



When photos backfire: Truthiness and falsiness effects in comparative judgments[☆]



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ABSTRACT

Claims are more likely to be judged true when presented with a related nonprobative photo (Newman et al., 2012). According to a processing fluency account, related photos facilitate processing and easy processing fosters acceptance of the claim. Alternatively, according to an illusion-of-evidence account, related photos may increase acceptance of the claim because they are treated as tentative supportive evidence. We disentangle these potential mechanisms by using comparative claims. In forming comparative judgments, people first assess attributes of the linguistic subject of comparison and subsequently compare them to attributes of the referent (Tversky, 1977). Hence, photos of the linguistic subject in a sentence should facilitate, but photos of the linguistic referent should impair, fluent processing of this sequence. In contrast, a photo of either the subject or the referent can be perceived as tentative evidence. In two experiments (total $N = 1200$), photos of the subject increased acceptance of comparative claims relative to a no-photo condition (a truthiness effect), but only when the subject was otherwise difficult to visualize. Photos of the referent decreased acceptance of comparative claims relative to a no-photo condition (a falsiness effect), but only when the subject of comparison was otherwise easy to visualize. All results are consistent with a context-sensitive fluency account: increases in fluency foster, and decreases in fluency impair, acceptance of a claim as true. The results provide no support for an illusion-of-evidence account.

1. Introduction

The liquid metal inside a thermometer is magnesium. Without consulting external sources, most people will not know whether this statement is true or false. Previous research found that statements of this type are more likely to be accepted as true when they are accompanied by a nonprobative photo of the subject of the claim, here a thermometer (Newman et al., 2012; for a review, see Newman & Zhang, 2020). Although nonprobative photos provide no meaningful evidence that the claims are true, they produce a sense of “truthiness”, a feeling of truth that is not based on facts but can nevertheless persist over time (Fenn et al., 2013).

The explanation with the most empirical support is that nonprobative photos can inflate the truthiness of a claim—regardless of their informational value—by facilitating the conceptual processing of the claim, making it more vivid and imaginable in the recipient's mind. Failing to realize that the metacognitive ease arises from an irrelevant source, the experienced fluency may convey that the claim “feels right”. Indeed, numerous variables that facilitate ease of processing—from

repetition (e.g., Hasher et al., 1977) to color contrast (e.g., Reber & Schwarz, 1999) and rhyme (e.g., McGlone & Tofiqbakhsh, 2000)—have been found to increase perceived truth (for reviews, see Schwarz, 2015, 2018).

Another possibility that has not been fully ruled out is that nonprobative photos create an illusion of evidence. This may be the case for several reasons. First, most photos capture real events and photos have long been offered as evidence that an event has truly occurred (Mnookin, 1998). Second, photos are rich in perceptual and semantic details, just like real events. Given that people are more likely to assume that a mental event (e.g., an episodic memory) reflects reality when it features such details (Johnson et al., 1988), photos may be treated as evidence, consistent with the familiar claim that “seeing is believing”. Third, from a conversational perspective, speakers are expected to communicate only information that is relevant to the ongoing conversation (Grice, 1975; Sperber & Wilson, 1986). People find violations of this relevance principle unnatural (Davies & Katsos, 2009), and even children as young as three years old are sensitive to such violations (Eskritt et al., 2008). From this perspective, recipients may perceive

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photos that are related to a claim as the speaker's attempt to offer supportive evidence – or why else would the photo be presented? This is particularly likely when the speaker is perceived as a cooperative and trustworthy communicator, which is usually the case when messages are presented by a researcher (Schwarz, 1994, 1996). Hence, people may treat nonprobative photos that accompany a claim as tentative evidence, unless the photo is clearly unrelated to the claim. When the photo is clearly unrelated, none of the considerations above apply and truthiness effects are not observed (Newman et al., 2015).

It is difficult to disentangle the fluency account and the illusion-of-evidence account on the basis of available research. While many studies identified factors that moderate the truthiness effect of nonprobative photos – such as the temporal orientation and valence of the claim (Newman et al., 2018), one's background knowledge (Abed et al., 2017; or familiarity, e.g., Newman et al., 2012), and judgment contexts (Newman et al., 2015) – few have directly examined the mechanism(s) underlying truthiness effects. Moreover, both accounts lead to the same predictions under most conditions – any related photo is likely to facilitate processing and may be seen as tentative supporting evidence. However, these difficulties can be overcome by testing the influence of nonprobative photos on a type of claim that has so far not received attention: comparative claims about an unobservable difference between two targets.

1.1. Comparative and non-comparative claims

To date, studies have relied on non-comparative claims, such as *Turtles are deaf*. Such claims are more likely to be accepted when accompanied by a picture of a turtle, even though the picture provides no probative information about the turtle's hearing. This observation is compatible with a fluency account as well as an illusion-of-evidence account. But these accounts lead to diverging predictions for comparative claims, such as *Turtles have better hearing than sealions* or *Sealions have better hearing than turtles*. From an illusion-of-evidence perspective, a photo of a turtle as well as a photo of a sealion might be interpreted as supporting evidence for either claim. Hence, this account predicts that the influence of a nonprobative photo is independent of the direction of comparison (here, whether turtles are compared to sealions vs. sealions to turtles) and the specific target shown in the photo (here, a turtle or a sealion).

