Source Memory Is More Accurate for Opinions Than for Facts

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ABSTRACT

Effective communication relies on consumers remembering, sharing, and applying relevant information. Source memory, the ability to link a claim to its original source, is an essential aspect of accurate recall, attitude formation, and decision making. We propose that claim objectivity, whether a claim is a fact or an opinion, affects memory for the claim's source. This proposal follows a two-step process: (i) opinions provide more information about sources than facts do; (ii) claims that provide more information about sources during information encoding are more likely to be accurately attributed to original sources during recall. Across twelve pre-registered experiments (N=7,008) and a variety of consumer domains, we investigate the effect of claim objectivity on source memory. We find that source memory is more accurate for opinions than for facts, with no consistent effect on claim recognition memory. We find support for the proposed process by manipulating facts to be more informative about sources and opinions to be less informative about sources. When forming inferences and seeking advice from sources, participants integrate new evidence more accurately based on sources' previously shared opinions than facts. Our results indicate that opinions are more likely to be accurately attributed to original sources than are facts.

Keywords: source memory, objectivity, memory, opinions, facts

In an information-rich world, consumers continuously encounter claims originating from a variety of different sources. Media outlets publish headlines, online reviewers share experiences, friends offer recommendations, and politicians disseminate narratives. Billions of dollars are spent every year on advertisements, slogans, and marketing campaigns as companies compete with one another for consumers' time, attention, and memory. Effective communication relies heavily on memory processes, assuming that consumers will be able to accurately recall previously encountered information (Bettman 1979; Johar and Pham 1999; Lynch, Alba, and Hutchinson 1991; Lynch and Srull 1982). Source memory, the ability to link a claim to its original source, is an essential aspect of accurate recall, attitude formation, and subsequent decision making. For example, whether people believe news headlines to be real or fake, and criminal suspects to be guilty or innocent, depends on their source memory for presented claims (Fragale and Heath 2004). Source memory has consequential implications for persuasion (Kumkale and Albarracín 2004), consumer choice (Bettman 1979), and public health behaviors (Morgan et al. 2021).

However, as with other types of memory, source memory failures are common. In a pilot test with 98 participants on Amazon's Mechanical Turk, 95% of participants (93 of 98) reported having experienced a source memory failure, 55% of whom were not able to eventually recall the source. For participants who had experienced a source memory failure, 49% reported that it had been at least 'moderately important' to recall the source and 27% reported that it had been 'very important' or 'extremely important'. 73% of participants were frustrated by their source memory failures, with 26% reporting that the experience was very frustrating. Such experiences are reflected in the very presence of online forums (e.g., the *'/r/tipofmytongue'* subreddit serves as a resource for frustrated consumers to seek help with source memory failures) and entertainment

platforms (e.g., *Sporcle* allow users to play and test their source memory on "Who Said It?" quizzes for movie and TV quotes) based around source memory failures. A constant in our daily lives, source memory failures can have important consequences for advertising efficacy. For instance, source memory misattributions resulted in consumers incorrectly identifying FedEx as the official sponsor of the 1998 Winter Olympics rather than the true sponsor UPS (Johar and Pham 1999). After Energizer introduced commercials with their now-ubiquitous pink drumming bunny mascot in the late 1980s, reports claimed that up to 40% of consumers who praised the Energizer campaign inaccurately misattributed the pink drumming bunny mascot to competitor Duracell (Kent and Kellaris 2001; Krishnan and Chakravarti 2003).

Although source memory has received limited attention in consumer research, the causes of source memory failures have been a point of interest in cognitive science. Memory researchers have found that source memory accuracy is affected by the source of a claim (source effects), the recipient of a claim (individual differences), and by the context in which claims are encountered (context effects) (Bell, Mieth, and Buchner 2021; Cansino et al. 2019; Kassam et al. 2009). However, to our knowledge, whether features of the claims *themselves* might affect source memory accuracy has not been considered in the memory literature. Claim effects are not just a novel focus for source memory research, they are also of first-order relevance to marketing managers. In order to craft successful marketing campaigns and understand how consumers communicate with one another, it's important to identify how features of a claim can affect the way in which the claim is perceived, processed, and engaged with.

In the present research, we investigate the effects on source memory accuracy of one such claim feature: *claim objectivity*. While some claims are objective (reflecting verifiable truth or falsehood) other claims are subjective (reflecting opinions and beliefs). Claim objectivity has

a wide range of implications for consumer beliefs about quality vs. taste (Spiller and Belogolova 2017), workplace collaboration and negotiation (Liberman et al. 2012), political polarization (Skitka and Morgan 2014), interpersonal conflict (Ross and Ward 1995), and the spread of misinformation (Penney 2020). Yet research on claim objectivity in consumer behavior has also been limited.

Importantly, claim objectivity has the potential to affect source memory accuracy. The objectivity of a claim provides consumers with informational value about the claim's source. Both young children (ages 8-10) and adults (ages 17-40) learn more about a source when the source shares an opinion (e.g., *"Oranges are the tastiest fruit of all"*) than when the source shares a factual claim about the world (including accurate claims e.g., *"George Washington was the first president of the United States"* and inaccurate claims e.g., *"There are dinosaurs alive right now"*) (Heiphetz et al., 2014).

The present research finds that a claim's objectivity affects how accurately consumers are able to recall its original source, offering key considerations for memory researchers, consumer researchers, and industry practitioners.

CLAIM OBJECTIVITY

The claims we encounter and share vary in their objectivity. Some claims are objective, they are factual statements which can be verified as either true or false (e.g., "Stockholm is the capital of Sweden"). Other claims are opinions, they are subjective assessments which cannot be verified as true or false but people may agree or disagree with them (e.g., "Stockholm is more beautiful than Copenhagen"). Because opinions are subjective, they allow for inconsistent

assessments: Jack may believe that Stockholm is more beautiful than Copenhagen, Jill may believe that Copenhagen is just as beautiful, and yet because neither one of them expresses a belief that can be considered objectively true or false, neither one is right nor wrong. Factual statements, on the other hand, generally necessitate the existence of an objectively correct view: someone is either right or they are wrong.

Perceived objectivity is often at the root of conflict. When people believe that the conflicting perspective of an adversary is defined by objective inaccuracy, rather than simply reflecting a divergent opinion, they are less likely to be receptive to the adversary's perspective (Heiphetz and Young 2017; Liberman et al. 2012). Claim objectivity touches upon many aspects of our personal and professional lives, leading to interpersonal conflict (Ross and Ward 1995), undermining collaboration (Liberman et al. 2012), and driving political partisanship (Blatz and Mercier 2018; Skitka and Morgan 2014) and moral tribalism (Johnson et al. 2021).

Claim objectivity marks the foundation of ongoing legal and policy discussions about the credibility of social and traditional media sources, the spread of misinformation, and the rise of partisan conflict. In defending against a 2020 defamation lawsuit, Fox News' attorney argued that comments Tucker Carlson made on his show, "cannot reasonably be interpreted as facts" and as such cannot be considered as factually inaccurate (*McDougal v. Fox News Network LLC* 2020). In responding to a 2021 defamation lawsuit, former federal prosecutor Sidney Powell's attorneys similarly claimed that "no reasonable person would conclude that the statements were truly statements of fact… Powell's claims were her opinions" (*US Dominion, Inc. v. Powell* 2021). Facebook's policy of not fact-checking posts classified as opinions has stymied efforts from climate scientists to combat the spread of misinformation about climate change, resulting in the spread of climate change denialism posts on the platform when labeled as opinions (Penney

2020). These incidents highlight the increasing importance of understanding how claim objectivity affects the ways in which people process, remember, and engage with content (Shane 2017).

Perceived objectivity is of particular relevance for consumer researchers and marketing managers interested in product and attribute comparisons. Consumers are often exposed to advertisements or reviews that compare two brands, claiming one to be directly superior (e.g., "Coca-Cola is better than Pepsi"). Consumers are willing to pay more for the superior product in question when they believe that the comparison represents one of objective quality rather than one of subjective taste (Spiller and Belogolova 2017).

SOURCE MEMORY

Source memory is a form of associative memory, a critical function of human cognition that allows us to form, store, and remember associations between elements (Anderson 1983; Johnson, Hashtroudi, and Lindsay 1993). The formation and strength of these associative links (e.g., between a claim and its source) relies on the binding between an item and its surrounding features during the initial encoding of information (Johnson et al. 1993; Chalfonte and Johnson 1996; Mitchell and Johnson 2009; Old and Naveh-Benjamin 2008; Mitchell and MacPherson 2017; Greene, Martin, and Naveh-Benjamin 2021; Bell, Mieth, and Buchner 2022). Remembering a situation involves both the encoding of the individual elements that make up the situation (e.g., what was said, who said it, in what context it was said, etc.) as well as the encoding of links binding these various individual elements to one another, forming a web of interconnected elements and relational constructs (Chalfonte and Johnson 1996; Meiser and

Bröder 2002). Precisely *how* these links are formed, stored, and retrieved is a focus of ongoing research across a number of disciplines, aiming to identify the neural and cognitive mechanisms underpinning source memory processes (e.g., for a recent review see Kuhlmann et al., 2021).

Accurate item memory (memory for a previously seen focal item, e.g., what was learned) can be driven by episodic memory, a conscious process whereby a person can explicitly recall the focal item as well as the context in which it was learned. Accurate item memory can also be driven by familiarity-based memory, a process whereby the experience and context is not explicitly recalled but the focal item feels familiar (Yonelinas 2002). Whether both processes can also drive accurate source memory (memory for features of the context in which a focal item was previously seen, e.g., when, how, and from whom something was learned) is an unresolved question with contradictory findings (Mitchell and Johnson 2009; Mayes, Montaldi, and Migo 2007; Staresina and Davachi 2006). Kuhlmann et al. (2021) suggest that these seemingly contradictory findings can be resolved by considering distinctions in what is classified as the focal item for a task (i.e., when sources are the focal point of attention at encoding, 'source memory' may operate more like 'item memory'). The specific processes underpinning source memory are an active focus of investigation.

Source Memory Failures

Memory – including source memory – often fails us as consumers. Source memory is of particular relevance for aging consumers, who experience declines in associative memory performance (Law, Hawkins, and Craik 1998; Hashtroudi, Johnson, and Chrosniak 1989; Chalfonte and Johnson 1996). Reduced source memory accuracy in older adults is attributed to

weaker associative links formed during encoding between items and sources (Naveh-Benjamin 2000; Old and Naveh-Benjamin 2008). Strategies developed to assist older adults in source memory recall have targeted the encoding stage, aiming to strengthen the links formed between items and sources (Kuhlmann and Touron 2012). For instance, Glisky, Rubin, and Davidson (2001) ask participants to study the source-item relationship during encoding, finding that attributing greater attention to these relationships improves source memory at recall. These findings highlight the importance of source-item links formed during encoding as a key driver of source memory accuracy during recall (Johnson et al. 1993; Chalfonte and Johnson 1996).

When source memory recall is unsuccessful, consumers try to reconstruct associations based on existing information, heuristics, and stereotypes about source and information characteristics (Batchelder and Batchelder 2008; Kuhlmann and Touron 2011; Schaper, Kuhlmann, and Bayen 2019; Mieth et al. 2021). Informed guessing helps consumers, for example to identify the source of a textbook recommendation as a colleague rather than a car mechanic, based on the likelihood of the respective source options (Batchelder and Batchelder 2008; Bell, Mieth, and Buchner 2020; Bell et al. 2021). However, consumers are also susceptible to limited experiences with and lay beliefs about rarely-encountered groups of people, increasing a reliance on stereotypes particularly amongst older adults (Sherman and Bessenoff 1999; Klauer and Meiser 2000; Mather, Johnson, and De Leonardis 1999).

