# Consumers Make Different Inferences and Choices When Product Uncertainty Is Attributed to Forgetting Rather than Ignorance

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When a consumer realizes that information relevant to a consumption decision is missing, such uncertainty can be attributed to ignorance (i.e., the information has never been observed and is unknown) or to memory failure (i.e., the information has been observed and is forgotten). Although research has examined inferences about unknown attributes, no prior work has examined inferences about forgotten attributes. Across six experiments in the lab and in the field, we find that when uncertainty is attributed to ignorance, consumers often make inferences about unknown attributes based on existing correlational evidence (e.g., a brand comparison sheet that could indicate a positive or negative correlation between the unknown attribute and observable attributes). However, when uncertainty is attributed to memory failure, consumers tend to ignore such existing correlational evidence and instead make inferences about forgotten attributes that tend to be positively correlated with known attributes. This process occurs partly because when consumers believe that an attribute was forgotten, they falsely retrieve an impression about the attribute that tends to be consistent with their overall product evaluation. Overall, believing that an attribute is forgotten and believing that it is unknown can lead to opposite inferences and choices.

*Keywords*: inference, consumer behavior, uncertainty, memory, choice, forgetting

One consequence of information becoming more available in the modern world is that consumers may learn and subsequently forget a large amount of it. For example, when evaluating a smartphone, a consumer might view a product's detailed specification sheet, hear about a friend's experience, watch expert reviews on CNET, or view multiple product websites over a multiday or multiweek period. When a consumer realizes that information relevant to a consumption decision is missing, such uncertainty can be attributed to ignorance (i.e., the information has never been observed and is unknown) or memory failure (i.e., the information has been observed and is forgotten). Even if some memory failures can easily be resolved by an online search, many others cannot. For instance, a consumer may learn about and forget product information from someone who is no longer present, from a review website that can no longer be located, or from a prior experience of which there is no written record. Recent research has even

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suggested that use of technology increases forgetting (Barasch et al. 2017; Tamir et al. 2018). A central question for understanding the purchase decision, then, is how do consumers make inferences when the uncertainty is attributed to forgetting as opposed to ignorance?

For illustration, consider two consumers, Ignorant Iggy and Forgetful Fredric, both of whom are inferring the battery life of a phone that performs poorly on known attributes, including processing power. Although Iggy believes he never learned the battery life (i.e., it is unknown), Fredric believes he read a product review that tested it, but now has forgotten the outcome of the test and can no longer find the review. Both have access to a comparison sheet of brands that shows a negative correlation between battery life and processing power. Past research suggests that Iggy would infer a long battery life based on this existing correlational evidence of a negative relationship between battery life and processing power (Dick, Chakravarti, and Biehal 1990; Ford and Smith 1987). In contrast, since Fredric construes the battery life as forgotten, we predict that he will first search his memory to determine how long the battery life is. We propose that even though Fredric realizes that he has forgotten the precise battery life, this memory search will lead him to retrieve an impression that is positively correlated with known attribute levels, based on constructive memory processes (Brainerd and Reyna 2005; Deese 1959; Gallo 2010). Thus, Fredric will be more likely than Iggy to make the positively correlated inference that the battery life is short (because the processing power is also low) and will be less likely to attend to existing correlational evidence that battery life is long (i.e., that it is negatively correlated with processing power).

Past research has not examined how consumers make inferences about attributes that are believed to be forgotten and has instead focused on attributes that are perceived to be unknown (Bradlow, Hu, and Ho 2004; Broniarczyk and Alba 1994; Chernev and Carpenter 2001; Dick et al. 1990; Downing, Sternberg, and Ross 1985; Ford and Smith 1987; Hoch 1984; Huber and McCann 1982; John, Scott, and Bettman 1986; Johnson and Levin 1985; Kardes and Sanbonmatsu 1993; Meyer 1981; Ross and Creyer 1992). In this article, an "unknown" attribute is defined as an attribute value that a person believes she never observed (i.e., the uncertainty is attributed to ignorance). In contrast, we define a "forgotten" attribute as an attribute value that is believed to have been learned and then forgotten (i.e., the uncertainty is attributed to memory failure). Notably, this definition is based on the *attribution* of uncertainty to forgetting. Thus, a consumer could attribute uncertainty to forgetting when information was encoded and now is unavailable (Tulving and Pearlstone 1966), inaccessible (Wixted and Ebbesen 1997), lost (Peterson and Peterson 1959), or inhibited (Postman and Underwood 1973). This definition also encompasses situations where a consumer mistakenly attributes uncertainty to forgetting. For instance, a consumer might believe that she learned about an attribute, but in truth the attribute was never encoded (Craik and Lockhart 1972) or was never observed (Reason and Mycielska 1982).

The major contribution of this article is to be the first to examine how consumers make inferences about product attribute values that are believed to be forgotten rather than unknown. We show that when attributes are believed to be unknown, consumers tend to incorporate existing correlational evidence and make inferences about those unknown attributes that are positively or negatively correlated with known attributes. However, when attributes are believed to be forgotten, consumers tend to ignore existing correlational evidence and instead make inferences about those forgotten attributes that tend to be positively correlated with known attributes. This process occurs in part because in such situations, consumers attempt to retrieve the forgotten attribute value, which leads to distinct cognitive processes and potentially opposite inferences and choices.

In what follows, we first review how consumers use existing correlational evidence to make inferences about unknown attributes when uncertainty is attributed to ignorance. We then develop our theoretical predictions that when consumers make inferences about forgotten attributes, they will place less weight on existing correlational evidence and instead engage in a reconstructive memory process. We then test our predictions across six studies (one field experiment, two multiday experiments, and three laboratory experiments), across five product categories, across real and simulated forgetting, across correlational evidence presented in the study and held in ecological beliefs, across positive and negative correlational structures, and across a variety of delays between encoding and retrieval.

## INFERENCES ABOUT UNKNOWN ATTRIBUTES

A seminal finding in marketing research is that consumers rely on existing correlational evidence to infer the correlational relationship between an observable attribute and an unknown attribute. This process is known as a correlational inference (Kardes, Posavac, and Cronley 2004) and has been documented across a multitude of domains and decisions (Bradlow et al. 2004; Broniarczyk and Alba 1994; Chernev and Carpenter 2001; Dick et al. 1990; Downing et al. 1985; Ford and Smith 1987; Hoch 1984; Huber and McCann 1982; John et al. 1986; Johnson and Levin 1985; Kardes and Sanbonmatsu 1993; Meyer 1981; Ross and Creyer 1992).

Prior research has distinguished between existing correlational evidence that is observed during the inference (Broniarczyk and Alba 1994; Dick et al. 1990) and existing correlational evidence that is held in prior beliefs

(Broniarczyk and Alba 1994; Chernev and Carpenter 2001; Ford and Smith 1987). Broniarczyk and Alba (1994) referred to these two types of evidence as “data-based” and “theory-based,” respectively, but for ease of discussion, we will refer to them descriptively. In one demonstration of the role of existing correlational evidence that is observed in an inference task, participants were asked to make inferences about camera lens sharpness (Dick et al. 1990). During the experiment, participants were shown the correlation between lens sharpness and maximum shutter speed across nine brands. Participants made inferences about lens sharpness that were consistent with the direction of this existing correlational evidence (e.g., when the correlation was positive and shutter speed was high, consumers inferred that lens sharpness was high). Researchers have consistently found that participants attend to such information to make positively or negatively correlated inferences (Malmi 1986), though negatively correlated inferences may be less common or harder to understand in some domains (Johnson, Meyer, and Ghose 1989; Newman 1977).

Prior beliefs are a second type of existing correlational evidence consumers use to make inferences. In a demonstration of the role of prior beliefs about product parity, Chernev and Carpenter (2001) showed that consumers made negatively correlated inferences about unknown attributes from observable attributes: consumers held the belief that products at similar price points must sacrifice high performance on one attribute to achieve high performance on another attribute (see also Simonson, Carmon, and O’Curry 1994). Prior beliefs can also result in positively correlated inferences. Ford and Smith (1987) surveyed participants’ prior beliefs about the correlation between bicycle workmanship and both durability and weight and found that participants believed workmanship and durability were positively correlated, whereas workmanship and weight were not. They then provided participants with a bicycle’s durability or weight and asked participants to infer workmanship, observing that inferences about workmanship were highly correlated with durability but not weight, consistent with prior beliefs.

Taken together, these studies show that when dealing with unknown information, consumers rely on a variety of existing correlational evidence to make positively or negatively correlated inferences. In the next section, we will turn to forgotten attributes and discuss why we believe that consumers will fail to integrate such existing correlational evidence when an attribute is perceived to be forgotten and instead make positively correlated inferences.

## INFERENCES ABOUT FORGOTTEN ATTRIBUTES

We propose that when consumers make inferences about an attribute that is believed to be forgotten, such existing correlational evidence will be suppressed. We argue that consumers will instead make inferences that tend to be positively correlated, even when existing correlational evidence suggests that the inference should be negatively correlated.

Memory is not an exact record of the past but rather a constructive process that is subject to errors and distortions (Bartlett 1932; Bernstein and Loftus 2009; Johnson 2006; Johnson, Hashtroudi, and Lindsay 1993; Mantonakis, Whittlesea, and Yoon 2008; McClelland, McNaughton, and O’Reilly 1995; Schacter and Tulving 1994). Information about an object is drawn from different areas of the brain (Damasio 1989; Squire 1987), and memories are formed through pattern completion processes (McClelland et al. 1995), including linking together associated information (Deese 1959), separating out nonrelevant information (Norman and Bobrow 1979), and filling information gaps through reconstructive memory processes (Brainerd and Reyna 2005; Gallo 2010; Koutstaal and Schacter 1997). For instance, when consumers attempt to align attributes in product comparisons, they may falsely retrieve an attribute value that was never shown (Mehta, Hoegg, and Chakravarti 2011).

Past research suggests that people might also use constructive processes to retrieve an impression about an attribute value that has been completely forgotten. Within this project, we operationalize this retrieved impression as a memory of the approximate value of a product attribute (e.g., remembering that a bicycle is lightweight while forgetting the precise weight). Retrieved impressions are subject to constructive processes and may reflect true or false memories (Brainerd and Reyna 2005). Impression retrieval has been studied in subjective judgment domains, such as memories of pain (Terry and Gijsbers 2000), emotions (Kensinger and Corkin 2003), and consumer attitudes (Sanbonmatsu and Fazio 1990). However, impressions have not been studied in the context of estimating an attribute value that has some objective value. Thus, studying this type of impression retrieval also makes a modest but novel contribution to understanding how retrieved impressions affect inferences about attribute values.

We propose that when consumers are making an inference about a forgotten attribute, they will attempt to retrieve an impression of the attribute, even when it has been completely forgotten. We first argue that retrieving this impression will “crowd out” attention for existing correlational evidence. Thus, we expect that existing correlational evidence will be suppressed and will be less likely to be incorporated into inferences about forgotten attributes as compared to unknown attributes.

> **H1:** Consumers will be less likely to rely on existing correlational evidence to make an inference when they believe a missing attribute is forgotten as compared to unknown.