In contrast, previous research into the processing of comparative claims (Tversky, 1977; Tversky & Gati, 1978) suggests that the direction of comparison should influence whether the target shown in the photo facilitates or impairs fluent processing, resulting in differential effects on the perceived truth of the associated claim. Evaluating the truth of any comparative claim requires that the subject of the claim is compared to its referent (e.g., in the claim *Turtles have better hearing than sealions*, turtles constitute the subject and sealions the referent). As Tversky (1977; Tversky & Gati, 1978) demonstrated, the comparison process begins with an assessment of features of the subject, which are then checked against features of the referent. Hence, switching subject and referent results in qualitatively different judgments, such as the memorable observations that North Korea is judged as being more similar to China than China is to North Korea (Tversky & Gati, 1978). Similarly, female teachers are judged as more empathetic than male teachers when they serve as the subject of the comparison, but as less empathetic when they serve as the referent of the comparison, reflecting that the direction of comparison influences which features come to represent the attribute “empathetic” (Wänke et al., 1995). Such direction of comparison effects have been observed in many domains, including person perception (Srull & Gaelick, 1983), relationship satisfaction (Schwarz & Scheuring, 1989), consumer preference (Dhar & Simonson, 1992), and public opinion (Wänke et al., 1995; Wänke, 1996). Throughout, they reflect that comparative statements are about the subject, which is then compared to a referent. From a fluency perspective, photos of the subject should facilitate a processing

sequence that begins with assessing attributes of the subject, whereas photos of the referent should impair it. Hence, the fluency account predicts that, relative to a no-photo condition, a comparative claim is more likely to be accepted as true when it is accompanied by a photo of the subject of comparison (i.e., a truthiness effect), but less likely to be accepted as true when it is accompanied by a photo of the referent of comparison (i.e., a falsiness effect).

To date, falsiness effects of nonprobative photos have only been observed when the photo was clearly unrelated to the claim; for example, when a claim about macadamia nuts appeared with a photo of a trash can (Newman et al., 2015). This may reflect that the unrelated photo was not perceived as tentative supportive evidence or that it impaired processing of the claim. This ambiguity does not apply in the case of comparative claims, which provide an opportunity to test whether related photos increase rejection of a claim when they render processing disfluent.

Finally, numerous studies indicate that fluency effects are relative and driven by changes in fluency rather than the absolute level of fluency (Wänke & Hansen, 2015), which is consistent with the general observation that people are more sensitive to changes in experience than to steady states (Berelson & Steiner, 1964). Hence, fluency effects are more reliably observed in within-participant designs, where the processing experience differs from trial to trial, than in between-participant designs, where the processing experience for a given participant remains relatively constant across trials (e.g., Hansen et al., 2008; Newman et al., 2015; Westerman, 2008; for a review, see Wänke & Hansen, 2015). This robust observation suggests that the size of the expected effects of nonprobative related photos should depend on how easily the targets within each claim can be processed without photos, and thus the extent to which the addition of photos changes processing of the claim. This prediction cannot be derived from an illusion-of-evidence account. For ease of exposition, we elaborate on all predictions in more detail in the context of the respective experiments.

2. Present research

We tested diverging predictions derived from the fluency and illusion-of-evidence accounts in two experiments by presenting comparative statements using targets that are either easy or difficult to process without photos. To identify suitable targets, we drew on imageability and familiarity ratings in the Medical Research Council Psycholinguistic Database - Version 2.00 (Wilson, 1988), following Newman, Azad, Lindsay, & Garry, 2018. We selected commodities that are either high or low in both imageability and familiarity (henceforth referred to as high vs. low imageability conditions).¹ The selected commodities were then combined with statements that predicted their change in market price in three months. To ensure that the items would produce the standard truthiness effect observed in previous studies, we conducted a preliminary experiment with noncomparative statements (e.g., *Milk [Bhang] will have increased in price in three months*). It showed that nonprobative related photos increase the likelihood that a claim is judged true, in particular when the targets are unfamiliar and difficult to imagine without a photo (see Supplementary materials for details). After establishing that standard truthiness effects can be obtained with the present materials, we used the materials to generate comparative claims (e.g., *Milk [Bhang] will have increased more in price than Strawberry [Aster] in three months*). For all studies, we report how we determined the sample size, all data exclusions, all manipulations, and all measures.

¹ The correlation between the ratings of familiarity and imageability for our stimulus set was $r(46) = 0.98, p < .001$. Note, however, that there are familiar concepts that are difficult to imagine (e.g., freedom, justice), which makes imageability the more appropriate term for the present purposes.

3. Experiment 1: nonprobative photos and the truth of comparative claims

The criterion for a truthiness or falsiness effect is whether a nonprobative photo increases or decreases acceptance of the claim as true relative to a no-photo condition, not whether the acceptance is above or below chance. Hence, all hypotheses pertain to whether a photo increases or decreases acceptance of a given claim relative to a no-photo condition.

The illusion-of-evidence account predicts (i) that photos of the subject, as well as photos of the referent, will increase acceptance of a claim as true, (ii) independent of the initial ease of processing (due to imageability and familiarity) of the subject or referent. In contrast, the fluency account predicts that photos of the subject and the referent will produce opposite effects on truth judgment and that their impact will be moderated by the ease of processing the subject. Because the processing of comparative claims starts with the subject (Tversky, 1977), a photo of the subject should facilitate processing of the claim, especially if the subject is otherwise difficult to imagine. This predicts (iii) that a given comparative claim is more likely to be judged true when it is presented with a photo of the subject than without a photo. This truthiness effect should (iv) be more pronounced under conditions of low rather than high imageability, which is compatible with previous findings that truthiness effects of photos are attenuated when the claims are already easy to process at baseline (Abed et al., 2017; Newman et al., 2012). In contrast, a photo of the referent is likely to impair the processing of a comparative claim because the photo interferes with attending to the subject at the initial stage of processing. Hence, a given comparative claim should (v) be less likely to be judged true when it is presented with a photo of the referent than without a photo, resulting in a falsiness effect. This adverse impact of a referent photo should be more apparent when the subject would have been otherwise easy to imagine than when the subject is difficult to imagine to begin with. Hence, the predicted falsiness effect of referent photos should (vi) be more pronounced under conditions of high rather than low imageability.