Source Memory in Consumer Contexts

Advertising efficacy relies in part on consumers making decisions at a later point in time, based on accurate recall of information that was presented to them earlier (Bettman 1979; Biehal

and Chakravarti 1986; Keller 1987; Lynch, Marmorstein, and Weigold 1988). As a result, memory processes have long been of interest to both academic and industry researchers (e.g., Burke and Srull 1988; Hutchinson and Moore 1984; Keller 1987; Lynch and Srull 1982; Kent and Kellaris 2001). As noted earlier, source memory failures can lead consumers to misattribute event sponsorships or advertising campaigns to competitors.

Research on competitive advertisement interference builds on the same associative network model used for source memory (Anderson 1983; Hutchinson and Moore 1984). When consumers encounter competitive advertising, the strength of the associations between the target brand and its advertised claims is weakened, resulting in worse memory for the target brand as the source of the advertised claims (Keller 1987; Burke and Srull 1988; Kent and Allen 1994; Kent and Kellaris 2001; Lee and Lee 2007). Competitive advertisement interference may also result in reduced evaluations of the target brand, as links between initially-formed attitudes and the target brand are weakened with the influx of information from competitors (Baumgardner et al. 1983; Burke and Srull 1988).

Source memory also affects consumers' interpersonal interactions and adaptive social behaviors. For instance, participants in a dictator game rely on source memory for other players' past choices in order to inform and update their own future behaviors accordingly (Schaper, Mieth, and Bell 2019).

Variability in Source Memory Accuracy

Source memory varies across people, contexts, and sources. Notably, accuracy declines with age and associated neurological deficits (Cansino et al. 2019; Hashtroudi et al. 1989;

Janowsky, Shimamura, and Squire 1989; Schacter et al. 1994; Simons et al. 2004). Informational salience also impacts source memory: source memory for claims is enhanced when people know beforehand that the information may be important later (Kassam et al. 2009) and factors such as source emotionality and source credibility can enhance source memory accuracy (Bell et al. 2021; Davidson, McFarland, and Glisky 2006).

Yet to our knowledge, research on features of the claims themselves that may affect source memory has been limited. The role of emotional claims has been disputed as a source effect of emotional sources rather than as a claim effect of valence (Davidson, McFarland, and Glisky 2006; Doerksen and Shimamura 2001). Variability in source memory accuracy is subject to differences across people, contexts, sources, and claims, but prior research has focused primarily on individual differences, context effects, and source effects, and has not substantially addressed claim effects. In the current research, we aim to address this gap by investigating a claim effect, specifically the role of claim objectivity, on source memory.

Source Memory and Claim Objectivity

As noted earlier, subjective claims provide more information about a source than do objective claims (Heiphetz et al. 2014), and source memory accuracy is affected by the strength of source-claim links formed during encoding (Greene et al. 2021; Mitchell and Johnson 2009; Mitchell and MacPherson 2017; Pham and Johar 1997). Because opinions are more informative about a source than are facts, we predict that the associative links formed during encoding will be stronger between sources and opinions than between sources and facts. As a result, we expect that consumers will be more likely to correctly identify the original source of a claim when the

claim is an opinion than when the claim is a fact.

OVERVIEW OF EXPERIMENTS

In twelve pre-registered experiments, we examine the effect of claim objectivity on source memory across different consumer environments. In experiments 1, 2a, 2b, and 2c we establish the main effect. In experiment 3, we examine whether source expertise moderates this effect, finding no such evidence. In experiments 4 and 5 we identify process evidence by making facts more informative about a source (experiment 4) or opinions less informative about a source (experiment 5). In experiments 6a and 6b we consider two downstream consequences of the observed main effect, finding that participants are better able to form inferences about sources (experiment 6a) and are more likely to seek relevant advice from sources (experiment 6b) based on sources' previously shared opinions than their previously shared facts. In the general discussion, we discuss three experiments in which we did not find an effect of claim objectivity on source memory. Together, these twelve experiments constitute all of the experiments we conducted in which we varied claim objectivity and measured source memory accuracy.

Each experiment used a similar design and method, as pre-registered on AsPredicted, so we describe that overall approach first before describing each experiment in detail. This research was certified exempt by the home institution IRB. All anonymized data, code, materials (including a full list of sources and claims), and pre-registrations are available on Research Box (https://researchbox.org/501&PEER_REVIEW_passcode=ZNQBPW).

Method Across Experiments

For each experiment we recruited a convenience sample of participants from Amazon Mechanical Turk. Sample sizes were large enough to provide at least 80% power to detect a within-subject difference of 0.15 standard deviations in our target measure of source memory for opinions versus facts. The overall experimental design used in each experiment was based on the source memory literature (e.g., Kassam et al. 2009). Each experiment was composed of three stages.

First was the encoding stage. A set of sources, individuals with names and photographs, were shown sequentially to participants. Each source was accompanied by four claims: two factual statements and two opinions (experiment 4 used six claims per source, with four factual statements and two opinions). Participants were presented with an engagement task and asked to rate each source for likeability, knowledgeability, or usefulness; the specific prompt varied across experiments. To control for stimulus effects, the particular set of claims shown to each participant during the encoding stage was counterbalanced across participants. Source images were taken from a publicly available repository of artificial faces produced by a generative adversarial network (Karras, Laine, and Aila 2019).

Second was the filler stage, during which participants reported basic demographics. The primary purpose of this stage was to separate the encoding stage from the recall stage. Including a period of delay after encoding is commonplace in source memory research; subsequent memory tests are more likely to rely on recall processes rather than on information active in working memory (for a recent review of source memory procedures, see Kuhlmann et al. 2021).

Third was the recall stage, which tested participants' source memory and claim recognition memory. In each experiment, the memory tests in the recall stage provided our key

dependent measures. Participants were tested on the information (claims and sources) that they had been previously presented during the encoding stage of each experiment. To test source memory, participants were sequentially presented with previously seen claims (half factual statements, half opinions) and asked to identify the original source that had accompanied each claim from a multiple-choice list of sources. The multiple-choice list of sources (including both photographs and names of each source) included all of the original sources seen in the encoding stage as well as an equal number of filler sources not previously seen. To test recognition memory, participants were sequentially presented with claims and asked to identify whether each claim had been shown to them earlier or not. In the recognition memory test, half of the claims participants were tested on had been previously presented to them (during the encoding stage of an experiment, with an equal number of previously seen opinions and previously seen facts tested). The other half of the claims participants were tested on had not been previously presented to them (with an equal number of opinions and facts tested). Participants' performance on the claim recognition memory task was used to identify inattentive participants, based on at or below-chance performance as pre-registered across experiments.

Across experiments, we also controlled for the particular subset of claims that was used to test for source memory vs. recognition memory. Each participant saw a set of claims during the encoding stage. In the recall stage, half of the claims from the encoding stage was used to test source memory and the other half of the claims from the encoding stage was used to test recognition memory. Which half of the claims from the encoding stage was used to test source memory vs. recognition memory was counterbalanced across participants.

The primary measure of interest was the effect of claim objectivity on source memory. For each participant, the key dependent variable was the within-subject difference between the

percentage of opinions that the participant correctly attributed to their original sources and the percentage of facts that the participant correctly attributed to their original sources. This within-subject difference reflected the effect of claim objectivity on source memory. In each experiment, we regressed the key dependent variable on an intercept (the key estimate) and a complete set of contrast coded variables (to account for baseline differences between different subsets of claims and sources that were counterbalanced between participants). The intercept represented the key estimate of interest: the difference in source memory for opinions vs. facts. The contrast coded variables allowed us to control for variations in the stimuli. We used a similar approach to analyze recognition memory as a control variable.

EXPERIMENT 1

Experiment 1 lays the groundwork for the 3-stage experimental design. Subsequent experiments followed this paradigm closely, extending the findings of experiment 1 across a variety of consumer contexts. Experiment 1 was pre-registered on AsPredicted. See Research Box for a complete list of stimuli and sources.

Method

In the encoding stage, participants ($N = 399$) were presented with 32 general claims about the world from 8 sources. Data were collected on Amazon MTurk using CloudResearch's "block low quality participants" filter (Litman, Rosenzweig, and Moss 2020). Each source was accompanied by a name, a photograph, and four claims: two factual statements (e.g., "Aristotle

was a Greek philosopher") and two opinions (e.g., "Chocolate ice cream tastes better than zucchini"), drawn from prior literature (Fazio et al. 2015; Goodwin and Darley 2008; Pennycook and Rand 2019). For each presented source, participants were asked to provide a rating for how much they like the source on a scale from (1) Dislike to (5) Like.

In the filler stage, participants were presented with a set of demographics questions. The primary purpose of the filler stage was to separate the encoding and recall stages.

In the recall stage, participants were presented with claims seen in the encoding stage. Claims from half of the sources were used to test source memory. Participants were asked to identify each claim's source from a panel of 16 sources (with names and photographs), including the 8 sources seen in the encoding stage and 8 novel sources not previously seen. Claims from the other half of the sources were used to test claim recognition memory. Using binary yes/no measures, participants were asked whether or not they had seen each of 32 claims (8 factual statements and 8 opinions from the encoding stage; 8 filler factual statements and 8 filler opinions not seen previously).

Results

The recall stage provided us with our measures of interest. Our within-subject dependent variable was the difference between the percentage of opinions that the participant correctly attributed to their original sources and the percentage of facts that the participant correctly attributed to their original sources. This within-subject difference reflected the effect of claim objectivity on source memory. This within-subject difference score was regressed on a contrast-coded variable (-1, +1) representing the between-subject counterbalancing of claims used to test

source memory vs. recognition memory.[1] This variable was intended to merely be a nuisance variable to account for differences in baseline tendencies between sets. The intercept was the key test of interest, representing the within-subject main effect of claim objectivity on source memory, averaged across counterbalanced groups. 76 participants were excluded from the analysis of experiment 1 for scoring at or below chance on the recognition memory task, suggesting inattentiveness.[2]

Participants correctly identified the source for 46.8% of opinions and for 34.3% of factual statements. Source memory accuracy was greater for opinions than for factual statements (b = 12.47, $t(321) = 10.54$, $p < .001$)[3]. See Figure 1 and Table 1. As a benchmark for source memory accuracy, because participants are presented with 16 sources during the source memory test, a naïve participant selecting sources purely at random would have correctly identified the sources for 6.3% of claims. If a more sophisticated participant selected at random from one of the eight non-filler sources, they would have correctly identified the sources for 12.5% of claims. Thus, participant performance on this task is substantially better than chance.

A secondary measure of interest was the effect of claim objectivity on claim recognition memory. They key dependent variable for this measure was the participant-level within-subject difference between the percentage of opinions that the participant correctly identified as having been presented earlier or not and the percentage of factual statements that the participant

[1]In experiment 1, all participants encoded the full stimulus set (32 claims across 8 sources), removing the need for contrast-coded variables to account for stimulus subset assignment.
[2]Although these exclusion criteria were not pre-registered for experiment 1, they are consistent with the exclusion criteria pre-registered for a majority of the following experiments. The results of analyses that do not exclude inattentive participants do not lead to qualitatively different inferences. See supplementary materials for robustness checks including inattentive participants.
[3]The difference between opinions and facts also varied across counterbalanced groups, as indicated by the test of the nuisance contrast code: $b = 7.28$, $t(321) = 6.15$, $p < .001$. We also reanalyzed the data allowing for random effects for claim (Judd, Westfall, and Kenny 2017). The coefficient on objectivity remained the same (b = 12.47); given this less powerful test, t = 4.53.

correctly identified as having been presented earlier or not. Participants correctly recognized whether 86.2% of opinions had been presented earlier and correctly recognized whether 82.5% of factual statements had been presented earlier. Although in experiment 1 recognition memory was more accurate for opinions than for factual statements ($b = 3.73$, $t(321) = 6.08$, $p < .001$), in the experiments that follow we do not find a systematic effect of claim objectivity on recognition memory. We discuss this further in the general discussion.