We propose that consumers will retrieve an impression of a forgotten attribute value that is positively correlated (i.e., evaluatively consistent) with overall product evaluations. Past research suggests that consumers might engage in a constructive process where they recall an impression of a forgotten attribute based on an overall evaluation of a product. Memories retrieved through constructive processes tend to be consistent with an overall theme (Roediger et al. 2001; Roediger and McDermott 2000), related facts that are known (Loftus 2005), or an overall gist meaning (Brainerd and Reyna 2005). For example, in the Deese–Roediger–McDermott memory illusion, the presentation of a series of thematically consistent words (e.g., bed, night, pajamas, pillow, dreams) that are associated with a nonpresented "critical lure" (e.g., sleep), can cause false recall and recognition of the critical lure in a later test (Deese 1959; Gallo 2010; Roediger and McDermott 1995). Similarly, 70% of people in an experiment retrieved the false memory that they had committed criminal assault and were confronted by police during early adolescence when presented with false facts consistent with this conclusion (Shaw and Porter 2015). Likewise, consumers falsely recall product information consistent with the gist of an advertisement (Braun 1999; Braun, Ellis, and Loftus 2002; Braun-LaTour, Grinley, and Loftus 2006; Braun-Latour and Zaltman 2006), or thematic information presented in a story (Sulin and Dooling 1974).

We predict that consumers will tend to falsely recall that a forgotten attribute's value is consistent (i.e., positively correlated) with their overall evaluation of the product. Memory of overall product evaluations remain strong as time passes and product details fade from memory (Kardes 1986; Sanbonmatsu, Kardes, and Sansone 1991) and consumers tend to rely heavily on these evaluations in memory-based decisions (Sanbonmatsu and Fazio 1990). Thus, it makes sense that as other product details fade, consumers would rely on overall product evaluations to retrieve an impression of a forgotten attribute value. We propose that retrieved impressions of attribute values will be consistent with overall product evaluations (i.e., retrieved impressions of an attribute value will tend to be high when attributes of the same product are known or remembered to be high). We expect that consumers will rely on these positively correlated impressions, rather than existing correlational evidence, to make an inference about an attribute that is perceived to be forgotten.

> **H2:** If consumers believe a missing attribute is forgotten as opposed to unknown, then they will be more likely to make inferences that are positively correlated with known attributes.

The directional predictions that would be expected based on these patterns of inference making are shown in table 1. In summary, we predict that inferences about unknown attributes will be more likely than those about forgotten attributes to adhere to existing correlational evidence of a negative or positive correlation between the known attributes and the unknown attribute. In contrast, we expect inferences about forgotten attributes to be more likely than inferences about unknown attributes to be positively correlated with known attributes, even when existing correlational evidence indicates that the relationship is negative.

**TABLE 1**

THE PREDICTED DIRECTIONAL INFERENCE ABOUT THE VALUE OF FORGOTTEN AND UNKNOWN ATTRIBUTES WHEN THE VALUE OF KNOWN ATTRIBUTES IS LOW OR HIGH AND THE EXISTING CORRELATIONAL EVIDENCE INDICATES A POSITIVE OR NEGATIVE CORRELATION

| | | Existing correlational evidence | |
|---|---|---|---|
| | | Evidence of positive correlation | Evidence of negative correlation |
| Value of known attribute(s) | High | Inferred **unknown** attribute value: ***High*** Inferred **forgotten** attribute value: ***High*** | Inferred **unknown** attribute value: ***Low*** Inferred **forgotten** attribute value: ***High*** |
| | Low | Inferred **unknown** attribute value: ***Low*** Inferred **forgotten** attribute value: ***Low*** | Inferred **unknown** attribute value: ***High*** Inferred **forgotten** attribute value: ***Low*** |

Implicit in this prediction is the idea that the thought processes involved in making an inference about a forgotten attribute will be different from those involved in making an inference about an unknown attribute. When an attribute is perceived to be unknown, we expect consumers to engage in well-documented reasoning processes (i.e., they will think about how the relationship between unknown and observable attributes can be deduced from existing correlational evidence; Dick et al. 1990). In contrast, when consumers believe the same attribute has been forgotten, we expect that they will first attempt to retrieve an impression of the attribute. We expect consumers will then use this retrieved impression of the value as a primary input to making an inference.

> **H3:** If an attribute is perceived to be forgotten as opposed to unknown, then consumers will be less likely to think about relevant existing correlational evidence and more likely to think about their overall impression of the attribute.

Across one field experiment, three multiday studies, and five lab experiments, we tested the predictions outlined above by manipulating the perception that information was forgotten versus unknown (table 6 summarizes the studies and their findings). All of the studies followed the same basic structure shown in figure 1: participants first learned about product attributes, took a break, and then made inferences about an attribute that was perceived to be either unknown or forgotten. To manipulate whether an attribute

**FIGURE 1**

FLOW OF TYPICAL STUDY


was forgotten or unknown in studies 1a, 1b, 2, and supplemental study 1 (web appendix A), we placed participants in either a forgotten condition where they learned and then forgot an attribute value, or an unknown condition where they were never told the value of the same attribute. Studies 3–5 and supplemental studies 2 and 3 employed a novel "simulated forgetting" method that held information constant across conditions and merely varied the perception that an attribute was forgotten as opposed to unknown. Specifically, we did not show the attribute value in the learning phase of either condition. Instead, we either told participants that we had shown them an attribute value in the forgotten condition, or that we had not shown them the attribute value in the unknown condition. In study 4, we also used a query theory protocol to test our prediction that consumers tend to think more about their impressions of an attribute when inferring forgotten attributes, but they tend to think more about existing correlational evidence when inferring unknown attributes. Finally, in study 5, we moved outside of the laboratory to examine the consequences of these inferences for decision making in a field setting with real choices.

## STUDY 1A: INFERENCES ABOUT BICYCLE ATTRIBUTES

The goal of study 1a was to test our prediction that when an attribute was perceived to be forgotten as compared to unknown, participants would be less likely to incorporate existing correlational evidence (hypothesis 1) and more likely to make a positively correlated inference (hypothesis 2).

We tested these predictions by having participants make inferences about a bicycle in a multiday study. We experimentally manipulated (1) whether a target attribute would be perceived as forgotten or unknown (i.e., uncertainty condition), (2) whether externally presented evidence indicated that the target attribute was positively or negatively correlated with observable attributes (i.e., existing correlational evidence condition), and (3) whether the quality level of the observable attributes was high or low (i.e., quality condition). Thus, the study employed a 2 (uncertainty: forgotten vs. unknown) × 2 (existing correlational evidence: positive vs. negative correlation) × 2 (quality: high vs. low) mixed factorial design where the first factor was between-participant and the second two factors were within-participant. This design and the stimulus material were adapted from Ford and Smith (1987) and developed from real mountain bike reviews on bikeradar.com.

Table 2 shows our predictions, which were preregistered at http://aspredicted.org/blind.php? x=ve3n7n.

### Method

We recruited 336 participants (69.7% female; $M_{age}$ = 36.3; SD = 12.3 years) on Prolific Academic to complete a multiday online study in exchange for a £.80 payment. A total of 398 participants completed the learning phase, and 336 returned a day later for the inference phase. Attrition did not differ between the two uncertainty conditions, $\chi^2(1) = .62, p = .431$.

*Learning Phase.* Participants entered the study and were told that they would learn about two different mountain bikes as reviewed by *Mountain Biking* magazine. Half of the participants first viewed a high-quality bicycle with 25 attributes. The other half first viewed a low-quality bicycle also with 25 attributes. To ensure that participants read the attributes, we had them copy each attribute value into a box. Sample screenshots of what participants saw during the learning phase are shown in web appendix D.

Participants were also assigned at random to a between-participant forgotten or unknown condition. We experimentally manipulated whether the missing attribute would be unknown or forgotten by hiding the target attribute in the learning phase when a participant was in the unknown condition and by showing the attribute in the learning phase when a participant was in the forgotten condition. The target attribute was "Number of retail locations servicing bike" for one bicycle and "Carbon emissions produced in manufacturing" for the other bicycle.[1] We randomly varied which attribute was assigned to the high- and low-quality bicycle. The actual value of each target attribute was assigned randomly from a uniform distribution of 21–80, to ensure that it was uncorrelated with the other bicycle attributes. Confirming that a majority of participants did encode the value of the forgotten attribute, in a post-test ($n = 49$) a majority of participants appeared to encode the value of the forgotten attribute.[2]

1 We pretested this design to confirm that most participants would forget these values before the inference phase (i.e., participants' remembered values on average were no better than random guessing one day after they had learned the attribute). The position of the forgotten attribute in the list was also set at random.

2 In this post-test, participants learned about a bicycle, following the exact procedure from study 1a. Participants were then quizzed on the value of the "forgotten" attribute immediately after taking a short break (during which they answered unrelated questions). To assess encoding, we calculated the percentage of participants who had a level of estimate accuracy (calculated as the absolute difference between the inferred value and true value) above chance levels. The mean accuracy that would be achieved by drawing at random from a 1–100 uniform distribution was 28. The results suggested that many participants had encoded the value, at least in short-term memory: 91.8% of

**TABLE 2**

STUDY PREDICTIONS (MAPPED ON TO TABLE 1)

| | | Existing correlational evidence condition | |
|---|---|---|---|
| | | Evidence of positive correlation | Evidence of negative correlation |
| Quality condition | High | Inferred **unknown** attribute value: ***High*** Inferred **forgotten** attribute value: ***High*** | Inferred **unknown** attribute value: ***Low*** Inferred **forgotten** attribute value: ***High*** |
| | Low | Inferred **unknown** attribute value: ***Low*** Inferred **forgotten** attribute value: ***Low*** | Inferred **unknown** attribute value: ***High*** Inferred **forgotten** attribute value: ***Low*** |

Participants then advanced to a new page and learned about the opposite bicycle following the exact same procedure. Whether the participant was evaluating the high- or low-quality bicycle is the within-participant "quality condition." Participants then exited the first phase of the study.

*Inference Phase.* Participants returned to the second phase of the study a day later. Half of the participants first viewed the high-quality bicycle; the other half first viewed the low-quality bicycle. Both bicycles were shown in the same format as in the learning phase, except that the target attribute was now hidden for all participants.

While participants viewed either bicycle, they were shown a brand comparison sheet with three other bicycles, ranging from low to high quality, shown in web appendix P. The comparison sheet was assigned at random to indicate either a positive or negative within-brand correlation between the observable attributes and the missing target attribute. In the positive correlation condition, the rating of the target attribute was 5 on the low-quality comparison bicycle 1; 50 on the medium-quality comparison bicycle 2; and 95 on the high-quality comparison bicycle 3. In the negative correlation condition, the rating of the target attribute was reversed: 95 on the low-quality comparison bicycle 1; 50 on the medium-quality comparison bicycle 2; and 5 on the high-quality comparison bicycle 3.[3]

participants' accuracy levels ($M$ = 8.2, SD = 15.8) were below 28, significantly better than 50% (chance level) in a binomial test, $p <$ .001. Demonstrating that forgetting did occur in study 1a, the recall in the post-test was much better than in the inference phase of study 1a, where only 50.9% of inferences were more accurate than 28 ($M$ = 27.6, SD = 20.8), no different than 50% (i.e., chance level) in a binomial test ($p$ = .694).

3 The existing correlational evidence condition was within-participant and randomly assigned at the bicycle level. This means that some participants were presented with existing correlational evidence of a positive correlation on both bicycles, some participants were presented with existing correlational evidence of a negative correlation on both bicycles, and some participants were presented with existing correlational evidence of a negative correlation on one bicycle and a positive correlation on the other bicycle. The reported results did not differ across the four possible within-participant combinations of correlational evidence conditions.