These predictions also bear on theoretical issues beyond the effect of nonprobative photos on assessments of truth. First, with regard to comparative judgment, observing the predicted differential effects of subject photos and referent photos under conditions of high and low imageability would further support the notion that comparisons begin with an assessment of the subject, as initially proposed by Tversky (1977) for judgments of similarity. Second, with regard to the informational value of fluency experiences, the same pattern of results would provide novel data that highlight that fluency effects are relative – experiencing low fluency due to a referent photo is less informative when low fluency is already expected from the low imageability and familiarity of the subject than when it contrasts with the otherwise easy processing of a highly imageable and familiar subject. Finally, the fluency account predicts that exposure to related, but nonprobative photos can produce a falsiness effect when they pertain to the referent. To date, falsiness effects have only been observed for photos that were completely unrelated to any aspect of the claim with which they were paired (Newman et al., 2015).

3.1. Method

3.1.1. Participants

Since there was no previous study that reported falsiness effects of nonprobative photos related to the claim, we used the average size (Cohen's $d = 0.19$) of falsiness effects produced by unrelated photos in Newman et al.'s (2015) within-subject experiments to estimate the sample size required to capture a falsiness effect, if any, of the referent photos. A priori power analysis using G*Power (Faul et al., 2007) indicated that 586 participants were needed for an ANOVA test of repeated measures and a within-between interaction, with $\alpha = 0.05$ and power = 0.90. We posted 600 timeslots on Amazon Mechanical

Turk, limiting participation to participants with United States IP addresses and approval ratings of 95% or higher for previous HITS. Participants were compensated with \$0.60; a total of 603 participants completed the experiment and no participant was excluded from analysis.

3.1.2. Design

The experiment follows a 3 (photo: subject, referent, no) \times 2 (imageability: high, low) mixed design, with type of photo manipulated within participants and imageability between participants. We manipulated imageability as a between-subject variable in order to avoid large discrepancies in the imageability of the items that participants were asked to compare. Participants were randomly assigned to either the high or low imageability condition.

3.1.3. Material

Comparative statements were created from the 48 commodities used in the preliminary study (see Supplementary materials). By pairing commodities that had the closest imageability ratings, twelve comparative statements were created for each imageability condition. The statements had the following structure: *[Commodity A] will have increased more in price than [Commodity B] three months from today*. Each statement appeared either with a photo of commodity A (subject photo condition), a photo of commodity B (referent photo condition), or no photo (no-photo condition). Each photo had a label that identified the commodity (see Fig. 1). The phrase “three months from today” was not repeated in the experimental phase after the initial instructions.

Imageability was manipulated as a between-subject variable and participants saw either twelve statements with familiar and easy-to-visualize commodities (high imageability condition) or twelve statements with unfamiliar and difficult-to-visualize commodities (low imageability condition). To manipulate photo type as a within-subject variable and to counterbalance the photo type paired with each statement and the direction of comparison, we created six versions of each statement for both imageability conditions. For example, the statement *Shrimp will have increased more in price than Roses* was paired with a photo of the subject in counterbalance 1, with a photo of the referent in counterbalance 2, and with no photo in counterbalance 3. Counterbalance 4–6 repeated this arrangement except that the direction of comparison was reversed (i.e., the statement became *Roses will have increased more in price than Shrimp*). The counterbalance was arranged such that 1) each participant in either imageability conditions only saw one version of each statement, and 2) among the twelve statements they saw, four appeared with a photo of the subject, four appeared with a photo of the referent, and four appeared with no photo. The order of the twelve statements was randomized. Fig. 1 gives an example of different photo types paired with the same statement in both the high and low imageability conditions.

3.1.4. Procedure

The experiment was conducted on Qualtrics. All participants were informed prior to participation that they must use a computer rather than a smartphone. Those who connected with a smartphone were automatically identified by Qualtrics and redirected to a page informing them that they could not participate on a mobile device. This was to ensure that all participants could see the complete statements and the accompanying photo at the same time.

Participants were informed that they would see statements comparing the prices of commodities in three months and that each statement would appear either with or without a photo. They were to decide whether each statement is true or false based on their intuition. They were then given an example of the statements (e.g., *Gold will have increased more in price than Silver*) with and without a photo. After the instructions, participants were randomly assigned to either the high or low imageability condition. They then made a true/false judgment about each of the twelve statements by clicking a “true” or “false”