TABLE 1

SUMMARY STATISTICS: ALL EXPERIMENTS

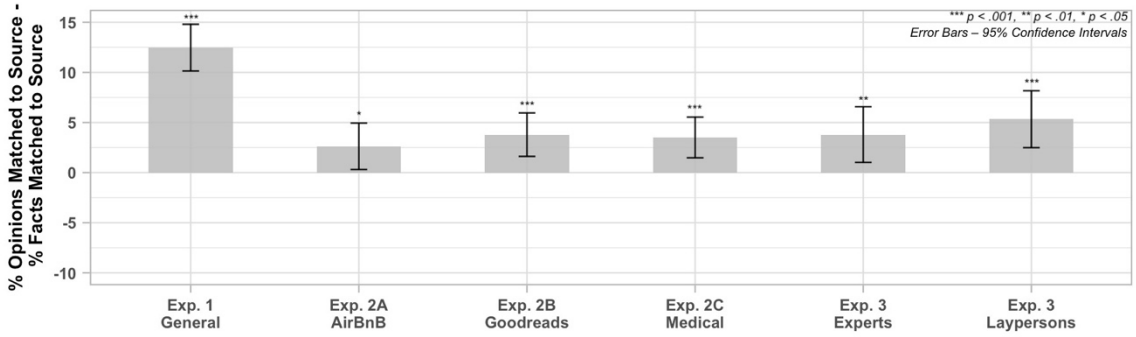
		Source Memory			Recognition Memory		
Experiment	*N*	Opinions (%)	Facts (%)	Opinions – Facts *(95% CI)*	Opinions (%)	Facts (%)	Opinions – Facts *(95% CI)*
1	399	46.76	34.29	12.47 *(10.14, 14.80)*	86.20	82.46	3.73 *(2.52, 4.94)*
2A (AirBnB)	501	42.90	40.27	2.63 *(0.31, 4.94)*	80.64	85.17	-4.53 *(-5.93, -3.14)*
2B (Goodreads)	504	36.63	32.84	3.79 *(1.62, 5.96)*	77.66	77.64	0.03 *(-1.31, 1.36)*
2C (Medical)	501	36.44	32.93	3.51 *(1.48, 5.54)*	84.68	85.22	-0.54 *(-1.82, 0.74)*
3 (Layperson)	606	37.93	32.60	5.33 *(2.49, 8.17)*	80.82	77.63	3.19 *(0.65, 5.72)*
3 (Expert)	606	36.37	32.57	3.79 *(1.02, 6.57)*	81.83	80.05	1.78 *(-0.64, 4.20)*
4 (World facts)	403	41.11	38.18	2.93 *(0.66, 5.20)*	80.57	79.00	1.57 *(0.21, 2.93)*
4 (Source facts)*	403	41.11	42.18	3.99 *(1.74, 6.24)*	80.57	75.18	-3.83 *(-5.24, -2.42)*
5 (Authors)	1,213	36.76	33.50	3.26 *(1.40, 5.12)*	78.53	78.19	0.34 *(-0.95, 1.63)*

5 (Re-tellers)	1,213	27.55	26.55	1.00 *(-0.87, 2.87)*	77.33	78.17	-0.84 *(-2.14, 0.46)*
6a (Inferences)	640	40.65	36.58	4.06 *(2.07, 6.06)*	87.31	85.62	1.69 *(0.61, 2.77)*
6b (Advice seeking)	639	40.96	38.18	2.78 *(0.69, 4.88)*	87.89	85.75	2.13 *(1.10, 3.17)*
S1 (Metacritic)	499	20.38	21.06	-0.67 *(-2.04, 0.70)*	68.12	70.83	-2.71 *(-3.99, -1.44)*
S2 (Cued recall)	501	31.80	31.77	0.03 *(-2.15, 2.21)*	69.82	70.35	-0.53 *(-2.10, 1.05)*
S3 (Media sources)	601	26.84	27.73	-0.89 *(-2.93, 1.15)*	85.71	84.49	1.22 *(-0.04, 2.48)*

NOTE.—*Effect size estimates for *Experiment 4 (Source Facts)*, reflect the difference between facts about the source and facts about the world.

FIGURE 1

SOURCE MEMORY IN EXPERIMENTS 1-3: MAIN EFFECT



NOTE.—Source memory is more accurate for opinions than for factual statements in the context of general claims (experiment 1), AirBnB reviews (experiment 2a), Goodreads reviews (experiment 2b), medical claims (experiments 2c and 3). In experiment 3, this effect holds for medical claims from expert sources as well as for medical claims from layperson sources.

EXPERIMENTS 2A, 2B, 2C

Experiment 2a, 2b, and 2c aimed to replicate the findings of experiment 1, expanding the observed main effect into the consumer domain of online reviews across three distinct contexts: reviews for AirBnB rentals for apartments in New York (experiment 2a), book reviews from a popular online book review platform, Goodreads (experiment 2b), and medical guidance for a fake disease based on recent public health literature (experiment 2c). The methodology used for all three experiments was largely the same, building on the design of experiment 1 while employing considerably larger stimulus sets in order to increase power and robustness. Whereas experiment 1 presented all participants with a single fixed set of eight sources and 32 claims, experiment 2 expanded the stimulus set and decoupled claims from sources. In experiments 2a-c, the stimulus set for each experiment consisted of 24 sources and 96 claims divided into four between-subject groups, such that each participant was presented with one of four unique sets of 6 sources and 24 claims. The stimulus set of 96 claims for each experiment was selected from a larger set of claims, pretested using the same population on Amazon MTurk. Claim pretesting ensured that factual claims were perceived as objective and opinions were perceived as subjective. Pretesting also ensured that differences in claim objectivity were not confounded by differences in claim emotionality, valence, or arousal. A complete list of stimuli, sources, and pre-tested values for possible claim confounds are available on Research Box. Additionally, rather than asking participants to rate each source for likability during the encoding stage (as in experiment 1), in experiment 2a-c participants were instead asked to provide a rating for how useful the reviews from each source are. This change ensured that participants were not inadvertently directed to differentially attend to opinions over facts as a result of the likability engagement task. Experiments 2a, 2b, and 2c were each pre-registered on AsPredicted.

Method

Experiment 2a (N = 501) used a full set of 24 sources and 96 claims drawn from AirBnB reviews for apartment rentals in New York City, including 48 factual statements (e.g., "The room had black curtains") and 48 opinions (e.g., "The room had tasteless curtains"). The stimulus set was randomly distributed across four between-subject groups such that each participant was exposed to one of four sets of six sources and 24 claims (12 factual statements, 12 opinions). Data were collected on Amazon MTurk using CloudResearch's "block low quality participants" filter. In the encoding stage, each participant was sequentially presented with six sources. Each source was accompanied by four claims (two factual statements, two opinions) and participants were asked to provide a rating for how useful the reviews from the source are on a scale from (1) Not at all useful to (5) Very useful. As pre-registered, 81 participants were excluded from the analysis of experiment 2a for scoring at or below chance on the recognition memory task, suggesting inattentiveness.

Experiment 2b (N = 504) used a full set of 24 sources and 96 claims drawn from public book reviews on Goodreads. Data were collected on Amazon MTurk using CloudResearch's "block low quality participants" filter. As in experiment 2a, the stimulus set was divided into four between-subject groups, with assignment of group counterbalanced across participants. Participants were presented with a set of six sources, each of which was accompanied by two factual statements (e.g., "*The Walmart Book of the Dead*, inspired by ancient Egyptian funerary texts, has shoplifters, greeters, and circuit court judges wander Walmart unknowingly consigned to their afterlives") and two opinions (e.g., "*The Walmart Book of the Dead* is a profoundly

original look into an afterlife where people wander Walmart, it is full of profound character studies, glowing prose, and sweet sincerity"). As pre-registered, 56 participants were excluded from the analysis of experiment 2b for scoring at or below chance on the recognition memory task, suggesting inattentiveness.

Experiment 2c (N = 501) used a full set of 24 sources and 96 claims about a fictional disease, NKV, drawn from a protocol developed for clinical research (Morgan et al. 2021). Just as in experiments 2a and 2b, the full stimulus set was divided into four between-subject groups, with participants randomly assigned to one of four claim subsets. Participants were presented with six sources each of which was accompanied by two factual statements (e.g., "NKV medications come in pill and liquid form") and two opinions (e.g., "NKV medications are more pleasant in pill than in liquid form"). Data were collected on Amazon MTurk using CloudResearch's "approved participants" filter (Litman et al., 2020). As pre-registered, 29 participants were excluded from the analysis of experiment 2c for scoring at or below chance on the recognition memory task, suggesting inattentiveness.

Of the 24 claims each participant saw in the encoding stage, 12 claims were used to test source memory (six factual statements, six opinions). To test source memory, participants were asked to identify each claim's source from a panel of 12 sources (with names and photographs), including all six sources that the participant saw in the encoding stage as well as six novel (filler) sources not previously seen. The remaining 12 claims not used to test source memory were instead used to test claim recognition memory. Participants were asked whether they had previously been shown each of the 12 claims (six factual statements, six opinions) along with 12 novel claims not previously seen (six filler factual statements, six filler opinions). The particular subsets of 12 claims used to test source memory vs. the subsets of 12 claims used to test

recognition memory were counterbalanced across participants.

Results

As in experiment 1, the key test of interest in experiments 2a, 2b, and 2c was a within-subject participant-level difference in source memory accuracy for opinions and source memory accuracy for facts. In each experiment, the stimulus set was divided into four between-subject groups, with assignment of group counterbalanced across participants, such that every participant saw one of four randomly-assigned sets of 24 claims and 6 sources. Of the 24 claims that each participant saw, the particular subset of 12 claims that was used to test source memory vs. claim recognition memory was also counterbalanced between-subjects. In each experiment, this 4x2 counterbalancing resulted in 8 between-subject groups.

For each experiment, the key dependent variable was regressed on the complete set of 7 contrast-coded variables (-1, +1) representing the 8 between-subject groups. These were intended to merely be nuisance variables. In each experiment, the intercept was the key test of interest, representing the main effect of claim objectivity on source memory.

In experiment 2a, participants accurately identified the source for 42.9% of opinions and for 40.3% of factual statements ($b = 2.63$, $t(412) = 2.23$, $p = .026$). In experiment 2b, participants accurately identified the source for 36.6% of opinions and for 32.8% of factual statements ($b = 3.79$, $t(440) = 3.43$, $p < .001$). In experiment 2c, participants accurately identified the source for 36.4% of opinions and for 32.9% of factual statements ($b = 3.51$, $t(464) = 3.40$, $p < .001$).

In all three experiments, we find that source memory is more accurate for opinions than

for factual statements.[4] See Figure 1. Selecting sources purely at random would have allowed participants to correctly identify the sources for 8.33% of claims (or, if they chose at random from previously seen sources, for 16.67% of claims). In experiments 2a-c, participants' source memory accuracy for both factual statements and for opinions is much better than would be expected by purely random chance performance.

As in experiment 1, we analyzed recognition memory using the same analysis approach as for source memory. In experiment 2a, on average, participants correctly recognized 80.6% of opinions and 85.2% of factual statements (b = -4.53, $t(412)$ = -6.38, $p < .001$). In experiment 2b, on average, participants correctly recognized 77.7% of opinions statements and 77.6% of factual statements (b = .03, $t(440)$ = .04, p = .968). In experiment 2c, on average, participants correctly recognized 84.7% of opinions and 85.2% of factual statements (b = -.54, $t(464)$ = -1.02, p = .768). In contrast to the results of experiment 1, recognition memory in experiment 2a was less accurate for opinions than for factual statements in experiment 2a and no different in experiments 2b and 2c.