Participants were then asked to make an inference about the target attribute while viewing the brand comparison sheet. In the *forgotten condition*, participants read, "The attribute value of '[forgotten attribute]' for the [target bicycle] was shown to you yesterday. You learned about this yesterday, but the experimenter has hidden this value on the list below at random." In the *unknown condition*, participants read: "The attribute value of '[unknown attribute]' for the [target bicycle] was not shown to you yesterday. The experimenter chose this attribute to be hidden from you yesterday at random." Inferences in both conditions were made on a 1–100 scale (worst = 1, best = 100) in a numeric text box. Of note, we emphasized to participants that the hidden attribute had been chosen at random by the experimenter to avoid the confound that participants might make more negative inferences about deliberately withheld attributes (John, Barasz, and Norton 2016).

*Impression Retrieved.* After making the inferences, and on a separate page, participants were asked: "Were you able to accurately remember whether the value of '[forgotten attribute]' on the bicycle fell into a high range (51 or higher) or fell into a low range (50 or lower)?" (0 = low, 1 = high, 2 = "No, I forgot whether the value fell into a high or low range"). The purpose of this question was to measure whether participants retrieved an impression of the bicycle and to see if this impression also tended to be positively correlated with the quality level.

Participants then completed a second round, following the same procedure for the *opposite* bicycle. The brand comparison sheet showed the same three comparison bicycles, but the target missing attribute was now replaced with the missing attribute on the opposite bicycle.

*Manipulation Check.* After making both inferences, participants responded to a manipulation check where they were asked if they had been shown the value of the target attribute in the first phase of the study. Participants in the forgotten condition were also asked if they were able to accurately remember the exact value of the target attribute (0 = no, 1 = yes). Participants also provided a written response to the question: "What do you believe is the reason that some attributes were hidden from you?" Participants were then asked: "How knowledgeable do you consider yourself to be about mountain bikes?" on a seven-point scale (1 = Not at all knowledgeable, 7 = Extremely knowledgeable), and then they provided demographic information.

In summary, participants first learned about a high- and low-quality bicycle (i.e., within-participant quality condition). Participants then returned to the study a day later to make an inference about a missing attribute on each bicycle that was either unknown or forgotten (i.e., between-participant uncertainty condition). While making the inference, participants viewed existing correlational evidence indicating a positive or negative correlation between the missing attribute and the observable bicycle attributes (i.e., within-participant existing correlational evidence condition).

## Results and Discussion

Participants remembered the exact value of the attribute in only 4.4% of reviews in the forgotten condition, which suggests that most participants forgot the exact attribute value. In an additional 5.3% of the reviews in the forgotten condition, participants reported that they were able to remember the exact value but recalled an incorrect value. As specified in our preregistration, we dropped those trials in which participants remembered or reported remembering the exact value in the forgotten condition. Results do not significantly change if either group is included.

*Manipulation Check.* We first confirmed that the manipulation was successful. Participants responded that they had been shown the attribute value in 74.8% of the reviews in the forgotten condition, but only 6.5% of the reviews in the unknown condition, clustered $\chi^2$ (1) = 201.0, $p < .001$. This suggests that the manipulation was successful and most participants construed the target attribute as previously viewed in the forgotten condition and not previously viewed in the unknown condition.

Confirming that participants forgot the attribute value in the forgotten condition, the accuracy (calculated as the absolute difference between the inferred value and true value: $M = 27.6$, SD = 20.8) was no better than 28—the accuracy that would be achieved drawing at random from a 1–100 uniform distribution ($t(304) = .310$, $p = .754$, $d = .03$). In addition, accuracy was no different in trials where participants reported retrieving an impression ($M = 27.9$, SD = 21.6) than in those where they did not ($M = 27.4$, SD = 20.3, clustered $t(208) = .163$, $p = .871$, $d = .02$).

*Inferences.* We first investigated our primary prediction that in the forgotten as compared to the unknown condition, participants would be less likely to incorporate existing correlational evidence (hypothesis 1) and be more likely to make a positively correlated inference (hypothesis 2). As figure 2a shows, the inferences were in line with our predictions across all eight conditions. In the unknown condition, participants attended to existing correlational evidence and made negatively correlated inferences about the missing attribute in the negative correlation condition ($M_{high} = 38.1$, $SD_{high} = 32.0$ vs. $M_{low} = 68.9$, $SD_{low} = 28.3$, clustered $t(168) = 5.72$, $p < .001$, $d = 1.01$) and positively correlated inferences in the positive correlation condition ($M_{high} = 78.8$, $SD_{high} = 25.7$ vs. $M_{low} = 30.2$, $SD_{low} = 28.9$, clustered $t(164) = 8.11$, $p < .001$, $d = 1.77$). In contrast, in the forgotten condition, participants systematically made positively correlated inferences, in both the negative correlation condition ($M_{high} = 57.6$, $SD_{high} = 28.9$ vs. $M_{low} = 47.4$, $SD_{low} = 30.1$, clustered $t(148) = 2.08$, $p = .039$, $d = .35$) and positive correlation condition ($M_{high} = 70.0$, $SD_{high} = 27.2$ vs. $M_{low} = 41.2$, $SD_{low} = 32.0$, clustered $t(155) = 5.45$, $p < .001$, $d = .97$).

Formally, we tested these predictions using the following OLS regression:

$$I_{ij} = U_j + Q_i + E_{ij} + U_j \times Q_i + U_j \times E_{ij} + Q_i \times E_{ij} + U_j \times Q_i \times E_{ij} + Accuracy_{ij}$$

where inference $I_{ij}$ is the inference made by participant $j$ on trial $i$. $U_j$ is an indicator variable for our uncertainty condition (unknown = –1, forgotten = 1), $Q_i$ represents our quality condition (low = –1, high = 1), and $E_{ij}$ is our existing correlational evidence condition (negative correlation = –1, positive correlation = 1). We also include a variable representing the accuracy, calculated as the absolute difference between the actual value of the target attribute and the inferred value, to control for the actual accuracy of memory. The model includes all two-way and three-way interaction terms, and standard errors are clustered by participant.

*Test of Hypothesis 1.* The three-way interaction between existing correlational evidence, quality, and uncertainty ($E_{ij} \times Q_i \times U_j$) serves as a test for hypothesis 1, as it indicates whether participants in the forgotten condition were less likely than participants in the unknown condition to change their inferences as a function of the existing correlational evidence; we predicted a negative coefficient. The results of this analysis are shown in regression table 3. As predicted, in the forgotten as compared to the unknown condition, participants were less likely to incorporate existing correlational evidence, as indicated by a negative three-way interaction.[4]

4 A potential alternative explanation for the finding that existing correlational evidence was suppressed in the forgotten condition is that some participants remembered the true value of the target attribute. We addressed this issue by (1) showing that memory was no better than chance, and (2) controlling for accuracy in this regression model. To further test whether accurate memories played a role in the confirmation of hypothesis 2, we reran this analysis in three models. In the first model, we excluded participants who accurately recalled an impression (i.e., recalled that the attribute was "51 or higher" when it was 51 or higher). In the second model, we excluded participants whose accuracy was better than 30 (i.e., the inferred value was within 30 points of the true value). In the third model, we included participants in the forgotten condition only when the true value of the attribute was in fact negatively correlated with the bicycle quality (i.e., above 50 when bicycle quality was low, or 50 or below when quality was high). Thus, in the third model, any accurate memory should work against our hypothesis.
The interaction of $E_{ij} \times Q_i \times U_j$ was significant in model 1 ($b$ = –7.7, 95% CI = [–10.4, –4.9], $p < .001$), model 2 ($b$ = –6.5, 95% CI = [–10.1, –2.8], $p = .001$), and model 3 ($b$ = –7.6, 95% CI = [–10.1, –5.0], $p < .001$), suggesting that accurate memories in the forgotten condition played no role in the confirmation of hypothesis 2.

**FIGURE 2**

ACROSS ALL STUDIES, THE SAME PATTERN EMERGES: WHEN AN ATTRIBUTE WAS PERCEIVED TO BE FORGOTTEN AS OPPOSED TO UNKNOWN, PARTICIPANTS WERE LESS LIKELY TO INCORPORATE EXISTING CORRELATIONAL EVIDENCE TO MAKE A NEGATIVELY CORRELATED INFERENCE (HYPOTHESIS 1) AND WERE MORE LIKELY TO MAKE A POSITIVELY CORRELATED INFERENCE (HYPOTHESIS 2); STANDARD ERRORS DISPLAYED