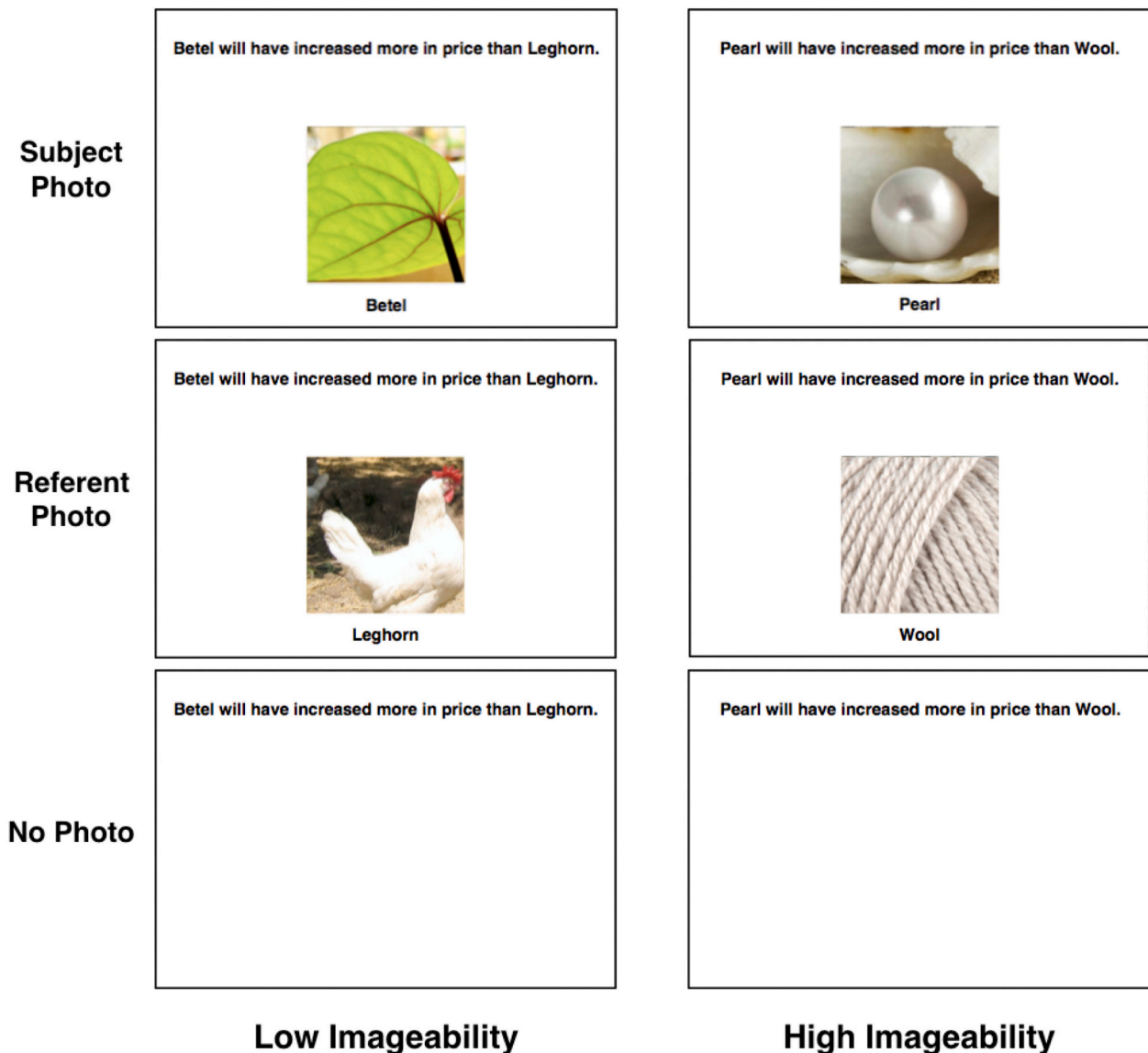


Fig. 1. Conceptual examples of different photo types paired with the same statement for both the high and low imageability conditions. Photo of Betel: Creative Commons License Attribution: Ananda Cilianuri. Photo of Leghorn: Creative Commons License Attribution: Naetoru.

button below the statement. Each statement appeared on a separate page and participants had to click “next” to move to the next page. At the end, participants were asked to report their native language and whether they had looked up the commodities online during the study.

3.2. Results

We first calculated the proportion of times participants responded “true” to each claim across experimental conditions. We then tested the predictions of the illusion-of-evidence account and fluency account with main effect contrasts between different photo types (subject vs. referent photo; subject vs. no photo; referent vs. no photo) and simple contrasts of photo type within each imageability condition. A sensitivity power analysis using G*Power indicates the experiment has 80% power to detect a minimum effect size of Cohen's $d = 0.162$ or $\eta_p^2 = 0.0065$. To correct for multiple comparisons, a Bonferroni adjustment was made to the p -values and 95% confidence intervals. The results of the omnibus analysis of variance and all interactions are reported in the Supplementary materials.

The left-hand panel of Fig. 2 shows the results (see also Table 1). Overall, a given comparative claim was more likely to be judged true

when accompanied by a photo of the subject than when accompanied by a photo of the referent, $F(1, 601) = 38.371, p < .001, \eta_p^2 = 0.060$, for the main effect contrast. Photos of the subject increased acceptance of the claim ($M = 0.577, SD = 0.266$) relative to the no-photo control condition ($M = 0.531, SD = 0.266$) – a truthiness effect; $F(1, 601) = 8.669, p = .003, \eta_p^2 = 0.014$, for the main effect contrast. On the other hand, photos of the referent decreased acceptance of the claim ($M = 0.477, SD = 0.274$) relative to the no-photo condition – a falseness effect; $F(1, 601) = 11.212, p = .001, \eta_p^2 = 0.018$, for the main effect contrast. These observations are consistent with a fluency account and incompatible with an illusion-of-evidence account.