Experiments 2a-c expanded upon the main effect initially observed in experiment 1. Using nearly 200 claims from online review platforms AirBnB and Goodreads, experiments 2a and 2b find that participants are better able to accurately identify the original source of a review claim when it is an opinion than when it is a fact. Experiment 2c finds that this effect is robust across 96 claims of medical advice about a fake disease. Even in a medical context, source misattributions were more frequent for factual claims than they were for opinions. Given the

[4]The magnitude of the main effect differed across stimuli sets in experiment 2a ($F(7, 412)$ = 3.23, p = .002) and in experiment 2b ($F(7, 440)$ = 2.43, p = .019). In experiment 2c, results did not significantly differ across stimuli sets ($F(7, 464)$ = 1.14, p = .338). We also reanalyzed the data allowing for random effects for claim (Judd et al. 2017). The coefficients on objectivity remained the same; given these less powerful tests, experiment 2a t = 1.22, experiment 2b t = 2.20, and experiment 2c t = 2.07.

importance of public health literacy, experiment 3 builds on the findings of experiment 2c with an additional focus on the role of source expertise.

EXPERIMENT 3

In experiment 3, we expand upon the finding of experiment 2c in a medical context to consider effects of source expertise. Source expertise plays an important role in effective communication, persuasion, and credibility, and so is of particular relevance in a medical context for promoting health literacy. Given prior findings that consumers pay closer attention to information when it comes from experts (Heesacker, Petty, and Cacioppo 1983; Tobin and Raymundo 2009), it is important to assess whether the effects of claim objectivity on source memory are attenuated by source expertise. If the effect persists for expert sources, the consequences for source memory errors may be higher than if the effect only holds for lay sources. As with all experiments, experiment 3 was pre-registered on AsPredicted. Data were collected on Amazon MTurk using CloudResearch's "approved participants" filter.

Method

Experiment 3 used the same design and stimulus set as was used in experiment 2c, with an added element of varying source expertise. Source expertise was manipulated by presenting participants ($N = 606$) with two distinct types of sources: medical professionals (experts) and laypeople (non-experts). Source expertise was signaled to participants by sources' names (e.g., "Dr. Alan, MD" vs. "Alan") as well as by the presence or absence of a prominent red medical

stethoscope logo on source photos, present during both encoding and recall stages; the subset of sources who were labeled as experts was counterbalanced across participants. In the encoding stage, each participant was presented with six sources (three medical experts, three laypersons), with each source accompanied by four claims (two factual statements, two opinions), as in experiment 2c. See Research Box for a complete list of stimuli and sources.

As in prior experiments, source memory was tested using a subset of half of the claims presented in the encoding stage (six factual statements, six opinions). Participants were asked to identify each claim's source from a panel of 12 sources (with names and photographs), including the three expert sources that were seen in the encoding stage, the three layperson sources that were seen in the encoding stage, and six filler sources (three layperson sources, three expert sources) not previously seen.

Results

Source expertise introduced an additional within-subject manipulation creating a 2 within-subject (fact vs. opinion claim) x 2 within-subject (expert vs. layperson source) x 4 between-subject (assignment of one of four stimulus sets) x 2 between-subject (subset of claims tested for source memory vs. recognition memory) x 2 between-subject (subset of sources as experts) design. The key tests of interest were the difference between the percentage of opinions vs. facts correctly attributed to their expert sources and the difference between the percentage of opinions vs. facts correctly attributed to their layperson sources. We regressed the key measures of interest on a complete set of 15 contrast-coded variables (-1, +1) representing the 16 between-subject groups. The intercepts were the key tests of interest, representing the simple effect of

claim objectivity on source memory for expert sources and layperson sources, respectively. The contrast-coded variables representing the between-subject groups and their interactions were intended to merely be nuisance variables to account for differences in baseline tendencies between sets. As pre-registered, 30 participants were excluded from the analysis of experiment 3 for scoring at or below chance on the claim recognition memory task, suggesting inattentiveness.

Replicating the results of experiment 2c, we find that source memory is more accurate for opinions than for factual statements when claims originated from layperson sources ($b = 5.33$, $t(560) = 3.68$, $p < .001$). Participants accurately identified the source for 37.9% of opinions from layperson sources and for 32.6% of factual statements from layperson sources. Extending the replication, when sources are denoted as medical experts, source memory is also more accurate for opinions than for factual statements ($b = 3.79$, $t(560) = 2.69$, $p = .007$). See Figure 1. Participants accurately identified the source for 36.4% of opinions from expert sources and for 32.6% of factual statements from expert sources. The difference between these two differences was not significant ($b = 1.53$, $t(560) = .73$, $p = .465$), indicating there is no evidence that the effect of claim objectivity on source memory is moderated by source expertise.[5] Prior work finds that consumers pay greater attention to information originating from sources with greater expertise (Heesacker, Petty, and Cacioppo 1983; Tobin and Raymundo 2009). It is possible that even with greater attention paid to expert sources, the effect of claim objectivity on source-claim binding during encoding, and the subsequently greater source memory accuracy for opinions during recall, is robust to changes in attention towards sources.

In addition to our main analysis of source memory, we also examined how accurately

[5]The magnitude of the main effect differed across stimuli sets in experiment 3 both for layperson sources ($F(15, 560) = 2.25$, $p = .004$) and for expert sources ($F(15, 560) = 1.94$, $p = .018$). We also reanalyzed the data allowing for random effects for claim (Judd et al. 2017). The coefficient on objectivity remained the same; given a less powerful test, $t = 2.99$ for the overall main effect.

participants were able to correctly identify the *expertise* of a claim's source, whether or not they could correctly identify the specific source (e.g., in some cases participants were able to correctly identify that a given claim originated from a medical professional, even though they could not correctly identify the particular medical professional source). This broader definition of accuracy allowed for analyses of memory of the source's expertise. When claims originated from layperson sources, participants correctly identified the sources' expertise for 69.8% of opinions and for 66.1% of facts. This difference is statistically significant ($b = 3.67$, $t(560) = 2.60$, $p = .010$). However, when claims originated from expert sources, participants correctly identified the sources' expertise for 74.6% of opinions and for 75.6% of facts. This difference is not statistically significant ($b = -.94$, $t(560) = -0.68$, $p = .499$). The difference between these two differences is statistically significant, with a greater effect of claim objectivity on memory for sources' expertise for claims originating from layperson sources than for claims originating from expert sources ($b = 4.61$, $t(560) = 2.30$, $p = .022$). Participants were more likely to misattribute facts than opinions originating from layperson sources to medical expert sources. This finding is aligned with research on source memory failures, such that even when memory for the specific source is not accessible, certain associations may persist (Hutchinson and Moore 1984; Kumkale and Albarracín 2004). Moreover, during source memory failures, consumers form educated guesses based on the content of the claims and heuristics about the most probable source for such a claim (Batchelder and Batchelder 2008; Bell et al. 2020; Bell et al. 2021).

As in prior experiments, in experiment 3 we also measured claim recognition memory. On average, participants correctly recognized 80.8% of opinions from layperson sources and 77.6% of factual statements from layperson sources. We find greater recognition memory for opinions than for factual statements when claims originate from layperson sources ($b = 3.19$,

$t(560) = 2.47$, $p = .014$). However, when claims originated from expert sources, participants on average correctly recognized 81.8% of opinions and 80.1% of factual statements. There was no statistically significant effect of claim objectivity on recognition memory for claims originating from expert sources ($b = 1.78$, $t(560) = 1.45$, $p = .149$). Whereas the effect of claim objectivity on source memory remained remarkably robust across experiments 1-3, the effect of claim objectivity on claim recognition memory was inconsistent.

EXPERIMENT 4

Whereas experiments 1-3 demonstrated the main effect across a variety of claim types, consumer contexts, and levels of source expertise, experiments 4 and 5 aimed to investigate process for the observed difference in source memory accuracy between opinions and factual statements. We initially predicted that source memory would be more accurate for opinions than for facts because (1) source-claim binding during encoding affects source memory during recall, and (2) opinions provide more information about sources than do facts. Based on this prediction, the observed difference in source memory accuracy between opinions and facts may be affected by how informative claims are about sources (and vice-versa; regardless of the directionality of this effect, a stronger source-claim association at encoding would be expected to result in more accurate source memory for the claim at recall).[6] In experiment 4, we test this process by making facts more informative about a source. In experiment 5, we test this process by making opinions less informative about a source.

Experiment 4 included a new type of claim – *facts about the source*. Facts about the

[6]We thank an anonymous reviewer for their insight on the bidirectionality of link formation.

source are objective claims that provide substantially more information about the source (on par with opinions) than do facts about the world. Thus, the introduction of facts about the source allowed for an investigation of whether the effect of claim objectivity on source memory accuracy may be driven by the extent to which claims provide information about their sources. Experiment 4 was pre-registered on AsPredicted. See Research Box for a complete stimulus set.

Method

Using a set of 48 claims and following the design used in experiment 1, participants in experiment 4 ($N = 403$) were exposed to a set of eight sources, each of which was accompanied by two facts about the world (e.g., "Canberra is the capital of Australia"), two opinions (e.g., "sunrises are prettier than sunsets"), and two facts about the source (e.g., "I play tennis every Monday"). As in prior experiments, source memory was assessed using a subset of half of the claims presented in the encoding stage (eight facts about the world, eight opinions, eight facts about the source). Participants were asked to identify each claim's source from a panel of 16 sources (with names and photographs), including the eight sources that were seen in the encoding stage, and eight novel sources not previously seen. When tested for recognition memory, we included a set of 24 filler claims (including all three types of claims) not previously seen in addition to the counterbalanced subset of 24 claims previously presented. Data were collected on Amazon MTurk using CloudResearch's "block low quality participants" filter.

Results

In experiment 4, our key dependent measures were (a) the difference between the percentage of opinions correctly matched to their initially presented sources and the percentage of factual statements about the world correctly matched to their initially presented sources (as in all experiments), and (b) the difference between the percentage of factual statements about the source correctly matched to their initially presented sources and the percentage of factual statements about the world correctly matched to their initially presented sources. These measures reflect the effect of claim objectivity on source memory, as well as the effect of information about the person vs. information about the world on source memory. We included a contrast-coded variable (1, -1) reflecting the counterbalanced assignment of stimulus subset used to test source memory and account for differences in baseline tendencies between tested stimulus subsets. The intercepts were the key tests of interest, representing (a) the main effect of claim objectivity on source memory and (b) the effect of a claim's information about a source on source memory for objective claims. 96 participants were excluded from the analysis of experiment 4 for scoring at or below chance on the recognition memory task, suggesting inattentiveness[7].

We replicated the findings of experiments 1-3. Participants accurately identified the source for 41.1% of opinions, for 38.2% of facts about the world, and for 42.2% of facts about the source. Source memory was significantly more accurate for opinions than for facts about the world ($b = 2.93$, $t(305) = 2.54$, $p = .012$). Moreover, consistent with the proposed process, source memory was significantly more accurate for facts about the *source* than for facts about the *world*

[7]Although these exclusion criteria are pre-registered for most other experiments, experiments 1 and 4 were conducted prior to other experiments and as such did not yet include these exclusion criteria in their pre-registrations. See supplementary materials for robustness checks that do not exclude inattentive participants; the results are not qualitatively different from those presented.

(b = 3.99, $t(305)$ = 3.49, p < .001)[8]. Source memory for facts about the source was not significantly different from source memory for opinions (b = 1.06, $t(305)$ = .99, p = .322). See Figure 2. In experiment 4, as a benchmark for source memory accuracy, a participant selecting sources purely at random would have correctly identified the sources for 6.25% of claims (or, if choosing at random from previously seen sources, for 12.5% of claims).