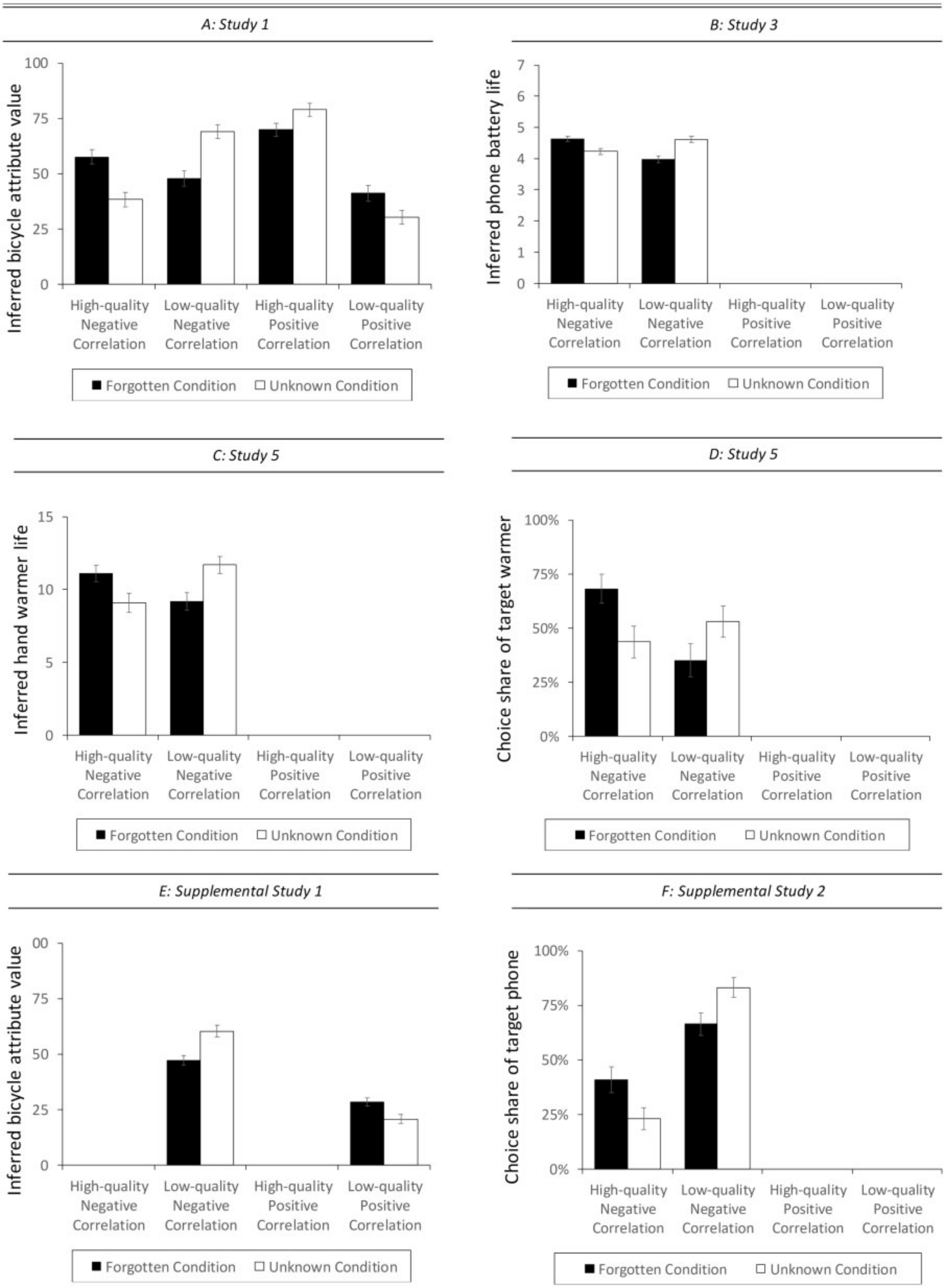

**TABLE 3**

STUDY 1A REGRESSION ESTIMATES OF EXPERIMENTAL CONDITIONS ON ATTRIBUTE INFERENCES

| Dependent variable | Inference ($I_{ij}$) |
|---|---|
| Uncertainty condition ($U_j$) | −.013 |
| *(unknown = −1, forgotten = 1)* | (1.157) |
| Quality condition ($Q_i$) | 7.113*** |
| *(low = −1, high = 1)* | (1.192) |
| Existing correlational evidence condition ($E_{ij}$) | 1.025 |
| *(negative correlation = −1, positive correlation = 1)* | (.999) |
| $U_j \times Q_i$ | 2.639* |
| | (1.186) |
| $U_j \times E_{ij}$ | .515 |
| | (.994) |
| $Q_i \times E_{ij}$ | 12.271*** |
| | (1.310) |
| $U_j \times Q_i \times E_{ij}$ | −7.582*** |
| | (1.300) |
| $\text{Accuracy}_{ij}$ | −.012 |
| | (.060) |
| Constant | 54.411*** |
| | (1.835) |
| Observations | 641 |
| R-squared | .245 |

*Note.*—Estimates represent OLS coefficients with robust standard errors in parentheses.
*$p < .05$; **$p < .01$; ***$p < .001$.

*Test of Hypothesis 2.* The two-way interaction between quality and uncertainty ($Q_i \times U_j$) serves as a test for hypothesis 2, as it indicates whether participants in the forgotten condition were more likely than participants in the unknown condition to make positive correlated inferences; we predicted a positive coefficient. As expected, in the forgotten as compared to the unknown condition, participants were more likely to make a positively correlated inference. Of note, this analysis controls for quality condition when assessing the effects of the existing correlational evidence condition, and vice versa. Thus, we can conclude that perception of a forgotten attribute reduces reliance on existing correlational evidence *independently* of increasing positively correlated inference making (i.e., hypotheses 1 and 2 are not simply two sides of the same effect). Also, this analysis controls for the accuracy of memory, so the informational differences across uncertainty conditions should be minimized. We found that $A_{ij}$ did not predict the inference, which suggests that accuracy was very low and most participants completely forgot the attribute value.

*Impression Retrieval.* We next examined our prediction that positively correlated inferences in the forgotten condition would be associated with the retrieval of positively correlated impressions. Finding such a result would provide additional evidence for our theoretical account that positively correlated inferences in the forgotten condition are driven by the retrieval of positively correlated impressions, rather than by other processes. Participants retrieved an impression in 46.2% of the trials in the forgotten condition. In line with a positive correlation, participants were more likely to retrieve the impression that the target attribute was "51 or higher" when the bicycle was high-quality (63.1%) as opposed to low-quality (37.9%), even though the actual value was equally likely to be high or low. In contrast, participants were more likely to retrieve the impression that the target attribute was "50 or lower" when the bicycle was low-quality (68.3%) as opposed to high-quality (31.7%), $\chi^2$ (1) = 12.6, $p < .001$. We also tested a mediation model to examine if the quality condition drove inference making through retrieved impressions. The full model is specified in web appendix E. As predicted, in a bootstrap model with 10,000 replications, the retrieval of impressions mediated the relationship between quality condition and inference making, $b_{\text{indirect-quality}} = 3.03$, bootstrapped 95% CI = [1.26, 4.80], $p = .001$, 30.7% of effect mediated.

*Knowledge.* In a purely exploratory analysis, we examined whether more knowledgeable individuals were more susceptible to false retrieval, as past research has shown (Baird 2003; Castel et al. 2007; Mehta et al. 2011). We found that there was no interaction between knowledge and the three experimental conditions when predicting inference making. However, high-knowledge individuals were more likely to retrieve a false impression, independent of the experimental conditions. A full analysis is contained in web appendix F.

*Ruling Out an Alternative Explanation.* We also ruled out the possibility that participants in the unknown condition made more negative inferences about deliberately withheld attributes (John et al. 2016). To test this possibility, we had a research assistant read and code each participant's response to the question: "What do you believe is the reason that some attributes were hidden from you?" The research assistant was instructed to:

> Please code which of these responses is about the reason: "This information was hidden from me because the bike manufacturer was trying to hide a poorly performing attribute"
>
> 0 = does not express this reason, 1 = does express this reason

There was no difference in this reason in the forgotten condition (.0%) as compared to the unknown condition (.5%), $\chi^2$ (1) = 1.0, $p = .317$. Dropping the single participant who expressed this reason did not change the results.[5]

5 A secondary alternative explanation for these results is that participants provided noisier responses in the forgotten condition, which resulted in less weight placed on existing correlational evidence. To examine this possibility, we tested whether inferences were noisier in the forgotten condition than in the unknown condition. We found no evidence in support of this explanation: in an F test for the homogeneity of variances, there was no difference in variance between treatment

To summarize, when an attribute was forgotten as opposed to unknown, participants were less likely to incorporate existing correlational evidence (hypothesis 1) and more likely to make positively correlated inferences (hypothesis 2). We predicted that this pattern would occur because when an attribute was perceived to be forgotten, participants would attempt to retrieve the value. We proposed that in attempting to retrieve the exact value, participants would realize that this value had been forgotten and would instead retrieve an impression of the attribute value. We find preliminary evidence to suggest that many participants did view the exact value as forgotten but still retrieved an impression of the value. However, this impression was no more accurate than random guessing and tended to be positively correlated with quality level, even though the actual value in the forgotten condition was not related to quality level. We replicated the results of study 1a in supplemental study 1 (web appendix A) with a design in which the quality condition is a between-participant factor where participants view only one bicycle. This addresses a potential concern that viewing contrasting quality levels is a necessary condition for the effects established in study 1a to occur.

## STUDY 1B: INFERENCES ABOUT BICYCLE ATTRIBUTES OVER DIFFERENT DELAYS

The goal of study 1b was to replicate study 1a while also measuring overall product evaluations and manipulating degree of forgetting. Degree of forgetting was manipulated by separating the time between the learning phase and the inference phase by either one day or one week, following the methods of Sanbonmatsu et al. (1991). Consistent with hypothesis 2, we expected that inferences about a forgotten attribute would be positively correlated with overall product evaluations. We expected this correlation would strengthen as forgetting increased (i.e., as the delay period was longer). We predicted this would occur because as time passes, the actual correlation between a target attribute and other attributes tends to fade from memory, whereas overall product evaluations remain stable (Kardes 1986; Sanbonmatsu et al. 1991). Thus, we expected this study to show that as forgetting increases, reliance on overall product evaluations for inference making increases. Since this study focused only on forgotten attributes, we had no unknown condition or existing correlational information condition. Thus, the study employed a between-participant two-condition (delay: one day vs. one week) design. Our predictions were preregistered at http://aspredicted.org/blind.php? x=nu7v3w.

conditions when participants evaluated a high-quality bike with positive correlational evidence ($SD_{forgotten} = 27.2$ vs. $SD_{unknown} = 25.7$, $p = .624$); a high-quality bike with negative correlational evidence ($SD_{forgotten} = 28.9$ vs. $SD_{unknown} = 32.0$, $p = .355$); a low-quality bike with positive correlational evidence ($SD_{forgotten} = 32.0$ vs. $SD_{unknown} = 28.9$, $p = .356$); or a low-quality bike with negative correlational evidence ($SD_{forgotten} = 30.1$ vs. $SD_{unknown} = 28.3$, $p = .590$).

### Method

We recruited 351 participants (53.1% female; $M_{age} = 28.1$; SD = 8.5 years) on Prolific Academic to complete a multiday online study in exchange for a £.80 payment. Attrition was worse in the one-week delay condition: 126 out of 175 in this condition completed both phases, compared to 151 out of 176 in the one-day delay condition, $\chi^2(1) = 10.04$, $p = .002$. Dropout rates did not appear to vary with demographic variables, as there was no difference across delay conditions in gender, $t(275) = .03$, $p = .974$, or age, $t(275) = .84$, $p = .399$.

*Learning Phase.* Participants entered the study and were told that they would learn about a mountain bike as reviewed by *Mountain Biking* magazine, following the procedure of study 1a. Participants copied 25 attribute values into separate text boxes. To simplify the procedure in study 1b, participants only learned about the high-quality bicycle from study 1a, and the target attribute was always "Number of retail locations servicing bike," which was assigned randomly from a uniform distribution of 1–100 to ensure that it was uncorrelated with the other bicycle attributes. Participants then exited the first phase of the study.

*Inference Phase.* Participants were assigned at random to be invited to return to the study one day or one week later. As a manipulation check, participants were first instructed to recall as many of the attributes of the bike as they could in an open text box. Participants were told: "You don't have to remember the exact value of the attribute, just that the attribute was listed. For instance, if you write down 'price' below, this would count, even if you don't recall the precise price." On the following page, participants were shown the bike attributes they listed and the actual bike attributes (without values). Participants then self-coded the number of attributes they were able to recall accurately. This was our manipulation check of recall.

Participants then made an overall evaluation of the bicycle: "Please indicate your overall evaluation of the bicycle" (very unfavorable = –4, very favorable = 4). This measure was taken from Sanbonmatsu et al. (1991) and was our primary measure of overall evaluation.

Participants were then shown the bicycle with all the attribute values except the "Number of retail locations servicing bike" (i.e., the forgotten attribute). Participants estimated this attribute value on a 1–100 scale (worst = 1, best = 100). Participants then assessed how confusing the task was (not at all confusing = 1, very confusing = 7), provided demographic information, and were debriefed.

## Results and Discussion

*Manipulation Check.* We first confirmed that the manipulation was successful. Participants were able to recall fewer bicycle attributes after a one-week delay ($M = 2.8$, SD = 2.2) than after a one-day delay ($M = 3.6$, SD = 2.6, $t(275) = 2.60$, $p = .010$, $d = .31$).

