. L. R. (2003). Learning facts from fiction. *Journal of Memory and Language*, *49*(4), 519–536.

Marsh, R. L., Landau, J. D., & Hicks, J. L. (1997). Contributions of inadequate source monitoring to unconscious plagiarism during idea generation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(4), 886.

McCabe, D. P., & Castel, A. D. (2008). Seeing is believing: The effect of brain images on judgments of scientific reasoning. *Cognition*, *107*(1), 343–352.

McDaniel, M. A., Einstein, G. O., Dunay, P. K., & Cobb, R. E. (1986). Encoding difficulty and memory: Toward a unifying theory. *Journal of Memory and Language*, *25*(6), 645–656.

McDaniel, M. A., Waddill, P. J., Finstad, K., & Bourg, T. (2000). The effects of text-based interest on attention and recall. *Journal of Educational Psychology*, *92*(3), 492–502.

McGlone, M. S., & Tofighbakhsh, J. (2000). Birds of a feather flock conjointly (?): Rhyme as reason in aphorisms. *Psychological Science*, *11*(5), 424–428.

Michael, R. B., Newman, E. J., Vuorre, M., Cumming, G., & Garry, M. (2013). On the (non)persuasive power of a brain image. *Psychonomic Bulletin & Review*, *20*(4), 720–725.

Mikkelson, D. (Fact checker). (2008, March 12). Kidney theft. Snopes.com. Retrieved from http://www.snopes.com/horrors/robbery/kidney.asp

Mullet, H. G., Umanath, S., & Marsh, E. J. (2014). Recent study, but not retrieval, of knowledge protects against learning errors. *Memory & Cognition*, *42*(8), 1239–1249.

Neisser, U. (1981). John Dean's memory: A case study. *Cognition*, *9*, 1–22.

Newman, E. J., Garry, M., Bernstein, D. M., Kantner, J., & Lindsay, D. S. (2012). Nonprobative photographs (or words) inflate truthiness. *Psychonomic Bulletin & Review*, *19*(5), 969–974.

Newman, E. J., Garry, M., Unkelbach, C., Bernstein, D. M., Lindsay, D. S., & Nash, R. A. (2015). Truthiness and falsiness of trivia claims depend on judgmental contexts. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *41*(5), 1337–1348.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, *2*(2), 175–220.

Nyhan, B. (2016, June). The challenge of false beliefs. Presented at *How We Can Improve Health Science Communication*, University of Michigan, Ann Arbor. Retrieved from https://www.isr.umich.edu/cps/events/Nyhan_20160613.pdf

Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, *32*(2), 303–330.

Parks, C. M., & Toth, J. P. (2006). Fluency, familiarity, aging, and the illusion of truth. *Aging, Neuropsychology, and Cognition*, *13*(2), 225–253.

Pornpitakpan, C. (2004). The persuasiveness of source credibility: A critical review of five decades' evidence. *Journal of Applied Social Psychology*, *34*(2), 243–281.

Rapp, D. N., Hinze, S. R., Kohlhepp, K., & Ryskin, R. A. (2014). Reducing reliance on inaccurate information. *Memory & Cognition*, *42*(1), 11–26.

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition*, *8*, 338–342.

Reder, L. M., & Kusbit, G. W. (1991). Locus of the Moses illusion: Imperfect encoding, retrieval, or match? *Journal of Memory and Language*, *30*, 385–406.

Roediger, H. L., Meade, M. L., & Bergman, E. T. (2001). Social contagion of memory. *Psychonomic Bulletin & Review*, *8*(2), 365–371.

Simmons, J. P., & Nelson, L. D. (2006). Intuitive confidence: Choosing between intuitive and nonintuitive alternatives. *Journal of Experimental Psychology: General*, *135*(3), 409–428.

Stanford History Education Group. (2016). *Evaluating information: The cornerstone of civic online reasoning*. Stanford Graduate School of Education. Retrieved from https://sheg.stanford.edu/upload/V3LessonPlans/Executive%20Summary%2011.21.16.pdf

Sternbergh, A. (2006, October 16). Stephen Colbert has America by the ballots. *New York Magazine*. New York, NY. Retrieved from http://nymag.com/news/politics/22322

Steuer, F. B., & Ham, K. W. (2008). Psychology textbooks: Examining their accuracy. *Teaching of Psychology*, *35*(3), 160–168.

Surowiecki, J. (2005). *The wisdom of crowds*. New York, NY: Anchor.

Taber, C. S., Cann, D., & Kucsova, S. (2009). The motivated processing of political arguments. *Political Behavior*, *31*(2), 137–155.

Taber, C. S., & Lodge, M. (2006). Motivated skepticism in the evaluation of political beliefs. *American Journal of Political Science*, *50*(3), 755–769.

Tal, A., & Wansink, B. (2016). Blinded with science: Trivial graphs and formulas increase ad persuasiveness and belief in product efficacy. *Public Understanding of Science*, *25*(1), 117–125.

Thompson, C. M., & Dennison, S. (2004). Graphic evidence of violence: The impact on juror decision-making, the influence of judicial instructions and the effect of juror biases. *Psychiatry, Psychology and Law*, *11*(2), 323+.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology*, *26*(1), 1–12.

Tversky, B., & Marsh, E. J. (2000). Biased retellings of events yield biased memories. *Cognitive Psychology*, *40*(1), 1–38.

Umanath, S., Butler, A. C., & Marsh, E. J. (2012). Positive and negative effects of monitoring popular films for historical inaccuracies: Learning history from popular films. *Applied Cognitive Psychology*, *26*(4), 556–567.

Underwood, J., & Pezdek, K. (1998). Memory suggestibility as an example of the sleeper effect. *Psychonomic Bulletin & Review*, *5*(3), 449–453.

Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(1), 219–230.

Unkelbach, C., & Stahl, C. (2009). A multinomial modeling approach to dissociate different components of the truth effect. *Consciousness and Cognition*, *18*(1), 22–38.

Wallace, W. T., & Rubin, D. C. (1991). Characteristics and constraints in ballads and their effects on memory. *Discourse Processes*, *14*(2), 181–202.

Weaver, K., Garcia, S. M., Schwarz, N., & Miller, D. T. (2007). Inferring the popularity of an opinion from its familiarity: A repetitive voice can sound like a chorus. *Journal of Personality and Social Psychology*, *92*(5), 821–833.

Weisberg, D. S., Keil, F. C., Goodstein, J., Rawson, E., & Gray, J. R. (2008). The seductive allure of neuroscience explanations. *Journal of Cognitive Neuroscience*, *20*(3), 470–477.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *19*, 1235–1253.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology Monograph Supplement*, *9*(2). Retrieved from http://isites.harvard.edu/fs/docs/icb.topic472736.files/Zajonc.pdf