The fluency account further predicts that the impact of photos is moderated by imageability. The results support this prediction. As Fig. 2 shows, the overall truthiness effect observed for claims presented with a photo of the subject of comparison held in the low imageability condition, $t(300) = 4.246, p < .001$, mean difference = 0.089, 95% CI [0.036, 0.142], Cohen's $d = 0.331$, but not in the high imageability condition, $t(301) = 0.142, p > .999$, mean difference = 0.003, 95% CI [-0.05, 0.056], Cohen's $d = 0.013$. This is reflected in a significant interaction of imageability and the main effect contrast between subject- vs. no-photo conditions, $F(1, 601) = 7.468, p = .006, \eta_p^2 = 0.012$.

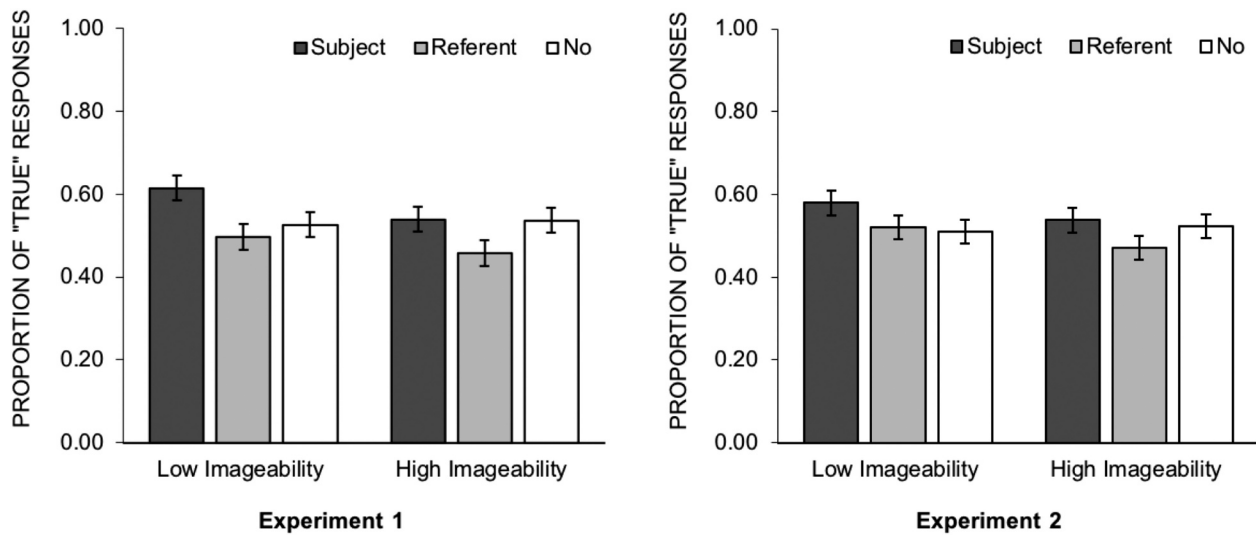


Fig. 2. Proportion of “true” responses to items that appeared with each photo type. Error bars represent the 95% confidence intervals for the photo effects.

Conversely, the overall falsiness effect observed for claims presented with a photo of the referent of comparison held in the high imageability condition, $t(301) = 3.393, p = .002$, mean difference = 0.079, 95% CI = [0.024, 0.133], Cohen's $d = 0.292$, but not in the low imageability condition, $t(300) = 1.303, p = .606$, mean difference = 0.029, 95% CI [-0.026, 0.084], Cohen's $d = 0.107$. However, the interaction between imageability and the referent- vs. no-photo main effect contrast was not significant, $F(1, 601) = 2.375, p = .124, \eta_p^2 = 0.004$. We address this issue in a meta-analysis after reporting experiment 2.

3.3. Discussion

Experiment 1 used comparative claims to examine divergent predictions of the illusion-of-evidence and the fluency account. The obtained results are consistent with a fluency account and difficult to derive from an illusion-of-evidence account. First, photos of the subject of comparison resulted in a truthiness effect, whereas photos of the referent of comparison resulted in a falsiness effect. Both presumably reflect the impact of the photos on the ease of processing a comparative claim. Because comparisons begin with an assessment of attributes of the subject, which are then compared with attributes of the referent (Tversky, 1977; Tversky & Gati, 1978), presenting a photo of the subject facilitates the flow of comparison, resulting in more fluent processing. In contrast, a photo of the referent disrupts the flow of

comparison, resulting in less fluent processing. As observed for many fluency manipulations—from repetition (Hasher et al., 1977) and color contrast (Reber & Schwarz, 1999) to rhyme (McGlone & Tofighbakhsh, 2000)—fluent processing increases, and disfluent processing decreases, the acceptance of claims as true (for reviews, see Dechêne et al., 2010; Schwarz, 2018).

Second, consistent with the relative nature of experienced fluency, truthiness and falsiness effects depended on the change in perceivers' processing experience. Seeing a photo of the subject increases ease of processing more when the subject is difficult to imagine without a photo than when it is easy to imagine to begin with, consistent with previous observations that truthiness effects are attenuated when claims are already easy to process at base-line (Abed et al., 2017; Newman et al., 2012). Hence, photos of the subject enhanced acceptance of the claim more in the low than in the high imageability condition. Conversely, seeing a photo of the referent while thinking about the subject should impair experienced fluency more when the subject is expected to be easy to process than when the subject is expected to be difficult to process to begin with. Again consistent with the relative nature of the fluency experience, this was the case – exposure to a referent photo impaired acceptance of the claim more when the subject was otherwise easy to imagine than when it was difficult to imagine. We return to the broader theoretical implications of these findings in the general discussion.