Our primary prediction was that participants would rely on their overall evaluation of the bicycle to retrieve an impression and make an inference about the forgotten attribute (hypothesis 2). We also predicted that the strength of the relationship between the overall evaluation and the inference would increase as the period of delay increased and participants forgot more details about the bicycle. We tested this in an OLS regression with the dependent variable as the inferred value of the forgotten attribute, and the independent variables as overall evaluation, delay condition (one day = 0, one week = 1), the interaction of these variables, and accuracy (the absolute difference between the actual value of the forgotten attribute and the inferred value). As predicted, we found a significant interaction, $b = 6.61$, 95% CI = [1.61, 11.60], $p = .010$, $\eta^2 = .02$. The relationship between the overall evaluation and inference was stronger after a one-week delay, $b = 10.4$, 95% CI = [6.64, 14.16], $p < .001$, than after a one-day delay, $b = 3.8$, 95% CI = [.52, 7.07], $p = .023$. Notably, we controlled for the accuracy of the memory of the attribute value, so reliance on overall evaluation is not simply increasing as consumers forget the specific value.

*Ruling Out Alternative Explanations.* This study also allowed us to rule out two alternative explanations. First, the tendency to make positively correlated inferences about forgotten attributes could be driven, in part, by the mere thought effect, in which beliefs become more extreme as time passes and people ruminate on confirmatory evidence (Tesser 1978). Providing evidence against this explanation, overall product evaluations were, if anything, less extreme after a one-week delay ($M = 6.7$, SD = 1.1) than after a one-day delay ($M = 6.9$, SD = 1.1, $t(275) = 1.78$, $p = .075$, $d = .22$). This evidence suggests that the mere thought effect is not driving these results.

Second, we examine whether confusion played a role in the tendency to make positively correlated inferences about forgotten attributes. For instance, it is possible that when consumers are more confused about a task, they tend to rely more on overall evaluations to make an inference. We tested this in an OLS regression with the dependent variable as the inferred value of the forgotten attribute, and the independent variables as overall evaluation, confusion, and the interaction of these variables. The interaction was not significant, $b = .59$, 95% CI = [–.94, 2.13], p = .448, $\eta^2 = .00$, and provided no support for this alternative hypothesis.

To summarize, when an attribute was forgotten, consumers made inferences that were positively correlated with overall product evaluations (hypothesis 2). As expected, we found that this mode of inference making increased as forgetting increased.

# STUDY 2: MEASURING RETRIEVED IMPRESSIONS OF A HOTEL ATTRIBUTE

In study 2, we further examined the inference process to test the prediction that retrieved impressions about forgotten attributes would be positively correlated with known attributes. In study 1a, we measured impression retrieval after participants made inferences so that the impressions themselves would not influence the inference process. Because of this ordering, the retrieved impression may have been influenced by the inference in study 1a. In study 2, we measured impression retrieval before inferences were made so that inferences would not affect impression retrieval. Further, in study 2, the learned attribute was slightly negatively correlated with other attributes. Thus, any accurate memory about the forgotten attribute should work against our hypotheses.

We tested these predictions by having participants recall an impression about a forgotten attribute of a high- and a low-quality hotel. We experimentally manipulated whether the quality level of the observable attributes was high or low (i.e., quality condition). Thus, the study employed a within-participant two-factorial design.

## Method

We recruited 202 participants (66.8% female; $M_{age} = 34.0$; SD = 10.6 years) on Prolific Academic to complete an online study in exchange for a £.50 payment.

*Learning Phase.* Participants entered the experiment and were told they would evaluate two hotels. Half of the participants first learned about a high-quality hotel; half of the participants first learned about a low-quality hotel. Whether a participant was evaluating the high- or low-quality hotel served as our manipulation of quality condition. For both hotels, participants viewed the same 20 attributes (e.g., Location, Concierge Service, Restaurant, etc., all shown in web appendix H). Each attribute was rated on a five-point scale with 1 being the worst and 5 being the best. Attribute values for the good (bad) hotel were shuffled at random for each participant from a negatively (positively) skewed distribution with a mean of 4.2 (1.8), a maximum of 5.0 (3.1), and a minimum of 2.9 (1). Participants clicked a box next to each attribute to acknowledge that they had read the value. The attribute "Room Amenities" was always shown to participants, but it was hidden in the inference phase and became the forgotten attribute. Room Amenities was always 2.9 for the good hotel and 3.1 for the bad hotel, so it was slightly negatively correlated with hotel quality. Participants then learned about the opposite hotel following the same procedure.

Next, participants completed a filler task that took approximately 5 minutes. In this filler task, participants read a performance review and answered three questions (web appendix G).

*Inference Phase.* Participants were then told they would evaluate the two hotels again. Half of the participants first evaluated the high-quality hotel; half of the participants first evaluated the low-quality hotel. For both hotels, participants were shown the values of all the attributes except Room Amenities in the same format as in the learning phase.

While viewing the first hotel, participants were asked if they were able to recall an impression of room amenities: "We would like you to attempt to remember if the attribute 'Room Amenities' was high (3 or above) or low (below 3). Are you able to remember this?" (0 = no, 1 = yes). If they responded yes, participants indicated if their impression was that the attribute was high or low. As a manipulation check to confirm that participants believed they had forgotten the exact value, they were asked if they could remember it (0 = no, 1 = yes).

Participants then made an inference about the rating of Room Amenities for the first hotel in a text box, completed the same round of questions for the *opposite* hotel, and were debriefed.

In summary, participants learned about a high- and low-quality hotel (i.e., within-participant quality condition), took a short break, recalled their impression of the value of room attributes, and made an inference about the value of a missing attribute for both hotels.

## Results and Discussion

Participants reported remembering the exact value in 23.0% of trials and retrieving an impression of the attribute in 65.3% of trials. As planned, we dropped the trials where participants reported remembering the exact value. Results do not change if these participants are included.

*Impressions Retrieved.* The key prediction in this study was that participants would report remembering an impression that was positively correlated with the hotel quality (even though the opposite was true). As predicted, a higher proportion of participants retrieved the false impression that the Room Amenities attribute for the high-quality hotel was rated "3 or higher" (40.5%) as compared to "below 3" (25.0%). In contrast, more participants retrieved the false impression that the Room Amenities attribute for the low-quality hotel was rated "below 3" (35.0%) as compared to "3 or higher" (19.0%), clustered $\chi^2$ (1) = 13.1, $p < .001$.

*Inference.* We then examined the prediction that participants would make the positively correlated inference that Room Amenities was higher for the high-quality hotel than for the low-quality hotel, even though the actual value was negatively correlated. As predicted, participants made the positively correlated inference that the high-quality hotel had a higher rating ($M = 3.45$, SD = .81) than the low-quality hotel ($M = 2.57$, SD = .80), clustered $t(309) = 7.60$, $p < .001$, $d = 1.09$. We also tested a mediation model to examine whether inferences were driven by retrieved impressions. The full model is specified in web appendix I. As predicted, the retrieval of impressions mediated the relationship between quality condition and inference making, $b_{indirect} = .14$, bootstrapped 95% CI = [.07, .22], $p < .001$ (30.4% of effect mediated; bootstrapping based on 10,000 resamples).

The contribution of this study was to test whether participants would retrieve an impression that a forgotten attribute was positively correlated with observable attributes, independently of making an inference. Unlike in study 1a, the impression was retrieved before any inference was made. Because of this ordering, this impression should be relatively unbiased by reasoning processes that may have impacted the impression in study 1a. Since we found that participants were biased to falsely retrieve a positively correlated impression, we conclude that the positively correlated inferences observed in study 1a were driven, in part, by the retrieval of a positively correlated impression. Notably, we did not manipulate whether an attribute was forgotten or unknown, or whether any existing correlational evidence was presented in study 2. Thus, the primary contribution of this study is to understand the processes of making an inference about a forgotten attribute and to rule out alternative explanations for the results of study 1a.

# STUDY 3: SMARTPHONE INFERENCES

A critical issue in studies 1 and 2 is that the forgotten condition is informationally different from the unknown condition. We address this issue in studies 3–5 (and supplemental studies 2 and 3) by using a novel "simulated forgetting" design where participants were placed either in a forgotten condition where they were induced to believe they had seen and forgotten a specific attribute, or in an unknown condition where they were induced to believe they had never seen the same attribute. Participants did not see the attribute in either condition (except in study 5, where they saw the attribute in both conditions). All other information was held constant in both conditions.

Another contribution of studies 3 and 5 is that they manipulate existing correlational evidence using prior beliefs. In study 1a, we introduced existing correlational evidence directly by providing participants with a brand comparison sheet that showed between-attribute correlations following the methods of Dick et al. (1990). In study 3, we introduced existing correlational evidence through prior beliefs about the correlations between attributes (Broniarczyk and Alba 1994; Chernev and Carpenter 2001; Ford and Smith 1987). We did this by designing our stimulus based on the prior belief that attributes tend to be negatively correlated because products at similar price points must sacrifice high performance on one attribute to achieve high performance on another attribute (i.e., a compensatory inference: Chernev and Carpenter 2001). In a pretest ($n = 201$), we confirmed that participants held the prior belief that smartphone battery life would be negatively correlated with the performance of observable attributes ($r = -.29$, $p < .001$) across the similarly priced smartphones shown in table 4.

The design of study 3 was a 2 (uncertainty condition: forgotten vs. unknown) × 2 (quality condition: high vs. low performance) factorial mixed design. The uncertainty condition was between-participant, and the quality condition was within-participant. We predicted that when an attribute was forgotten as opposed to unknown, participants would be less likely to make a negatively correlated inference based on the negatively correlated prior beliefs measured in the pretest (hypothesis 1), and more likely to make a positively correlated inference (hypothesis 2).

## Method

We recruited 299 participants (42.6% female; $M_{age}$ = 36.2; SD = 11.4 years) on Amazon Mechanical Turk (MTurk) to complete an online study in exchange for a $.35 payment.

*Learning Phase.* Participants first entered the study and were told they would learn about two phones. One phone had high-performance attributes, and the other phone had low-performance attributes, as shown in table 4. Whether the participant was evaluating the high- or low-performance phone served as our within-participant experimental manipulation of quality condition. Half the participants were first shown the attributes of the high-performance phone; half the participants were first shown the attributes of the low-performance phone. Attributes were presented for 1 second at a time on separate screens that advanced automatically. After the first round, participants were told they would learn about a second phone, and they repeated the same task viewing the attributes of the opposite phone.

Next, participants completed the same brief filler task as in study 2 to separate the learning phase from the inference phase. In this filler task, the participants read a performance review and answered three questions (web appendix G).

*Inference Phase.* Participants were assigned at random to a between-participant forgotten or unknown condition. In the forgotten condition, participants were told: "In the previous section, **we told you** the battery life." In the unknown condition, participants were told: "In the previous section, **we did not tell** you the battery life." Across the two conditions, only the information in bold was changed.

**TABLE 4**

ATTRIBUTES OF A HIGH- AND LOW-PERFORMANCE SMARTPHONE

| High-performance phone | Low-performance phone |
|---|---|
| Resolution: 4K | Resolution: 480p |
| Price: $750 | Price: $750 |
| Processor: 2.35 GHz | Processor: 1.35 GHz |
| RAM: 4 GB | RAM: 2 GB |
| Storage: 128 GB | Storage: 32 GB |
| Rear camera: 12 megapixel | Rear camera: 6 megapixel |
| Front camera: 8 megapixel | Front camera: 2 megapixel |
| Waterproof: IP68 | Waterproof: IP67 |
| Weight: .30 pounds | Weight: .30 pounds |
| Security: thumbprint | Security: none |
| Display size: 7 inches | Display size: 4 inches |

Participants were asked to judge the battery life of both the high- and low-performance phones on two separate seven-point scales (Very Short Battery Life = 1, Very Long Battery Life = 7). Finally, participants were asked to provide demographic information and were debriefed.