As in prior experiments, we included a claim recognition memory task. Participants accurately recognized 80.6% of opinions, 79.0% of facts about the world, and 75.2% of facts about the source. Recognition memory was more accurate for opinions than for facts about the world (b = 1.57, $t(305)$ = 2.27, p = .024). However, recognition memory was more accurate for facts about the world than for facts about the source (b = 3.83, $t(305)$ = 5.34, p < .001). This divergence between source memory and recognition memory again indicates that predicted differences in source memory are not simply tracking differences in recognition memory.

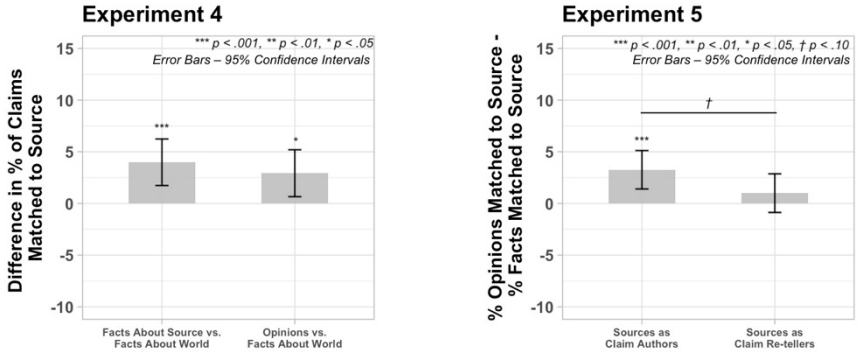
Experiment 4 provided initial evidence for the proposed process, finding that source memory is more accurate for claims which provide more information about a source. This offers insight into the observed difference in source memory accuracy between opinions and factual statements, given the baseline differences in informativeness about a source that claim objectivity often signals. In experiment 4, source memory was more accurate for factual statements when they were more informative about a source. In experiment 5, we instead investigate the effect of source memory on opinions that are not informative about a source. When opinions do not provide information about a source, we would expect that the source-

[8]In experiment 4, the results did not significantly differ across stimuli sets for both source memory for opinions vs. facts about the world ($F(1, 305)$ = 2.06, p = .152) and for source memory for facts about the source vs. facts about the world ($F(1, 305)$ = 2.32, p = .129). We also reanalyzed the data allowing for random effects for claim (Judd et al. 2017). The coefficients on claim type remained the same; given this less powerful test, t = 1.77 for facts about the self vs. facts about the world and t = 1.19 for opinions vs. facts about the world.

claim links formed during encoding between a source and an opinion are no stronger than the source-claim links formed during encoding between a source and a factual statement, reducing any differences we might have expected in source memory accuracy.

FIGURE 2

SOURCE MEMORY IN EXPERIMENTS 4 AND 5: PROCESS EVIDENCE



NOTE.—Source memory accuracy is affected by how much information claims provide about a source; source memory is more accurate when factual claims provide more information about a source (experiment 4) and source memory is not affected by claim objectivity when sources are re-tellers, rather than authors, of claims (experiment 5).

EXPERIMENT 5

In experiment 5, we use a between-subject design to manipulate how much information claims provide about their source, while holding constant the set of claims used. We then measure source memory and claim recognition memory. This use of a moderation design that holds constant the set of claims used between-subjects also serves to address any lingering concerns as to the role of stimulus sampling. If differences in source memory accuracy were due to the idiosyncratic memorability of a particular set of claims used, these differences would

persist across a design that differentially disrupts the source-relevance of a claim. In conjunction with the recognition memory findings throughout, the design in experiment 5 allows us to rule out the concern that our main effect is driven by enhanced memory overall for opinions versus facts. Experiment 5 was pre-registered on AsPredicted. Data were collected on Amazon MTurk using CloudResearch's "approved participants" filter.

Method

Experiment 5 used the same protocol, sources, and claims as in experiment 2b, with a full set of 24 sources and 96 claims drawn from public book reviews on Goodreads. See Research Box for a complete list of stimuli and sources. Participants (N=1,213; 121 excluded for low recognition memory scores) were presented with six sources, each of which was accompanied by four claims (2 factual statements, 2 opinions). In a between-subject manipulation of claim authorship, participants were told that the sources accompanying each set of claims were either (a) the authors of the claims (author condition, a direct replication of experiment 2b) or (b) the re-tellers of claims authored by others and randomly pulled out of a hat (re-teller condition). The manipulation of claim authorship created two contexts, one in which claims provide information about the sources (when the sources are authors of the claims), and one in which claims provide limited to no information about the sources (when the sources are simply re-telling claims that they did not write).

As in prior experiments, source memory was tested using a subset of half of the claims presented in the encoding stage (six factual statements, six opinions). Participants were asked to identify each claim's source from a panel of 12 sources (with names and photographs), including

the six sources that were seen in the encoding stage and six (filler) sources not previously seen.

Results

In each of the claim authorship conditions (authors vs. re-tellers), a stimulus set of 96 claims and 24 sources was counterbalanced across four between-subject groups such that each participant saw a subset of 24 claims and 6 sources. Of the 24 claims participants saw, half were used to test source memory and half were used to test recognition memory, counterbalanced between-subjects. This 2x4x2 counterbalancing resulted in 16 between-subject groups and 15 contrast-coded variables. The key difference score of interest was regressed on the complete set of 15 contrast-coded variables (-1, +1) representing the 16 between-subject groups. The coefficient on the contrast code representing the between-subject manipulation of claim authorship (authors vs. re-tellers) was the key test of interest, representing the interaction between claim authorship and claim objectivity on source memory. The remaining coefficients were intended to merely be nuisance variables to account for differences in baseline tendencies between sets and the interaction of those baseline tendencies with claim authorship. As such, the primary results of interest were (i) the effect of claim objectivity on source memory for author sources, which was a direct replication of experiment 2b, (ii) the effect of claim objectivity on source memory for re-teller sources, and (iii) the interaction effect of claim authorship, representing the difference between (ii) and (i). 121 participants were excluded from the analysis of experiment 5, as pre-registered, for scoring at or below chance on the recognition memory task, suggesting inattentiveness.

The main effect, represented by the intercept, replicated the results of experiments 1-4.

Source memory was more accurate for opinions than for facts (b = 2.13, t(1076) = 3.18, p = .002).[9] The interaction effect of claim authorship, represented by the coefficient on the contrast code reflecting the between-subject manipulation of claim authorship (authors vs. re-tellers), indicated a marginally significant reduction in the main effect. The magnitude of the difference in source memory accuracy between opinions and facts was reduced for re-tellers compared with authors (b = -2.26, t(1076) = -1.69, p = .092).[10]

When sources were presented as authors of claims, our results replicated those of experiment 2b. Participants accurately identified the source for 36.8% of opinions and for 33.5% of facts. Source memory was more accurate for opinions than for facts (b = 3.26 t(1076) = 3.45, p < .001). When sources were presented as re-tellers of claims, participants accurately identified the source for 27.5% of opinions and for 26.5% of facts. This difference is not statistically significant; source memory was not more accurate for opinions than for facts when claims originated from re-teller sources (b = 1.00, t(1076) = 1.05, p = .293). See Figure 2.

When comparing across conditions, source memory accuracy was reduced by 9.2 percentage points for opinions and by 6.9 percentage points for factual claims in the re-tellers condition compared with the authors condition. Participants choosing at random would have correctly matched the sources for 8.33% of claims (or, if they chose at random from previously

[9]In experiment 5, the magnitude of the main effect varied across the 8 sets of stimuli F(7, 1076) = 7.70, p < .001. The magnitude of the interaction effect of claim authorship did not vary significantly across the 8 sets of stimuli F(7, 1076) = .52, p = .824.

[10]This attenuation, though marginally significant, is a two-tailed test of a directional prediction, as specified in the pre-registration. We suspect that this may reflect an effect of participant inattention. When using a stricter exclusion of participants who scored at or below 75% accuracy on claim recognition memory, the simple effect in the authors condition (b = 4.51, t(571) = 3.39, p < .001) is fully attenuated by the authorship condition manipulation (b = 2.25, t(571) = 2.36, p = .018) resulting in no simple effect in the re-tellers condition (b = .01, t(571) = .01, p = .995). We also reanalyzed the data allowing for random effects for claim (Judd et al. 2017). The coefficient on the interaction between claim objectivity and source authorship remained the same; given this less powerful test, t = 1.31.

seen sources, for 16.67% of claims). Participants perform substantially better than chance at the source memory task in both conditions.

We also find that claim objectivity does not affect recognition memory, when aggregated across authorship conditions (b = -.25, t(1076) = -.54, p = .592). We find no interaction effect of claim authorship on a difference in recognition memory between opinions and facts (b = .59, t(1076) = 1.26, p = .208). There was no simple effect of claim objectivity on recognition memory for sources as authors (b = .34, t(1076) = .51, p = .608) nor for sources as re-tellers (b = -.84, t(1076) = -1.27, p = .206). Average claim recognition memory collapsed across both facts and opinions was no different between authorship conditions (b = .301, t(1076) = .745, p = .456).

EXPERIMENTS 6A AND 6B

In experiments 6a and 6b we consider downstream consequences. In an information-rich landscape it is often necessary to update priors with additional context, integrating new evidence to form more accurate beliefs about the world. For instance, a colleague might mention their favorite restaurant. However, we may only learn afterwards that the restaurant is located in Helsinki. Integrating this new evidence, we update our beliefs about the colleague, learning that they have been to Finland.

Using the same three-stage design as in prior experiments, experiments 6a and 6b initially provide participants with claims taken out of context, later providing context for those claims during the recall task. At the recall stage, participants are asked to integrate the new information in relation to previously-seen claims, and form inferences about previously-seen sources (experiment 6a) or share intentions to seek advice from previously seen sources (experiment 6b).

Method

Experiments 6a and 6b used a stimulus set consisting of 12 sources and 48 claims (24 factual statements and 24 opinions). See Research Box for a complete list of stimuli and sources. Participants were presented with six sources, each of which was accompanied by four claims (2 factual statements, 2 opinions). The claims were presented as snippets of overheard conversation, taken out of context (e.g., *"…variable-venturi carburetors weigh less than fixed-venturi carburetors…"*). The particular subset of claims presented was counterbalanced across participants, as was the subset of sources accompanying the claims. During the encoding stage, participants were asked to rate how interesting a conversation with each of the six presented sources would be on a scale from (1) Not at all interesting to (5) Very interesting.

Unlike in prior experiments, in experiments 6a and 6b participants were not asked to identify the source of a previously-seen claim. Instead, participants were presented with additional contextual evidence about previously-seen claims (e.g., *"On a daily basis, car mechanics work with and compare the two different types of carburetors found in cars (variable-venturi vs. fixed-venturi)"*). Based on the new contextual information about previously-seen claims, participants were asked to either make inferences about sources (experiment 6a) or to report advice-seeking intentions from relevant sources (experiment 6b).

In experiment 6a ($N = 640$), participants were asked to make an inference about the sources of 12 previously-seen claims to which each new piece of contextual information applied (e.g., *"To the best of your ability, please identify the person who you think is a car mechanic"*). Based on these instructions, participants selected the source about whom an inference might be

made from a multiple-choice list of 12 sources (6 previously-seen sources, 6 filler sources not previously seen). Participants could make inferences about the sources by integrating the new contextual information with the previously-seen claims, and relying on the encoded associations between previously-seen claims and their respective sources. Pretest data indicated that when claims, sources, and context were all presented simultaneously, participants did not draw substantively different conclusions about sources based on differences in claim objectivity.

In experiment 6b ($N = 639$), participants were asked to indicate advice-seeking intentions based on inferences that could be made about the sources of 12 previously-seen claims (6 factual statements, 6 opinions) to which each new piece of contextual information applied (e.g., *"To the best of your ability, please identify the person who you would most likely seek advice from about fixing your car")*. Based on these instructions, participants selected the source from whom they would seek relevant advice. By integrating the new contextual information about previously-seen claims with the sources that had initially accompanied those claims, participants could infer the relevance of a source's expertise.