Table 1
Mean proportions of “true” responses and unstandardized effect sizes for each target condition.

Experiment	Imageability	Photo type	Mean (SD)	Effect size (ES)	95% CI for ES
Experiment 1	Low (N = 301)	Subject	0.615 (0.269)	0.089***	[0.036, 0.142]
		Referent	0.497 (0.274)	0.029	[-0.026, 0.084]
		No	0.526 (0.268)		
	High (N = 302)	Subject	0.540 (0.259)	0.003	[-0.050, 0.056]
		Referent	0.458 (0.274)	0.079**	[0.024, 0.133]
		No	0.536 (0.266)		
Experiment 2	Low (N = 291)	Subject	0.580 (0.239)	0.070**	[0.018, 0.121]
		Referent	0.521 (0.269)	0.010	[-0.042, 0.063]
		No	0.510 (0.257)		
	High (N = 306)	Subject	0.538 (0.274)	0.015	[-0.036, 0.065]
		Referent	0.470 (0.241)	0.053*	[0.002, 0.104]
		No	0.523 (0.256)		

The unstandardized effect sizes are raw mean differences between the target and no-photo conditions.

* $p < .05$.
 ** $p < .01$.
 *** $p < .001$.

Third, neither the differential effects of subject and referent photos nor their moderation by imageability is predicted by an illusion-of-evidence account. According to this account, the fact that a photo is presented as part of the task conveys that the photo is relevant to the task – or why else would it be presented? As discussed above, such an account would predict a main effect of the presence of apparently supportive evidence, which was not obtained.

Finally, a caveat needs attention. In experiment 1, all photos had a label that identified the commodity shown (as illustrated in Fig. 1), repeating the name of one of the two commodities mentioned in the claim. Such a label was missing in the no-photo condition, where the names of both commodities were only presented as part of the claim itself. It is conceivable that the verbal label of the photo shown increased processing fluency beyond the influence of the photo itself. Experiment 2 addresses this concern by replicating experiment 1, using the same procedures and materials, with the verbal labels removed from the photos. This also allows us to test the robustness of the reported results in a direct replication that merely differs in the presence of verbal labels on the nonprobative photos shown.

4. Experiment 2

4.1. Method

4.1.1. Participants

We aimed to recruit 600 Mturk workers to keep the number of participants consistent with experiment 1. The eligibility criteria and compensation followed experiment 1 and a total of 597 participants completed the study. No participant was excluded from data analysis.

4.1.2. Material, design, and procedure

Experiment 2 is a direct replication of experiment 1, except that the labels that identified the commodity shown were removed from the photographs. A separate follow-up study indicated that participants could identify which commodity was being shown to them in the low imageability condition even without the labels, $Maccuracy = 0.607$, $SD = 0.154$, $t(80) = 6.261$, $p < .001$. For a detailed discussion, see Appendix D in Supplementary materials.

4.2. Results and discussion

Data analysis followed the same procedure as experiment 1. As shown in the right-hand panel of Fig. 2 (see also Table 1), experiment 2 replicated the results of experiment 1, although with slightly smaller effect sizes. A sensitivity power analysis using G*Power indicates the experiment has 80% power to detect a minimum effect size of Cohen's $d = 0.163$ or $\eta_p^2 = 0.0066$.

Claims accompanied by a photo of the subject were again more likely to be judged true than claims accompanied by a photo of the referent; $F(1, 595) = 18.186$, $p < .001$, $\eta_p^2 = 0.030$, for the main effect contrast. Compared to the no-photo condition ($M = 0.517$, $SD = 0.256$), photos of the subject produced truthiness effect ($M = 0.558$, $SD = 0.258$), $F(1, 595) = 7.825$, $p = .005$, $\eta_p^2 = 0.013$, whereas photos of the referent produced a falsiness effect ($M = 0.495$, $SD = 0.256$), although the latter was not significant, $F(1, 595) = 1.981$, $p = .16$, $\eta_p^2 = 0.003$.

Further replicating experiment 1, simple contrasts between the subject- and no-photo conditions within each level of imageability revealed that photos of the subject increased acceptance of the claim in the low imageability condition, $t(290) = 3.544$, $p = .004$, mean difference = 0.070, 95% CI [0.018, 0.121], Cohen's $d = 0.281$, but not in the high imageability condition, $t(305) = 0.648$, $p > .999$, mean difference = 0.015, 95% CI [-0.036, 0.065], Cohen's $d = 0.056$. This is reflected in an interaction between imageability and the subject- vs. no-photo contrast, $F(1, 595) = 3.317$, $p = .069$, $\eta_p^2 = 0.006$. Also replicating experiment 1, simple contrasts between the referent- vs. no-

photo conditions showed that photos of the referent decreased acceptance of the claim in the high imageability condition, $t(305) = 2.458$, $p = .038$, mean difference = 0.053, 95% CI [0.002, 0.104], Cohen's $d = 0.214$, but not in the low imageability condition, $t(290) = 0.483$, $p > .999$, mean difference = 0.01, 95% CI [-0.042, 0.063], Cohen's $d = 0.039$. This is reflected in an interaction between imageability and the referent- vs. no-photo, $F(1, 595) = 4.350$, $p = .037$, $\eta_p^2 = 0.007$. Detailed descriptive statistics are reported in Table 1 and a full omnibus ANOVA is reported in the Supplementary materials.