In summary, participants first learned about a high- and a low-performance phone (i.e., within-participant quality condition). Participants took a short break and then made an inference about the battery life of both phones, which was framed as either unknown or forgotten (i.e., between-participant uncertainty condition).

## Results and Discussion

*Inference.* We tested our predictions in a regression with battery life inference as the dependent variable and condition (0 = unknown vs. 1 = forgotten), target phone (0 = low- vs. 1 = high-performance), and the interaction of condition and phone as independent variables while clustering standard errors on participant. Results are shown in figure 2b. In line with our prediction, we found a significant interaction, $b = 1.04$, 95% CI = [.62, 1.46], $p < .001$. As predicted, in the unknown condition participants made the negatively correlated inference that the battery life would be shorter on the high-performance phone ($M = 4.23$, SD = 1.22) than on the low-performance phone ($M = 4.63$, SD = 1.16), $b = -.40$, 95% CI = [–.68, –.13], $p = .004$, $d = .34$. In the forgotten condition, however, participants made the positively correlated inference that the battery life would be longer on the high-performance phone ($M = 4.62$, SD = 1.08) than on the low-performance phone ($M = 3.98$, SD = 1.29), $b = .64$, 95% CI = [.32, .96], $p < .001$, $d = .54$.

In summary, our results held in a simulated forgetting experiment. When participants construed the attribute as unknown, they incorporated existing correlational evidence that observable attributes were negatively correlated with missing attributes. When participants construed the attribute as forgotten, they tended to make positively correlated inferences. We also replicated the findings of study 3 in the incentive-compatible choice of a smartphone in supplemental study 2 (web appendix B).

## STUDY 4: PROCESS TRACING OF TELEVISION INFERENCES

The previous studies showed that people consistently make different inferences when the same attribute is perceived to be forgotten as compared to unknown. In study 4, we dig more deeply into this process and use a query theory–based thought-listing protocol (Johnson, Häubl, and Keinan 2007) to verify our prediction that consumers tend to think more about existing correlational evidence when inferring an unknown attribute and tend to have more thoughts consistent with retrieving an attribute impression when inferring a forgotten attribute (hypothesis 3). A secondary contribution of this study is that it involves an incentive-compatible choice to show how differences in the attribution of uncertainty can lead to consequential consumer behavior.

### Method

We recruited 292 participants (48.1% female; $M_{age}$ = 36.7; SD = 12.3 years) on MTurk to complete an online study in exchange for a $.45 payment plus the possibility of receiving a TV.

*Learning Phase.* Participants were first told they would be evaluating a TV. They were then shown all the attributes of TV A in table 5. Participants viewed each attribute for approximately 1 second, and then the screen advanced to the next attribute. This continued in a randomized order until all attributes had been shown. Notably, screen size was never shown to participants to induce them to believe that it was either forgotten or unknown. Next, participants completed the same filler task as in past studies (web appendix G).

*Inference Phase.* Participants were then randomly assigned to a between-participant uncertainty condition, which served as our primary experimental manipulation. In the forgotten condition, participants were told: "In the previous section **we told** you the screen size of TV A." In the unknown condition, participants were instead told: "In the previous section **we did not tell** you the screen size of TV A." Across the two conditions, only the information in bold was changed.

Next, participants estimated the screen size of TV A in a numeric text box labeled "inches" while viewing table 5. Of note, we also presented the existing correlational evidence that the screen size was negatively correlated with resolution on TVs B and C.

Participants then made a choice between TV A and TV C. Participants were told: "A participant will be selected at random to receive their actual TV choice. Winners will be notified and the TV will be shipped direct via Amazon." A winner was selected, and the chosen TV was shipped and delivered (receipt in web appendix O).

**TABLE 5**

STUDY 4 STIMULI

| TV A | TV B | TV C |
|---|---|---|
| **Price: $795** | **Price: $795** | **Price: $795** |
| **Screen: ?? inches** | **Screen: 40 inches** | **Screen: 51 inches** |
| **4K resolution** | **2K resolution** | **1080p resolution** |
| *Touch screen remote* | *Touch screen remote* | *Touch screen remote* |
| *YouTube plugin* | *YouTube plugin* | *YouTube plugin* |
| *Eco friendly* | *Eco friendly* | *Eco friendly* |
| *1 year warranty* | *1 year warranty* | *1 year warranty* |
| *Bluetooth* | *Bluetooth* | *Bluetooth* |
| *Blu-ray* | *Blu-ray* | *Blu-ray* |
| *Surround sound* | *Surround sound* | *Surround sound* |
| *LED* | *LED* | *LED* |
| *Quadcore processor* | *Quadcore processor* | *Quadcore processor* |
| *DirectTV ready* | *DirectTV ready* | *DirectTV ready* |
| *Multi lingual display* | *Multi lingual display* | *Multi lingual display* |
| *Voice recognition* | *Voice recognition* | *Voice recognition* |

*Thought Rating.* On the next screen, participants responded to the prompt, "Please tell us in 1 to 2 sentences how you judged the screen size of TV A in the previous task" in an open text box (responses are shown in web appendix J). Participants then advanced to a screen where they viewed and self-coded this response. Participants rated how much the thought described the use of existing correlational evidence (i.e., evidence thoughts) by responding to this prompt: "Please examine your response above. Is your response about the relationship between the screen size and TV resolution?" on a seven-point scale (1 = This does not describe my response at all, 4 = This somewhat describes my response, 7 = This exactly describes my response). Participants then rated how much their thoughts were consistent with retrieving an impression of the screen size (i.e., impression thoughts) by responding to this prompt: "Please examine your response above. Is your response about evaluating your general impression of the TV screen size?" on the same scale.

### Results and Discussion

*Inference.* As expected, screen size estimates were larger in the forgotten condition ($M$ = 44.7, SD = 10.4) than in the unknown condition ($M$ = 40.1, SD = 7.3), $t(290)$ = 4.41, $p < .001$, $d$ = .52. This finding is in line with participants making more negatively correlated inferences in the unknown condition and more positively correlated inferences in the forgotten condition (hypotheses 1 and 2).

*Choice.* As predicted, we found that the choices participants made were consistent with the inferences they drew.

A higher percentage of participants chose TV A in the forgotten condition (40%) than in the unknown condition (28%), z = 2.26, $p = .024$.

*Thought Rating.* Drawing on hypothesis 3, we predicted that thought processes would be more impression-based in the forgotten condition and more evidence-based in the unknown condition. We tested this prediction in two OLS regressions. In the first regression, evidence rating was the dependent variable, and uncertainty condition (0 = unknown, 1 = forgotten) was the independent variable; we controlled for impression rating. As predicted, inferences were rated as less evidence-based in the forgotten condition ($M = 3.8$, SD = 2.3) than in the unknown condition ($M = 5.2$, SD = 2.2), $b = -1.33$, 95% CI = [–1.88, –.79], $p < .001$, $d = .64$. In the second regression, impression rating was the dependent variable and uncertainty condition was the independent variable; we controlled for evidence rating. As predicted, inferences were rated as more impression-based in the forgotten condition ($M = 4.5$, SD = 2.0) than in the unknown condition ($M = 3.3$, SD = 2.1), $b = 1.21$, 95% CI = [.71, 1.70], $p < .001$, $d = .62$. Importantly, both regressions control for the alternative rating, which suggests that the processes measured by these thought ratings are independent—the decreasing occurrence of evidence-based thoughts does not fully account for the increasing occurrence of impression-based thoughts in the forgotten as compared to the unknown condition. This is consistent with our finding in study 1a that hypotheses 1 and 2 are independent.

*Ruling Out Alternative Explanations.* We first examined the possibility that participants in the unknown condition made more negative inferences about deliberately withheld attributes (John et al. 2016). A research assistant blind to our hypotheses coded participants' reasons following the same coding scheme from study 1a. None of the participants in either condition expressed the reason: "This information was hidden from me because the TV manufacturer was trying to hide a poorly performing attribute." This finding suggests that participants did not view the feature as deliberately withheld in either condition.

The design of this study also allowed us to test another alternative hypothesis: namely, that our results could be explained in part by consumers' self-perceptions about the type of information they forget. For example, consumers might infer that they tend to forget less surprising or less extreme information. Therefore, the results in this study could be related to the more complex inference that consumers believe they forget less extreme screen sizes. Following this logic, consumers might estimate the forgotten screen size to be more average than the unknown screen size. To test this possibility, we had a research assistant blind to our hypotheses read and code each of the participants' described thought processes. The research assistant was instructed to:

> Please read the statements below and classify whether any of the participants expressed the logic that they would expect to only forget less surprising or less extreme information. For example, a participant might say: "I would only expect to forget a value that's not surprising, so I estimated the TV size to be average." Mark "1" under logic if the statement follows the logic above, and "2" if not.

We then examined the number of participants in the forgotten condition who self-described this thought process. Only three participants (2.1%) described a thought process that our research assistant rated as consistent with this logic. This suggests that most participants did not base their inferences and judgments on the belief that they forgot less extreme information. This finding is consistent with the results of Morewedge, Gilbert, and Wilson (2005), who found that people are unaware that they tend to forget more typical instances.

In summary, we replicated our main results in a real choice context: when participants viewed TV resolution as unknown as compared to forgotten, inferences tended to be more negatively correlated. We also uncovered important evidence about the inference process. When participants viewed an attribute as forgotten as opposed to unknown, they were *less likely* to report thinking about existing correlational evidence of a negative relationship between observable attributes and the missing attribute and were *more likely* to have thoughts consistent with attempting to retrieve an overall impression of the screen size. Finally, we showed that the tendency to have such thoughts mediated the relationship between the uncertainty condition and the degree to which participants drew positively or negatively correlated inferences.

## STUDY 5: HAND WARMER CHOICES IN THE FIELD

A weakness of the prior studies is that they all occurred in a laboratory setting. In study 5, we examined how these effects generalize to a field setting with real choices. In this study, participants made an inference and a choice about a hand warmer. Participants were placed either in a forgotten condition where they were induced to believe they had forgotten the "heating life" of a hand warmer, or in an unknown condition where they were induced to believe they had never seen the heating life. In both conditions, participants were shown the heating life in a difficult-to-remember format. Participants were also placed in a quality condition where the observable attribute, "maximum temperature," was either high or low. Thus, the study employed a 2 (uncertainty: forgotten vs. unknown) × 2 (quality: high-heat vs. low-heat) factorial design where both factors were between-participant.

In a pretest, we established that participants held the prior belief that heating life and maximum temperature were negatively correlated ($n = 75$, $r = -.27$). We predicted that when heating life was viewed as unknown, participants would incorporate this existing correlational evidence and make a negatively correlated inference about heating life from the maximum temperature. In contrast, we predicted that when heating life was viewed as forgotten, participants would ignore this existing correlational evidence (hypothesis 1) and instead make a positively correlated inference (hypothesis 2). We preregistered these predictions at http://aspredicted.org/blind.php? x=fn7ta7.