Results

In experiment 6a, participants were asked to match attributes (e.g., *'is a car mechanic'*) to sources, based on inferences learned from novel contextual information about claims previously accompanied by the sources. The key measure of interest was the difference between the percentage of attributes accurately matched to sources previously accompanied by opinions and the percentage of attributes accurately matched to sources previously accompanied by factual statements. This measure reflects the effect of claim objectivity on the accuracy with which new

information is integrated to form beliefs about sources.

In experiment 6b, participants were asked to select sources from whom they would seek relevant advice (e.g., *'about fixing your car'*), based on relevance learned from novel contextual information about claims previously accompanied by the sources. The key measure of interest was the difference between the percentage of relevant advice-seeking intentions accurately matched to sources previously accompanied by opinions and the percentage of relevant advice-seeking intentions accurately matched to sources previously accompanied by factual statements. This measure reflects the effect of claim objectivity on the accuracy with which new information is integrated to seek advice from sources learned to have topically relevant experience.

In both experiments 6a and 6b, the stimulus set of 48 claims and 12 sources was counterbalanced across 8 between-subject groups such that every participant was exposed to 24 claims accompanied by 6 sources. The particular subset of 24 claims presented to each participant was assigned randomly. Each participant was also randomly assigned to one of two subsets of 6 sources to accompany the claims. Of the 24 claims that each participant saw, half were used to test source memory and half were used to test recognition memory, counterbalanced between-subjects. This 2x2x2 counterbalancing resulted in 8 between-subject groups and 7 contrast-coded variables. The key measure of interest was regressed on the complete set of 7 contrast-coded variables (-1, +1) representing the 8 between-subject groups. In each experiment the intercept was the key test of interest, representing the main effect of claim objectivity on making accurate inferences about sources (experiment 6a) or seeking advice from matched sources (experiment 6b). 42 participants were excluded from the analysis of experiment 6a and 42 participants were excluded from the analysis of experiment 6b, as pre-registered, for scoring at or below chance on the recognition memory task, suggesting inattentiveness.

In experiment 6a, participants accurately matched context-based attributes to sources for 40.6% of opinions and for 36.6% of factual statements ($b = 4.07$, $t(590) = 4.00$, $p < .001$). Likewise in experiment 6b, participants accurately identified the source for 41.0% of opinions and for 38.2% of factual statements ($b = 2.78$, $t(589) = 2.61$, $p = .009$).

In both experiments, we find that participants are able to integrate new evidence about sources more accurately when the new evidence provides context for opinions that had previously accompanied the sources than when the new evidence provides context for factual statements that had previously accompanied the sources.[11] See Figure 3. Selecting sources purely at random would have allowed participants to correctly identify the sources for 8.33% of claims (or, if they chose at random from previously seen sources, for 16.67% of claims).

A secondary measure of interest was the difference in recognition memory accuracy for opinions versus factual statements. In experiment 6a, participants correctly recognized 87.3% of opinions and 85.6% of factual statements ($b = 1.69$, $t(590) = 3.08$, $p = .002$). In experiment 6b, participants correctly recognized 87.9% of opinions statements and 85.8% of factual statements ($b = 2.13$, $t(589) = 4.04$, $p < .001$).

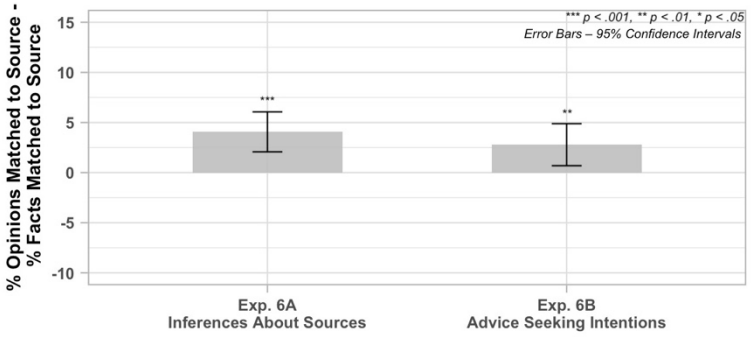
In experiments 6a and 6b, recognition memory is more accurate for opinions than for facts. Exploratory analyses help to distinguish recognition memory for previously seen claims from recognition memory for filler claims. In experiment 6a, claim recognition memory is more accurate for filler opinions than for filler facts ($b = 3.34$, $t(590) = 5.60$, $p < .001$). In contrast, claim recognition memory is no more accurate for previously seen opinions than for previously seen facts ($b = 0.04$, $t(590) = 0.05$, $p = .961$). Exploratory analyses find similar results for

[11]The magnitude of the main effect differed across stimuli sets in experiment 6a ($F(7, 590) = 3.48$, $p = .001$) and in experiment 6b ($F(7, 589) = 4.64$, $p < .001$). We also reanalyzed the data allowing for random effects for claim (Judd et al. 2017). The coefficients on objectivity remained the same; given these less-powerful tests, experiment 6a $t = 2.25$, experiment 6b $t = 1.43$.

experiment 6b, with a significant effect of claim objectivity on recognition memory for filler claims (b = 4.39, $t(589) = 7.17$, $p < .001$), but not for previously seen claims (b = -0.12, $t(589)$ = -0.14, p = .887). These results indicate that rather than claim objectivity differentially affecting memory for claims shown to participants during the encoding stage, the effect of claim objectivity on recognition memory in experiments 6a and 6b seem to be uniquely driven by participants' inability to identify filler facts (compared to filler opinions) as novel.

FIGURE 3

SOURCE MEMORY IN EXPERIMENTS 6A AND 6B: DOWNSTREAM CONSEQUENCES



NOTE.—The effect of claim objectivity on source memory has notable implications; participants were better able to integrate new evidence, forming more accurate inferences about sources (experiment 6a) and reporting a greater likelihood of seeking advice from relevant sources (experiment 6b) when new evidence was based on sources' previously shared opinions than when new evidence was based on sources' previously shared facts.

Experiments 6a and 6b expand on the consequences of the effect of claim objectivity on source memory demonstrated in experiments 1-3. Better source memory for opinions than for factual statements affects how accurately consumers make inferences about others, integrating

new information to update their beliefs about sources and seeking advice from sources learned to be relevant. These findings support the important implications of source memory, with varying accuracy affected by claim objectivity, for consumer attitudes, beliefs, and behaviors.

GENERAL DISCUSSION

Across nine experiments, we find that source memory is significantly more accurate for claims that are subjective opinions than for claims that are objective factual statements. This effect holds across a variety of consumer contexts, claims, and for both experts and lay sources. Two additional experiments consider the consequences of this effect for the integration of new evidence to form beliefs and advice-seeking intentions. While claim objectivity affects source memory, it does not have a consistent effect on recognition memory. Two experiments shed light on the potential process at play. When claims provide more information about a source during encoding, people are more likely to remember the source associated with the claim during recall.

Claim Objectivity and Source Memory

The magnitude of the observed effect size across experiments 1-3 ranges from a 2.63% difference in experiment 2a to a 12.47% difference in experiment 1. In experiment 1, while source gender was balanced across participants, each individual participant was tested on source memory using either exclusively male or female sources, which may help explain why the magnitude of the observed effect in this experiment is less pronounced in subsequent experiments where source gender was heterogenous for each participant during source memory

recall tasks. Nonetheless, the magnitude of the observed effect remains consistent across a variety of contexts and claims.

Experiments 2c and 3 introduce implications for medical decision making, finding that an increase in source memory accuracy for opinions over facts persists even for expert sources. Prior work on source expertise suggests that participants pay closer attention to information when it comes from experts (Tobin and Raymundo 2009). This might suggest that the main effect would be attenuated by sources' expertise. However, claim objectivity still affects source memory even when claims are accompanied by expert sources. It is possible that the attentional benefits of source expertise may not be sufficient to attenuate the strength of the source-claim links formed during encoding between facts and sources, up to that of opinions.

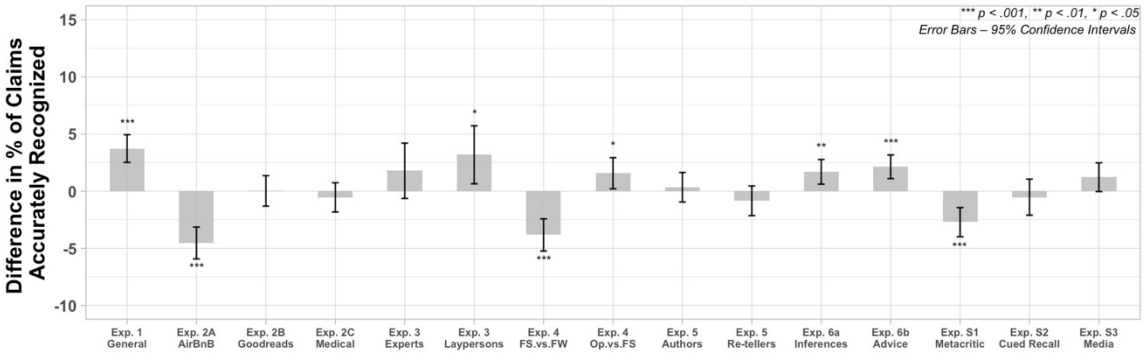
Claim Objectivity and Recognition Memory

Across experiments, we also measured claim recognition memory. In experiment 1, for layperson sources in experiment 3, and in experiments 6a and 6b, we find that recognition memory is greater for opinions than for facts. In experiment 2, we find the opposite, that recognition memory is greater for facts than for opinions; similarly in experiment 4 we find that recognition memory is greater for facts about the world than for facts about the source. In experiments 2b, 2c, 4, 5, and for expert sources in experiment 3, we find no difference in recognition memory accuracy between opinions and facts. See Figure 4. Exploratory analyses in experiments 6a and 6b find that the effect of claim objectivity on claim recognition memory was unique to filler claims, and not present for claims presented during the encoding stage. Analyzing data across experiments using a linear mixed model with experiment level random effects finds

no significant difference in claim recognition memory for opinions versus facts ($b = 0.14$, $t = 0.21$).

FIGURE 4

EXPERIMENTS 1-6 AND S1-3: CLAIM RECOGNITION MEMORY



These results suggest that the consistent effect of claim objectivity on source memory is unique to the processes underlying source memory (e.g., the strength of the source-claim links formed during encoding) rather than simply affecting claim encoding resulting in more accurate memory for one type of claim over another. This is further reinforced by the finding in experiment 5, where a manipulation that reduced the relevance of a source's link to its claims attenuated the difference in source memory accuracy but had no effect on recognition memory accuracy even though the set of claims tested remained exactly the same.

Supplementary Experiments

We conducted three additional experiments throughout the course of data collection. These pre-registered experiments included substantial changes to the experimental design which resulted in attenuations of the main effect. We present them as supplements rather than boundary

conditions because the null effects were unexpected. Whereas we anticipated extensions of the main effect, these experiments instead present either a set of potential post-hoc boundary conditions or possibly type II errors (80% power across 12 experiments would lead one to find significant results in 9.6 experiments in expectation). Additional testing is required to be able to explicitly identify each as a boundary condition. Together, these 12 experiments constitute all of the experiments we conducted in which we varied claim type and measured source memory.