In sum, experiment 2 replicated the results of experiment 1 using the same procedures and photos, while removing the previously used verbal identifiers of the commodities shown. However, not all the differences observed in these experiments were significant and we address this using analyses suggested by McShane and Böckenholt (2017).

5. Meta-analysis

To calculate more precise effect size estimates for the influence of subject and referent photos, we conducted a single-paper meta-analysis based on the comparative judgments collected in experiments 1 and 2, following recommendations by McShane and Böckenholt (2017). Appendix E presents the estimated unstandardized effect sizes (i.e., the raw mean differences between the proportion of “true” responses to claims paired with each photo type). As shown in Fig. 3a, all three main effect contrasts were significant. 1) Photos of the subject produced a higher proportion of “true” responses than photos of the referent. When compared to the no-photo condition, 2) photos of the subject increased acceptance of the claim, whereas 3) photos of the referent decreased acceptance of the claim. This confirms the emergence of a truthiness effect for subject photos and a falsiness effect for referent photos.

Simple contrasts within each imageability condition further revealed 4) that the truthiness effect produced by subject photos was reliable when the commodities were difficult to imagine, but not 5) when they were easy to imagine (Fig. 3b). In contrast, the falsiness effect produced by referent photos was 6) reliable when the commodities were easy to imagine, but 7) not when they were difficult to imagine (Fig. 3c). These effects are also reflected in significant interactions between imageability and the main effect contrasts (i.e., subject vs. no photo, referent vs. no photo), as shown in the right-hand panels of Fig. 3b and c.

6. General discussion

We examined two potential mechanisms underlying the influence of nonprobative photos on judgments of truth. Going beyond earlier research, we used comparative rather than non-comparative claims, varied whether a nonprobative photo depicted the subject or the referent of the comparison, and whether the subject of the claim was easy or difficult to process without a photo. These variations allowed us to further illuminate and disentangle the processes underlying the truthiness effect (Newman et al., 2012), and to identify novel conditions under which reliable falsiness effects emerge.

That nonprobative photos can influence the perceived veracity of a claim has received broad attention because it is counterintuitive and violates normative standards of truth assessment – after all, nonprobative photos provide no evidence bearing on the claim. An analysis in terms of Grice's (1975) logic of conversation calls this assumption into question. The mere fact that normatively irrelevant information is presented as part of a task renders it conversationally relevant, which can entice participants to draw on it in forming a judgment (for reviews, see Schwarz, 1994, 1996). Presenting a photo as part of a claim may similarly convey that it can be treated as evidence for the claim. Moreover, most photos that people encounter in daily life capture real events and photos have long been offered as evidence that an event has truly occurred (Mnookin, 1998). In addition, photos are rich in perceptual and semantic details and people are more likely to assume that