## Method

We gave out hand warmers to 182 people (59.9% female) in Paris over three cold days in March 2018. The first author collected data at multiple locations in and around the Luxembourg Gardens and the Eiffel Tower. The average daily temperature was 37 degrees Fahrenheit across the days the study was conducted. To attract participants, we created a sign that read "Receive a hand warmer in exchange for your participation in a 2 minute study with the INSEAD-Sorbonne Lab" (in French). Participants approached the experimenter, were handed a tablet, and were instructed to follow the on-screen instructions in French. All the questions and stimulus material were on the tablet so that the experimenter was blind to conditions and responses. When participants finished the survey, they handed the tablet back to the experimenter, who then gave them the hand warmer they chose from a display on the tablet. When groups of individuals approached the experimenter, they were asked to complete the survey one at a time.

*Learning Phase.* Participants entered the study and were given a tablet that provided all instructions on screen. Participants first learned about a warmer by reading a short description that included the heating temperature and by viewing 15 attributes that were shown in rapid succession (250 milliseconds each). Participants were randomly assigned to learn about one of two warmers: either a high-heat warmer, which has a 136 degree Fahrenheit temperature and lasts for 8 hours, or a low-heat warmer, which has a 104 degree Fahrenheit temperature and lasts for 12 hours (descriptions and pictures appear in web appendixes K and L). Whether a participant learned about the high- or low-temperature warmer served as our between-participant experimental manipulation of quality condition. The actual brand names of the hand warmer were hidden and replaced by the names Diamond and Silver at random.

*Filler Task.* On the next screen, participants were asked to memorize the number 934578. The only purpose of this task was to provide a break between the learning and inference phase and increase the likelihood that participants would forget the hand warmer's heating life. This manipulation has been shown to greatly increase rates of forgetting (Squire 1987).

*Inference Phase.* Participants were then asked to make an inference about the number of hours the target warmer lasted on a 20-point scale ranging from 1 to 20 hours. While making this inference, participants were randomly assigned to either an unknown or a forgotten uncertainty condition. In the unknown condition, participants read, on screen: "You **were not** shown the heating life at the beginning of the study"; in the forgotten condition, participants read: "You **were** shown the heating life at the beginning of the study." Across the two conditions, only the information in bold was changed. This served as our primary manipulation of uncertainty condition and was shown on the same page as participants made their inference. As a control variable, participants also rated the importance of hand-warmer life on a seven-point scale (1 = Not at all important, 7 = Extremely important).

Participants were then asked to make a choice between the warmer they had just learned about (i.e., the target warmer) and an alternative warmer, which was always the opposite warmer (e.g., if the participant had learned about a low-heat, long-duration warmer, then the alternative warmer was a high-heat, short-duration warmer). On this screen, participants were shown the maximum temperature of both warmers, the price of both warmers (1 euro for both), and the life of the alternative warmer. However, the life of the target warmer was always hidden (a screenshot of this choice is shown in web appendix M). The order of presentation of the choice and the inference screen was randomized. We detected no differences by order.

*Manipulation Check.* On the final screen, participants responded to a manipulation check that asked if they had been told the heating life of the target hand warmer at the beginning of the study (0 = no, 1 = yes) and whether they had forgotten the heating life (0 = no, 1 = yes, 2 = I was not told the heating life). Participants were then debriefed and returned the tablet to the experimenter, who gave them the chosen warmer.

In summary, participants first learned about a high- or low-heat hand warmer, were then induced to believe its heating life was unknown or forgotten, and then made an inference about the heating life and chose between the target warmer and an alternative warmer. Thus, our study was a 2 (quality condition) × 2 (uncertainty condition) factorial design, with both factors between-participant.

## Results and Discussion

*Manipulation Check.* We first confirmed that participants construed the missing attribute as not previously shown in the unknown condition and previously shown in the forgotten condition. In the unknown condition, 11.6% of the participants responded that they were told the heating life, whereas 93.1% of participants in the forgotten condition responded that they had been told the heating life, $\chi^2$ (1) = 120.7, $p < .001$. In the forgotten condition, 84.8% of the participants who reported having been told the heating life also reported that they had forgotten the heating life, which suggests that the manipulation was successful. Removing participants who failed the manipulation check did not significantly alter the results, so we left them in the sample for all analyses, following the procedure specified in our preregistration.

*Inference*. Our primary prediction was that participants would make more negatively correlated inferences in the unknown condition and more positively correlated inferences in the forgotten condition. We tested our prediction in a regression model with inference as the dependent variable and uncertainty condition (0 = unknown, 1 = forgotten), quality condition (0 = low, 1 = high), and the interaction of uncertainty and quality condition as independent variables. Means from this analysis are shown in figure 2c. As predicted, this interaction was significant, $b = 4.51$, 95% CI = [2.31, 6.98], $p < .001$. When heating life was viewed as unknown, participants appeared to incorporate their prior beliefs and made the negatively correlated inference that the high-temperature warmer had a shorter heating life ($M = 9.2$ hours, SD = 3.6) than the low-temperature warmer ($M = 11.1$ hours, SD = 3.8), $b = –1.91$, 95% CI = [–3.54, –.77], $p = .022$, $d = .52$. In contrast, when heating life was viewed as forgotten, participants appeared to ignore these prior beliefs and instead made the positively correlated inference that the high-temperature warmer had a longer heating life ($M = 11.7$ hours, SD = 5.0) than the low-temperature warmer ($M = 9.1$ hours, SD = 3.5), $b = 2.61$, 95% CI = [.90, 4.31], $p = .003$, $d = .60$.

*Choice*. We tested whether participants made choices in line with their inferences in a logistic regression with choice (0 = alternative warmer, 1 = target warmer) as the dependent variable; the independent variables were uncertainty condition (0 = unknown, 1 = forgotten), quality condition (0 = low, 1 = high), and the interaction of uncertainty and quality condition. Means from this analysis are shown in figure 2d. As predicted, we found a significant interaction, $b = 1.76$, 95% CI = [.56, 2.97], $p = .004$. Participants in the unknown condition chose the inferred warmer less frequently when heating life was high (43.5%) but more frequently when heating life was low (53.1%), consistent with a negatively correlated inference. In contrast, participants in the forgotten condition chose the inferred warmer more frequently when heating life was high (68.1%) but less frequently when heating life was low (35.0%), consistent with a positively correlated inference.

*Mediation*. We also examined whether choice was driven by inferences in a logistic moderated-mediation model using the KHB method (Karlson, Holm, and Breen 2012), which is fully described in web appendix N. We found that the relationship between uncertainty condition (moderated by quality condition) and choice is fully mediated by the inference, $b_{indirect} = 1.14$, bootstrapped 95% CI = [.27, 2.01], $p = .010$ (bootstrapping based on 10,000 resamples).

In summary, we replicated our key findings in a field setting with real choices. When participants believed an attribute was unknown, they tended to make negatively correlated inferences and choices consistent with negative correlational beliefs (hypothesis 1). When participants believed heating life was forgotten, they did the opposite and made positively correlated inferences (hypothesis 2).

## GENERAL DISCUSSION

The amount of available product information has increased tremendously in recent decades, but the capacity of human memory has remained largely unchanged. It is likely that consumers learn and forget more information now than ever before. Complicating matters, as consumers have grown more and more accustomed to using the internet as a form of memory, they may forget more from their own mind (Tamir et al. 2018). Even though a great deal of information is available at our fingertips, forgotten information may still be difficult to reaccess in several situations. For instance, a consumer may learn about and forget product information from someone who is no longer present, from a review website that can no longer be located, or from a prior experience of which there is no written record. Even if a memory failure can easily be resolved by an online search, inferences are still likely to influence many choices. For example, a consumer may learn extensively about product specifications on the internet, forget some of this information, and then be unable to access the internet when making an in-store purchase. Consumers may not feel the need to look up forgotten information before purchasing a small item such as a hand warmer, and they may find it impractical to look up every bit of forgotten information when constructing a consideration set, which involves assessing many products.

Across eight studies (studies 1–5 in the main text and supplemental studies 1–3), we found a consistent pattern of results. When uncertainty was attributed to ignorance, participants incorporated existing correlational evidence and made positively or negatively correlated inferences (hypothesis 1). When uncertainty was attributed to forgetting, however, participants tended to make positively correlated inferences (hypothesis 2), tended to think less about existing correlational evidence and more about an overall impression of an attribute (hypothesis 3), and tended to retrieve false attribute impressions that were positively correlated with observable attributes and overall evaluations.

Notably, attributing uncertainty to forgetting rather than ignorance influenced real choices: the incentive-compatible choice of a TV in study 4, a phone in supplemental study 2, and a hand warmer in study 5. Table 6 summarizes the studies and their results.

The major contribution of this research is to show that when consumers perceive an attribute to be forgotten as opposed to unknown, they engage in different inference processes that can lead to opposite conclusions. We found evidence for a three-step process that helps to explain why consumers make different inferences when an attribute is forgotten as compared to unknown.

In the first step of the process, consumers recognize that a missing attribute value is forgotten. They then attempt to retrieve the forgotten attribute value. In contrast, when an attribute is perceived as unknown, consumers do not attempt to retrieve the attribute value and instead examine any existing correlational evidence. We found support for this process in study 4: when participants perceived an attribute to be forgotten as opposed to unknown, they explicitly reported more thoughts consistent with retrieving an impression and fewer thoughts about existing correlational evidence.

In the second step of this process, consumers retrieve an impression of the attribute value that is positively correlated with observable attributes. We proposed that these impressions would be evaluatively consistent with overall evaluations (i.e., positively correlated with known attributes) because prior constructive memory research suggests that retrieved information tends to be consistent with an overall theme (Roediger et al. 2001; Roediger and McDermott 2000), with related facts that are known (Loftus 2005), or with an overall gist meaning (Brainerd and Reyna 2005). We found evidence of such positively correlated impression retrieval in study 1a, study 1b, study 2, and supplemental study 1. Notably, roughly 50% of participants in the forgotten conditions of our studies retrieved an impression, which suggests that it is common to do so. Across all studies, retrieved impressions were no better than random guessing and tended to be falsely remembered as positively correlated with observable attribute values.

In the third part of the process, consumers use this retrieved impression as an input to inference making. Doing so leads them to make positively correlated inferences about forgotten attributes, even in situations where they would normally make a negatively correlated inference about the attribute if it were perceived to be unknown.

A second contribution of this work is to show that this retrieval process draws attention away from existing correlational evidence that indicates some relationship between observable attributes and a missing attribute. Importantly, in study 1a we showed that participants placed less weight on existing correlational evidence *independently* of more positively correlated inferences when they viewed an attribute as forgotten rather than unknown. In other words, hypotheses 1 and 2 are independent and not simply two sides of the same effect. In further support of this conclusion, participants in study 4 reported thinking about existing correlational evidence less when making an inference about an attribute that was forgotten as opposed to unknown. This occurred independently of participants having more thoughts consistent with the retrieval of an impression.

We also ruled out alternative explanations for these results. Namely, we found that this pattern of results could not be explained by participants making negative inferences about unknown attributes (John et al. 2016) by coding these attributions in studies 1a and 4, by self-perceptions about the type of information that is forgotten by coding these attributions in study 4, or by greater estimate noise when uncertainty was attributed to memory failure as compared to ignorance by measuring differences in estimate variance across all the studies and by taking a subjective measure of confusion in study 1b.

## Limitations and Future Research

*Will Inferences about Forgotten Attributes Always Be Positively Correlated?.* In this article, we found that inferences about forgotten attributes tended to be positively correlated across a wide range of judgments. This is notable, since a consumer could retrieve an attribute impression in the presence of a schematic representation that contained negative associations between attributes (Alba and Hasher 1983). For instance, if consumers believed there is a negative correlation between phone screens and battery life (or hand warmer temperatures and heating life), then why did they not retrieve a memory consistent with this belief?