In experiment S1 (N = 499; 170 excluded for inattentiveness as defined by low recognition memory scores), we deviated from the design used in experiments 1-6 by (i) using a larger stimulus set, presenting *each* participant with 12 sources for a total of 48 claims per person; (ii) presenting claims not as individually distinct statements but as single paragraph-style film reviews from Metacritic, where each review consisted of two factual statements and two opinions; and (iii) choosing longer, more nuanced claims for both factual statements (e.g., "*The Postman's White Nights* is shot in an isolated village in Northern Russia on and around Kenozero Lake, with a cast made up primarily of untrained locals playing versions of themselves") and opinions (e.g., "The setting itself is gorgeous, with its boxy cottages fringed by grassy clearings and woodlands, and the placid surface of the water stretching on for miles"). Source memory for factual statements (21.1%) and for opinions (20.4%) did not substantively differ based on claim type (b = -.67, $t(321)$ = -.96, p = .337). We suspect this result may be attributable to the increased cognitive load associated with a considerably larger and more complex stimulus set. Participants in experiment S1 were much more likely than in other experiments to have misattributed claims to sources not previously seen in this experiment (filler sources). Whereas in the other nine experiments, the average rate of misattribution of claims to filler sources ranged from 20.0% to 26.4%, in experiment S1 the average rate of misattribution of claims to filler sources was a

substantial outlier at 35.5%. Notably, 170 inattentive participants (34%) were excluded from analyses of experiment S1 for scoring at or below chance on the recognition memory task.

Experiment S2 (N = 501; 92 excluded for inattentiveness as defined by low recognition memory scores) followed the same design and used the same stimulus set as in experiment 2b (with Goodreads book review claims) but tested cued recall rather than full claim recall during the recall stage. In the source memory stage of experiment S2, participants were sequentially shown only the book titles present in previously-seen claims and asked to identify the sources associated with the reviews about those books based solely on the book titles (e.g., "Who do you know who has read *The Walmart Book of the Dead*?"). Participants accurately identified the source for 31.8% of opinions and for 31.8% of facts, a difference that is not statistically significant (b = .03, $t(401)$ = .03, p = .978). The results of experiment S2 suggest that, in the absence of any information about the substantive content of a claim, cued recall may be insufficient to accurately identify the claim's source. This may present a boundary condition for the main effect of claim objectivity on source memory, as successful source attribution can depend on how much information is provided during a recall task (Dodson and Johnson 1993).

Experiment S3 (N = 601; 42 excluded for inattentiveness as defined by low recognition memory scores) extended the investigation of source effects by deviating from human sources to consider media outlets. Using a stimulus set of 20 unique media sources and 80 claims in the form of news headlines, each participant was sequentially presented with five sources accompanied by two factual statements (e.g., "Biden Asks Congress to End Federal Moratorium on Evictions") and two opinions (e.g., "It Is Not Biden's Place to End Moratorium on Evictions"). As an engagement task during the encoding stage, participants were asked to indicate how interested they would be in visiting the media source's website on a scale from (1)

Not at all interested to (5) Very interested. When tested on source memory, participants on average accurately identified the sources for 26.8% of opinions and for 27.7% of facts, a difference that is not statistically significant (b = -.89, $t(551)$ = -.85, p = .393). Whereas opinion claims provide information about the attitudes and beliefs of their sources, it is possible that opinion news headlines may be perceived as less indicative of the views of a periodical publication (rather than those of a specific author), and the claim may subsequently lose some of its informational potency. Similarly, a source may provide useful information about a claim, but the use of randomly generated periodical publications may not allow for a stronger association to form between sources and claims as might be expected for familiar sources. As the extent to which a claim provides information about its source (or a source provides information about the claim) is key for stronger source-claim associative links to form during encoding, it is possible that the use of randomly generated media sources (rather than e.g., individual journalists or familiar media sources) limited our ability to detect a main effect.

Support for Potential Process

Experiments 4 and 5 present evidence to support the theorized process underpinning the observed main effect. In experiment 4, when facts display the opinion-like property of being more informative about sources, source memory is subsequently more accurate for those facts, on par with opinions. In experiment 5, when opinions are reduced in how informative they are about sources, source memory is subsequently reduced for opinions, on par with facts. The strength of source-claim links formed during encoding is affected by the strength of associations between sources and claims (Greene, Martin, and Naveh-Benjamin 2021; Mitchell and Johnson

2009). Opinions generally provide more information about sources than do facts (Heiphetz et al. 2014), subsequently resulting in differential source memory accuracy for opinions vs. facts.

Downstream Consequences and Consumer Implications

Experiments 1-3 find that consumers are better able to accurately identify the source of a claim when the claim is an opinion than when it is a fact. Put differently, consumers are more likely to make inaccurate source misattributions for facts than they are for opinions. Experiments 4 and 5 support a potential process underpinning this effect, emphasizing an inherent difference between opinions and facts, whereby consumers encoding information form stronger associations between sources and opinions than between sources and facts, with consequences for source memory. In experiments 6a and 6b, we extend the implications of differential source memory (in)accuracy, finding that it affects how well consumers are able to integrate new evidence about sources in order to make inferences about sources (experiment 6a) and demonstrate advice-seeking intentions for sources learned to be topically relevant (experiment 6b). The integration of new evidence for belief updating and attitude adjustment is an important aspect of behavior in an information-rich world where additional pieces of context are often learned over time rather than being presented all at once.

In designing campaigns to communicate to consumers, and to facilitate communication amongst consumers, marketing managers frequently rely on peers, experts, and celebrities as sources to share information about brands and products (Berger 2014). The ability to put such information to use depends on people accurately recalling the source. Source misattribution can negate the value of advice from experts, recommendations from trusted friends, and product

endorsement effects. Moreover, source misattribution could lead to counter-productive results – products being misremembered as recommended by a disliked rather than by a supported endorser or spurious public health behaviors being misremembered as advised by medical professionals rather than by lay strangers. The current findings provide a potentially useful tool for marketing managers and consumers alike who wish to enhance (or attenuate) the extent to which consumers remember the particular source of a claim.

For instance, in designing campaigns reliant on influencer endorsements to target a particular group, marketing managers may consider using claims that are inherently tied to the source (i.e., opinions) rather than factual claims to increase the likelihood that consumers will recall the particular endorser during a purchase decision. Similarly, guidance on policy and public health that relies on source expertise (i.e., bulletins from the Director of the Centers for Disease Control and Prevention) could benefit from including claims that inform the intended audience of the experts' personal beliefs and attitudes in addition to providing the necessary factual claims to encourage uptake of public health behaviors contingent on source expertise.

In navigating a saturated competitive advertisement landscape, firms may attempt to combat competitive advertisement interference via purchasing category exclusivity (Kent and Kellaris 2001; Danaher, Bonfrer, and Dahr 2008), but that can be exceedingly expensive and incurs additional risks (Crow and Hoek 2003). Instead, research on competitive advertisement interference has called for further work on changes in advertised messaging, which marketing managers can control, to strengthen associations between brands and advertisements and decrease vulnerability to competitive interference (Krishnan and Chakravarti 2003; Kent and Kellaris 2001). Although the present research does not directly focus on competitive advertisement interference, results may offer insight into one such approach to strengthen source

memory during encoding.

Advertised information consists of a variety of claims, some of which may have stronger associations with the brand than others. At recall, differential source memory may affect persuasion and consumer attitudes towards a brand. For instance, selectively cued recall can result in consumers recalling only a select subset of claims as associated with the target brand, rather than other claims, affecting brand attitudes (Hutchinson and Moore 1984). Consumers find claims made by credible sources to be more persuasive than claims made by less credible sources. The role of source credibility on persuasion is affected by whether or not consumers can recall the source of the claim (Hutchinson and Moore 1984; Fragale and Heath 2004; Bell et al. 2021). This can present diverging strategies for firms depending on their perceived credibility. A high credibility source benefits from accurate source memory, whereas a low credibility source benefits from poor source memory, increasing the likelihood that consumers misattribute the claim to a credible source or are persuaded without recalling the source (Moore and Hutchinson 1984; Fragale and Heath 2004; Bell et al. 2021).

As associative memory tends to weaken over time, warnings presented to consumers at encoding may not persist to recall. Labels intended to safeguard consumers from suspected misinformation or promotional content are often forgotten by the time the information itself is recalled, and as a result are not nearly as effective as when the information was initially presented (Bell et al., 2021). Claim objectivity lies at the foundation of ongoing legal and policy debates about credible sources and the spread of misinformation on social media. Considerable attention has been devoted to combating fake news, helping consumers discern inaccurate factual claims from accurate factual claims (Murrock et al. 2018). Efforts to combat misinformation and protect consumers from the influence of promotional content may benefit from strategies aimed

at improving source memory (Fragale and Heath 2004; Bell et al. 2021).

Limitations and Future Directions

Source memory is also affected by particularly salient claims and sources (Doerksen and Shimamura 2001). Regardless of a claim's objectivity, claims of a particularly outstanding nature (e.g., highly unusual claims or claims that elicit an emotional response) may provide greater information about their sources regardless of their objectivity. As such, the main effect of a claim's objectivity on source memory may be attenuated in the case of extraordinary claims or high-attention sources. Similarly, we expect that claim credibility can provide additional information about a source. For instance, if someone claims that "the moon is made of cheese", that claim presumably provides more information about the source than it does about the state of the world. Even though the noncredible claim is objective, it may be linked to a source more strongly during encoding than a more credible, less outlandish objective claim would be. Such effects of claim salience and credibility provide additional avenues for future research.

Though not included in the current stimuli, moral judgments present an important set of claims on which to further test source memory. While inherently subjective, widely held moral beliefs are perceived to be just as, if not more objective than, objective claims (Goodwin and Darley 2012; Heiphetz and Young 2017; Heiphetz et al. 2018), and sources sharing moral beliefs that are widely held are not presenting claims with high informational value about the sources themselves. The present results and mechanism suggest that source memory for moral claims may be on par with factual claims, rather than with other subjective claims. Reduced source memory accuracy for widely held beliefs may serve to accentuate perceptions of popular support.

When consumers are less able to attribute claims to individual sources, they could instead believe that the beliefs are held by a wide majority. Thus, the reduced source memory accuracy for widely held moral beliefs may serve to perpetuate their perceived objectivity.

CONCLUSION

In the current work, we investigate the effect of claim objectivity on source memory, the ability to accurately identify the source of a claim. Across twelve experiments our findings indicate that opinions are more likely to be correctly attributed to their sources than are factual statements. Investigations of process evidence indicate that this effect is driven by differences in how much information a claim provides about a source, where opinions generally provide more information about sources than do facts. The formation of stronger associative links between sources and opinion (vs. facts) during encoding results in more accurate source memory for opinions (vs. facts) during recall. The finding is robust across a variety of consumer contexts, is not attenuated by source expertise, and has consequences for consumer inferences. When communicating information to consumers, it is important to consider how the objectivity of a claim will affect consumers' ability to accurately remember where it came from.

REFERENCES

Anderson, J. R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior*, 22(3), 261-295.

Batchelder, W. H., & Batchelder, E. (2008). Metacognitive guessing strategies in source monitoring. *Handbook of Metamemory and Memory*, 211-244.

Bell, R., Mieth, L., & Buchner, A. (2020). Source attributions for detected new items: Persistent evidence for schematic guessing. *Quarterly Journal of Experimental Psychology*, 73(9), 1407-1422.

Bell, R., Mieth, L., & Buchner, A. (2021). Source memory for advertisements: The role of advertising message credibility. *Memory & Cognition*, *49*(1), 32-45.

Bell, R., Mieth, L., & Buchner, A. (2022). Coping with high advertising exposure: a source-monitoring perspective. *Cognitive Research: Principles and Implications*, 7(1), 82.

Berger, J. (2014). Word of mouth and interpersonal communication: A review and directions for future research. *Journal of Consumer Psychology*, *24*(4), 586-607.

Bettman, J. R. (1979). Memory factors in consumer choice: A review. *Journal of Marketing*, *43*(2), 37-53.

Biehal, G., & Chakravarti, D. (1986). Consumers' use of memory and external information in choice: Macro and micro perspectives. *Journal of Consumer Research*, 12(4), 382-405.