We offer one possible reason: applying a belief may require a higher order of cognition than is typically present in constructive memory processes. Constructive memory processes are viewed as lower-order processes (Schacter, Norman, and Koutstaal 1998). People tend to be unaware of any reconstruction processes occurring (Dodson and Johnson 1993; Dobson and Markham 1993; Johnson et al. 1993) and are often unable to distinguish real memories from false memories (Bernstein and Loftus 2009). In contrast, applying a prior belief to make an inference is typically regarded as a rule-based process that follows a series of logical calculations (Bradlow et al. 2004; Chernev and Carpenter 2001; Ross and Creyer 1992), and it is viewed as a higher-order process (Hinton 1990; Sloman 1996; Smolensky 1988). Evidence in support of this view is that prior beliefs are more likely to drive inference making when they are consciously prompted (Broniarczyk and Alba 1994; Simmons and Lynch 1991), and inferences based on prior beliefs occur more frequently among people who tend to engage in deeper cognition (Stayman and Kardes 1992). In addition, reality-monitoring processes may help to identify a memory as false when retrieving

**TABLE 6**

SUMMARY OF STUDIES AND RESULTS

| Study ($n = 2{,}553$) | Product domain | Study design | Forgetting manipulation | Existing correlational evidence | Key findings and test statistics |
|---|---|---|---|---|---|
| **1a** ($n = 336$) | Bicycles | Multiday (Prolific) | Real | Learned in study | Hypothesis 1: $b = -7.6$, 95% CI = [–10.1, –5.0], $p < .001$<br>Hypothesis 2: $b = 2.6$, 95% CI = [.31, 4.97], $p = .027$ |
| **1b** ($n = 351$) | Bicycles | Multiday (Prolific) | Real | None | Hypothesis 2: $b_{1\text{-day}} = 3.8$, 95% CI = [.52, 7.07], $p = .023$<br>Hypothesis 2: $b_{1\text{-week}} = 10.4$, 95% CI = [6.64, 14.16], $p < .001$ |
| **2** ($n = 200$) | Hotels | Lab study (Prolific) | Real | None | Hypothesis 2: $t(309) = 7.60$, $p < .001$ |
| **3** ($n = 299$) | Phones | Lab study (MTurk) | Simulated | Prior beliefs | Hypotheses 1 and 2: $b = 1.04$, 95% CI = [.62, 1.46], $p < .001$ |
| **4** ($n = 292$) | Televisions | Lab study (MTurk) | Simulated | Learned in study | Hypotheses 1 and 2: $t(290) = 4.41$, $p < .001$<br>Hypothesis 3: $b_{evidence} = -1.33$, 95% CI = [–1.87, –.79], $p < .001$<br>Hypothesis 3: $b_{impression} = 1.21$, 95% CI = [.71, 1.70], $p < .001$ |
| **5** ($n = 182$) | Hand warmers | Field experiment | Simulated | Prior beliefs | Hypotheses 1 and 2: $b_{inference} = 4.51$, 95% CI = [2.31, 6.98], $p < .001$<br>Hypotheses 1 and 2: $b_{choice} = 1.76$, 95% CI = [.56, 2.97], $p = .004$ |
| **Supplemental 1** ($n = 341$) | Bicycles | Multiday (Prolific) | Real | Learned in study | Hypothesis 1: $b = -9.7$, 95% CI = [–13.7, –5.6], $p < .001$<br>Hypothesis 2: $t(134) = 4.20$, $p < .001$ |
| **Supplemental 2** ($n = 302$) | Phones | Lab study (MTurk) | Simulated | Prior beliefs | Hypotheses 1 and 2: $b_{inference} = 2.65$, 95% CI = [1.31, 3.99], $p < .001$<br>Hypotheses 1 and 2: $b_{choice} = 1.76$, 95% CI = [.70, 2.81], $p = .001$ |
| **Supplemental 3** ($n = 248$) | Phones | Lab study (MTurk) | Simulated | Prior beliefs | Hypotheses 1 and 2: $b = .36$, BS 95% CI = [.13, .60], $p = .003$ |

that memory requires greater cognitive effort (Johnson 2006; Sugimori et al. 2014). Thus, if consumers falsely retrieve a memory based on a rule-based prior belief, they may also be more likely to detect it as false.

*Will Other Types of Existing Correlational Evidence or Rule-Based Inference Strategies Be Suppressed When a Consumer Considers an Attribute Forgotten?.* In this research, we tested two pieces of existing correlational evidence that informed how consumers made inferences: prior beliefs and observed correlations. We believe these to be two of the most relevant, according to our reading of prior research. However, many other inference strategies for unknown attributes have been observed. Consumers infer unobserved attributes based on inter-attribute correlations across products (Huber and McCann 1982; Jaccard and Wood 1988), syllogisms (Kardes 1988), or more general strategies, such as base rates or transitive judgments (Bryant and Trabasso 1971). We surmise that when an attribute is perceived to be forgotten rather than unknown, any inference strategies that require rule-based reasoning could be suppressed. For instance, across our studies, participants did not appear to make the rule-based inference that a forgotten attribute was deliberately withheld (John et al. 2016).

*How Do Consumers Identify When a Missing Attribute Has Been Forgotten?.* In real-world purchase decisions, a consumer is likely to determine whether an attribute was forgotten or unknown based on many situational factors, such as the depth of the prior information search or the type of information one normally expects to collect during product research. For example, consider a consumer who visits Apple's website and examines all the attributes of an iPhone, but then later cannot recall the screen size. It is likely that this consumer would view the screen size as forgotten, since this is an attribute that is prominently displayed on Apple's website. While outside of the scope of this article, a promising future direction of research would be to investigate what cues consumers examine to determine if an attribute has been forgotten or is unknown. We note that recognizing missing information (whether unknown or forgotten) may require explicit prompting, since individuals are often unaware of their own ignorance (Caputo and Dunning 2005; Walters et al. 2017).

*Do Inferences about Forgotten Attributes Vary with the Duration between Encoding and Retrieval?*. In the series of studies in this article, we found robust effects that occurred across delays lasting between a minute and a week. In study 1b, we found that the degree of positive correlation appeared to increase with delay. Consistent with this finding, Sanbonmatsu et al. (1991) found that consumers made stronger inferences about missing attributes based on overall product evaluations after a one-week delay than after no delay. A major point of distinction between these past findings and the present article is that in Sanbonmatsu et al. (1991), "other product attributes" (i.e., product attributes that were not inferred) were stored in memory, and the "inferred attribute" was unknown (i.e., never previously observed). In contrast, in our studies the other product attributes were observed from description, and the inferred attribute was forgotten. This suggests that constructive memory processes are similar across these inference tasks: as more information was forgotten about the overall product (Sanbonmatsu et al. 1991) or about a specific attribute (the present article), consumers increasingly relied on overall product evaluations to make inferences. A caveat is that the strength of some inferences may decline over longer delays (e.g., three weeks; Cronley et al. 2002).

*What Other Factors May Play a Role in Inferences about Unknown versus Forgotten Attributes?*. Other factors may also play a role in consumers attending more to correlational evidence for unknown attributes and more to overall evaluations for forgotten attributes. Information that is forgotten as opposed to unknown may feel more inherently knowable. Thus, the illusion of knowledge (Fernbach et al. 2013) or perceptions of epistemic uncertainty (Long, Fernbach, and De Langhe 2018; Ülkümen, Fox, and Malle 2016; Walters et al. forthcoming) may be greater for forgotten attributes than for unknown attributes. Thus, these perceptions of uncertainty may contribute to consumers' reliance on their own knowledge (i.e., summary overall evaluations) when inferring forgotten attributes and on external evidence when inferring unknown attributes. However, we found some evidence to suggest that the illusion of knowledge and perceptions of epistemic uncertainty may be lower when an attribute is perceived to be forgotten as compared to unknown in supplemental study 3. In this study, we found that participants were less confident when an attribute was viewed as forgotten rather than unknown, whereas the illusion of knowledge and perceptions of epistemic uncertainty are generally associated with higher confidence (Tannenbaum, Fox, and Ülkümen 2017; Walters et al. 2017).

## Managerial Implications

The research reported here suggests that managers should be careful when they design advertising to spark negatively correlated inferences (Chernev and Carpenter 2001). For example, Volkswagen's slogan that the VW "will stay ugly longer" prompts the negative inference that the VW's ugliness might be an indicator of the brand's high quality. However, many consumers may believe that they have encoded all relevant product information before purchasing a VW. If any relevant information is missing at the time of a purchase, it is likely that a consumer will construe this information as forgotten rather than unknown. Rather than making the negatively correlated inference that the ugly VW must be durable, the consumer may instead make the positively correlated inference that the ugly VW may be low performing on other attributes as well.

The distinction between memory failure and ignorance may also be especially relevant to marketers given the impact on real choices observed in these studies. Viewing an important attribute as forgotten rather than unknown may lead to large changes in choice share in favor of a product that performs well on observable attributes in contexts where consumers hold negatively correlated beliefs, such as price-quality inferences, weight-durability inferences, or battery life–power inferences. For instance, in study 5, when an attribute was viewed as forgotten rather than unknown, choice share for the hand warmer with better observable attributes increased by 24.6%. We observed a similar magnitude of change in incentive-compatible choices for a TV in study 4 and a phone in supplemental study 2, which suggests that these effects generalize across multiple domains. Thus, if a marketer anticipates that a target consumer will view a missing attributes as forgotten, it may be most important to create a positive overall impression of the advertised product, rather than highlighting each attribute value. In contrast, if missing attributes will be considered unknown (for instance, when a new product is being unveiled), missing attributes may be subject to greater rule-based logic, such as negatively correlated inference making (Chernev and Carpenter 2001) or skepticism (John et al. 2016). In these cases, it may be better to fully reveal all attribute levels, rather than focusing only on conveying a positive overall product evaluation.

We have highlighted how inferences can change when an attribute is viewed as forgotten rather than unknown. We found that consumers often use existing correlational evidence to make negatively correlated inferences about unknown attributes. However, when attributes are believed to be forgotten, consumers tend to ignore such existing correlational evidence and instead make inferences about those forgotten attributes that tend to be positively correlated with known attributes. This process occurs in part because when consumers believe an attribute is forgotten, they then retrieve a false impression about the attribute that also tends to be positively correlated with overall product evaluations. Viewing information as forgotten may lead to costly decision-making errors when consumers dismiss relevant existing correlational evidence and instead rely on these error-prone impressions.

## DATA COLLECTION INFORMATION

The data for study 1a, study 2, and supplemental study 1 were collected over the summer and autumn of 2018 by the first author on Prolific Academic. The data for study 1b were collected over the summer of 2019 by the first author on Prolific Academic. The data for study 3, study 4, supplemental study 2, and supplemental study 3 were collected on Amazon Mechanical Turk in the autumn of 2017 by the first author. The data for study 5 were collected by the first author in and around the Luxembourg Gardens and Eiffel Tower in Paris, France, over three days in the winter of 2018. Coding of study 1a, supplemental study 1, and study 4 was completed by two research assistants under the supervision of the first author. Both authors analyzed the data for all studies.

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