Blatz, C. W., & Mercier, B. (2018). False polarization and false moderation: Political opponents overestimate the extremity of each other's ideologies but underestimate each other's certainty. *Social Psychological and Personality Science*, *9*(5), 521-529.

Burke, R. R., & Srull, T. K. (1988). Competitive interference and consumer memory for

advertising. *Journal of Consumer Research*, 15(1), 55-68.

Cansino, S., Torres-Trejo, F., Estrada-Manilla, C., Ramírez-Barajas, L., Pérez-Loyda, M., Nava-Chaparro, A., ... & Ruiz-Velasco, S. (2019). Predictors of source memory success and failure in older adults. *Frontiers in Aging Neuroscience*, *11*, 17.

Chalfonte, B. L., & Johnson, M. K. (1996). Feature Memory and Binding in Young and Older Adults. *Memory & Cognition*, *24*(4), 403-416.

Davidson, P. S., McFarland, C. P., & Glisky, E. L. (2006). Effects of emotion on item and source memory in young and older adults. *Cognitive, Affective, & Behavioral Neuroscience*, *6*(4), 306-322.

Danaher, P. J., Bonfrer, A., & Dhar, S. (2008). The effect of competitive advertising interference on sales for packaged goods. *Journal of Marketing Research*, 45(2), 211-225.

Dodson, C. S., & Johnson, M. K. (1993). Rate of false source attributions depends on how questions are asked. *The American Journal of Psychology*, 541-557.

Doerksen, S., & Shimamura, A. P. (2001). Source memory enhancement for emotional words. *Emotion*, 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.

Fragale, A. R., & Heath, C. (2004). Evolving informational credentials: The (mis) attribution of believable facts to credible sources. *Personality and Social Psychology Bulletin*, *30*(2), 225-236.

Glisky, E. L., Rubin, S. R., & Davidson, P. S. (2001). Source memory in older adults: An encoding or retrieval problem?. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27(5), 1131.

Goodwin, G. P., & Darley, J. M. (2008). The psychology of meta-ethics: Exploring objectivism. *Cognition*, *106*(3), 1339-1366.

Greene, N. R., Martin, B. A., & Naveh-Benjamin, M. (2021). The effects of divided attention at encoding and at retrieval on multidimensional source memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*.

Hashtroudi, S., Johnson, M. K., & Chrosniak, L. D. (1989). Aging and source monitoring. *Psychology and Aging*, *4*(1), 106.

Heesacker, M., Petty, R. E., & Cacioppo, J. T. (1983). Field dependence and attitude change: Source credibility can alter persuasion by affecting message-relevant thinking. *Journal of Personality*, 51(4), 653-666.

Heiphetz, L., Spelke, E. S., Harris, P. L., & Banaji, M. R. (2014). What do different beliefs tell us? An examination of factual, opinion-based, and religious beliefs. *Cognitive Development*, *30*, 15-29.

Heiphetz, L., & Young, L. L. (2017). Can only one person be right? The development of objectivism and social preferences regarding widely shared and controversial moral beliefs. *Cognition*, *167*, 78-90.

Heiphetz, L., Lane, J. D., Waytz, A., & Young, L. L. (2018). My mind, your mind, and God's mind: How children and adults conceive of different agents' moral beliefs. *British Journal of Developmental Psychology*, *36*(3), 467-481.

Janowsky, J. S., Shimamura, A. P., & Squire, L. R. (1989). Source memory impairment in patients with frontal lobe lesions. *Neuropsychologia*, *27*(8), 1043-1056.

Johar, G. V., & Pham, M. T. (1999). Relatedness, prominence, and constructive sponsor identification. *Journal of Marketing Research*, *36*(3), 299-312.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, 114(1), 3-28.

Johnson, S. G., Rodrigues, M., & Tuckett, D. (2021). Moral tribalism and its discontents: How intuitive theories of ethics shape consumers' deference to experts. *Journal of Behavioral Decision Making*, *34*(1), 47-65.

Judd, C. M., Westfall, J., & Kenny, D. A. (2017). Experiments with more than one random factor: Designs, analytic models, and statistical power. *Annual Review of Psychology*, 68, 601-625.

Karras, T., Laine, S., & Aila, T. (2019). A style-based generator architecture for generative adversarial networks. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (pp. 4401-4410).

Kassam, K. S., Gilbert, D. T., Swencionis, J. K., & Wilson, T. D. (2009). Misconceptions of memory: the Scooter Libby effect. *Psychological Science*.

Keller, K. L. (1987). Memory factors in advertising: The effect of advertising retrieval cues on brand evaluations. *Journal of Consumer Research*, 14(3), 316-333.

Kent, R. J., & Allen, C. T. (1994). Competitive interference effects in consumer memory for advertising: the role of brand familiarity. *Journal of Marketing*, 58(3), 97-105.

Kent, R. J., & Kellaris, J. J. (2001). Competitive interference effects in memory for advertising: are familiar brands exempt?. *Journal of Marketing Communications*, 7(3), 159-169.

Klauer, K. C., & Meiser, T. (2000). A source-monitoring analysis of illusory correlations. *Personality and Social Psychology Bulletin*, 26(9), 1074-1093.

Krishnan, H. S., & Chakravarti, D. (2003). A process analysis of the effects of humorous advertising executions on brand claims memory. *Journal of Consumer Psychology*, 13(3),

230-245.

Kuhlmann, B. G., Symeonidou, N., Tanyas, H., & Wulff, L. (2021). Remembering and reconstructing episodic context: An overview of source monitoring methods and behavioral findings. *Psychology of Learning and Motivation*, 75, 79-124.

Kuhlmann, B. G., & Touron, D. R. (2011). Older adults' use of metacognitive knowledge in source monitoring: Spared monitoring but impaired control. *Psychology and Aging*, 26(1), 143.

Kuhlmann, B. G., & Touron, D. R. (2012). Mediator-based encoding strategies in source monitoring in young and older adults. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 38(5), 1352.

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

Law, S., Hawkins, S. A., & Craik, F. I. (1998). Repetition-induced belief in the elderly: Rehabilitating age-related memory deficits. *Journal of Consumer Research*, 25(2), 91-107.

Lee, B. K., & Lee, W. N. (2007). Decreasing advertising interference: The impact of comparable differences on consumer memory in competitive advertising environments. *Psychology & Marketing*, 24(11), 919-945.

Liberman, V., Minson, J. A., Bryan, C. J., & Ross, L. (2012). Naïve realism and capturing the "wisdom of dyads". *Journal of Experimental Social Psychology*, *48*(2), 507-512.

Litman, L., Rosenzweig, C., & Moss, A. (2020). New Solutions Dramatically Improve Research Data Quality on MTurk.

Lynch, J. G., Alba, J. W., & Hutchinson, J. W. (1991). Memory and decision making. *Handbook*

of Consumer Behavior, 1-9.

Lynch Jr, J. G., Marmorstein, H., & Weigold, M. F. (1988). Choices from sets including remembered brands: Use of recalled attributes and prior overall evaluations. *Journal of Consumer Research*, 15(2), 169-184.

Lynch Jr, J. G., & Srull, T. K. (1982). Memory and attentional factors in consumer choice: Concepts and research methods. *Journal of Consumer Research*, *9*(1), 18-37.

Mather, M., Johnson, M. K., & De Leonardis, D. M. (1999). Stereotype reliance in source monitoring: Age differences and neuropsychological test correlates. *Cognitive Neuropsychology*, 16(3-5), 437-458.

Mayes, A., Montaldi, D., & Migo, E. (2007). Associative memory and the medial temporal lobes. *Trends in Cognitive Sciences*, 11(3), 126-135.

McDougal v. FOX NEWS NETWORK, LLC, 489 F. Supp. 3d 174 (S.D.N.Y. 2020).

Meiser, T., & Bröder, A. (2002). Memory for multidimensional source information. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28(1), 116.

Mieth, L., Schaper, M. L., Kuhlmann, B. G., & Bell, R. (2021). Memory and metamemory for social interactions: Evidence for a metamemory expectancy illusion. *Memory & Cognition*, 49, 14-31.

Mitchell, K. J., & Johnson, M. K. (2009). Source monitoring 15 years later: what have we learned from fMRI about the neural mechanisms of source memory?. *Psychological Bulletin*, *135*(4), 638.

Mitchell, K. J., & MacPherson, S. E. (2017). The Cognitive Neuroscience of Source Memory: Moving the Ball Forward. *Cortex, 91*, 1-8.

Morgan, E. E., Watson, C. W. M., Woods, S. P., Gilbert, P. E., Villalobos, J., & Verduzco, M.

(2021). Misattributions of the source of health-related information in HIV disease. *Journal of Clinical and Experimental Neuropsychology*, *43*(1), 1-14.

Murrock, E., Amulya, J., Druckman, M., & Liubyva, T. (2018). Winning the war on state-sponsored propaganda: Results from an impact study of a Ukrainian news media and information literacy program. *Journal of Media Literacy Education*, *10*(2), 53-85.

Naveh-Benjamin, M. (2000). Adult age differences in memory performance: tests of an associative deficit hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 26(5), 1170.

Old, S. R., & Naveh-Benjamin, M. (2008). Differential effects of age on item and associative measures of memory: a meta-analysis. *Psychology and Aging*, 23(1), 104.

Pham, M. T., & Johar, G. V. (1997). Contingent processes of source identification. *Journal of Consumer Research*, *24*(3), 249-265.

Penney, V. (2020, July 14). How Facebook Handles Climate Disinformation. Retrieved July 17, 2020, https://www.nytimes.com/2020/07/14/climate/climate-facebook-fact-checking.html

Pennycook, G., & Rand, D. G. (2019). Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition*, *188*, 39-50.

Ross, L., & Ward, A. (1995). Psychological barriers to dispute resolution. In *Advances in Experimental Social Psychology* (Vol. 27, pp. 255-304). Academic Press.

Schacter, D. L., Osowiecki, D., Kaszniak, A. W., Kihlstrom, J. F., & Valdiserri, M. (1994). Source memory: Extending the boundaries of age-related deficits. *Psychology and Aging*, *9*(1), 81.

Schaper, M. L., Kuhlmann, B. G., & Bayen, U. J. (2019). Metamemory expectancy illusion and

schema-consistent guessing in source monitoring. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 45(3), 470.

Schaper, M. L., Mieth, L., & Bell, R. (2019). Adaptive memory: Source memory is positively associated with adaptive social decision making. *Cognition*, 186, 7-14.

Shane, S. (2017). From headline to photograph, a fake news masterpiece. *The New York Times*, *18*.

Sherman, J. W., & Bessenoff, G. R. (1999). Stereotypes as source-monitoring cues: On the interaction between episodic and semantic memory. *Psychological Science*, 10(2), 106-110.

Simons, J. S., Dodson, C. S., Bell, D., & Schacter, D. L. (2004). Specific-and partial-source memory: effects of aging. *Psychology and Aging*, *19*(4), 689.

Skitka, L. J., & Morgan, G. S. (2014). The social and political implications of moral conviction. *Political Psychology*, *35*, 95-110.

Spiller, S. A., & Belogolova, L. (2017). On consumer beliefs about quality and taste. *Journal of Consumer Research*, *43*(6), 970-991.

Staresina, B. P., & Davachi, L. (2006). Differential encoding mechanisms for subsequent associative recognition and free recall. *Journal of Neuroscience*, 26(36), 9162-9172.

Tobin, S. J., & Raymundo, M. M. (2009). Persuasion by causal arguments: The motivating role of perceived causal expertise. *Social Cognition*, *27*(1), 105-127.

US Dominion, Inc. v. Powell, Civil Action 1:21-cv-00040 (CJN) (D.D.C. Aug. 11, 2021)

Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language*, 46(3), 441-517.