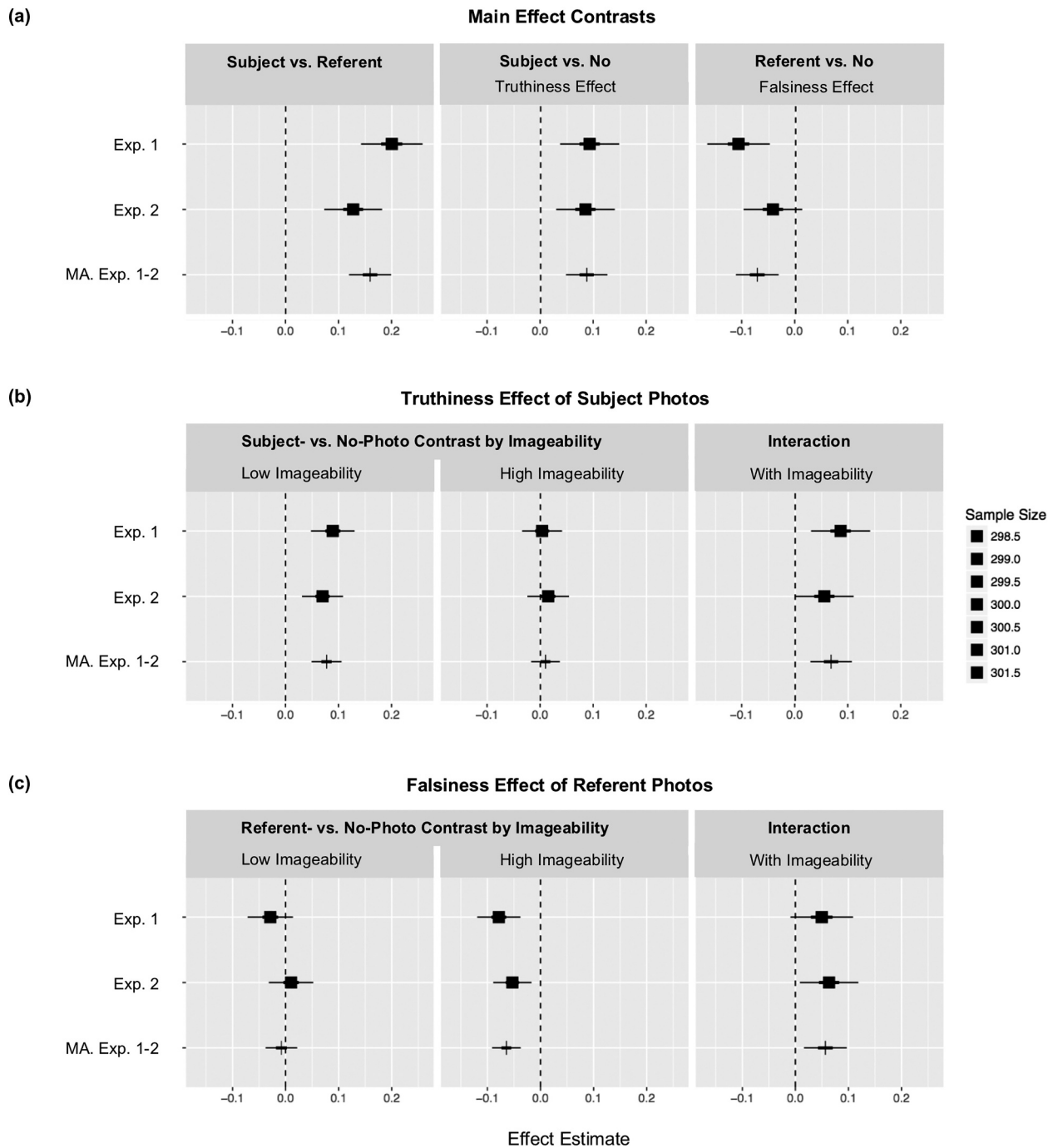


Fig. 3. Estimates of unstandardized effect sizes for experiment 1 and 2 and the single-paper meta-analysis (McShane & Böckenholt, 2017). The size of the squares represents the average sample size per condition; the horizontal thick and thin lines around the squares represent 50% and 95% CI intervals, respectively. The top panel (a) shows the three main effect contrasts. The middle panel (b) and bottom panel (c) show the effects of subject and referent photos, respectively, within each imageability condition, followed by their interaction with imageability.

a mental event (e.g., an episodic memory) reflects reality when it features such details (Johnson et al., 1988). In combination, these factors may create an illusion of supportive evidence when a claim is presented with a related photo, even when the photo does not have clear probative value. This account has not been directly tested in previous studies and seems more popular in skeptical reviews than in empirical research. Plausible as the account is, we have not obtained support for it. First, the illusion-of-evidence account predicts a main effect of presenting a related photo that is independent of the imageability of the subject. However, the imageability of the subject moderated the size of truthiness effects in both experiments with comparative claims, as well as the

preliminary experiment with noncomparative claims reported in the Supplementary materials. The illusion-of-evidence account also fails to explain a falseness effect when nonprobative photos of the referent are presented and its moderation by imageability, in contrast to the results of experiments 1 and 2.

However, one might attempt to reconcile the illusion-of-evidence account with the obtained falseness effect by assuming that a photo increases the perceived importance of the commodity it shows. Hence, whatever is shown in the photo is more likely to have increased in price, which produces a truthiness effect for subject photos and a falseness effect for referent photos under the constraints of the claims used in the

present experiments. Again, this *ex post facto* variant of the illusion-of-evidence account does not predict the observed moderation by imageability, and hence also fails to provide a coherent explanation of the results.

In contrast, the present results are fully consistent with a fluency account of truth judgment. As observed in numerous studies, claims are more likely to be accepted as true when incidental influences make them easier to process. This presumably reflects that fluency can be brought to bear on key criteria that people use in judging truth (Schwarz, 2015): Is it compatible with other things I know? Is it internally coherent and free of contradictions? Does it come from a credible source? Do others believe it? Each of these criteria can be evaluated analytically by drawing on relevant declarative inputs or intuitively by drawing on the ease with which the claim can be processed. When statements are coherent (Johnson-Laird, 2012) and compatible with the recipient's knowledge (Winkielman et al., 2012) they are more fluently processed than when they are incoherent or at odds with other beliefs the recipient holds. Fluently processed names feel more familiar and endow their bearers with higher trustworthiness (Silva et al., 2017). Widely shared beliefs have been encountered more frequently and are more easily processed due to repetition, which increases estimates of social consensus even when all repetitions come from a single source (Weaver et al., 2007). Finally, the amount of supporting evidence is overestimated when some can easily be brought to mind (Schwarz et al., 2007), consistent with the availability heuristic (Kahneman & Tversky, 1973). In short, the metacognitive experience of fluency provides an affirmative, but fallible, answer to each of the major truth criteria people use in assessing the veracity of claims (Schwarz, 2015, 2018). But as in other domains of judgment, people are more sensitive to their feelings than to the source of those feelings and hence misread incidental subjective experiences as relevant to the judgment at hand (for reviews, see Schwarz, 2012; Schwarz & Clore, 2007). Hence, many incidental manipulations of fluency have been found to increase a claim's acceptance, from repeating a claim (e.g., Hasher et al., 1977) to repeating its denial (e.g., Skurnik et al., 2005), presenting it in an easy-to-read color contrast (e.g., Reber & Schwarz, 1999), in high acoustic quality (e.g., Newman & Schwarz, 2018) or a rhyming form (McGlone & Tofigbakhsh, 2000).

From this perspective, nonprobative photos should increase the acceptance of a claim to the extent that they facilitate processing of the claim, but decrease acceptance to the extent that they impair processing of the claim. Empirically, this was the case. First, relative to a no-photo condition, nonprobative photos of the subject of a claim increased acceptance of comparative claims, provided that the subject of the claim was unfamiliar and difficult to imagine without a photo. This moderation by familiarity and imageability parallels the earlier observation that nonprobative photos exert less influence on the acceptance of non-comparative claims when the subject of the claim is familiar (Abed et al., 2017; Newman et al., 2012).

Second, and more importantly, nonprobative photos of the referent decreased the acceptance of comparative claims as true, provided that the subject was easy to imagine without a photo. Empirically, this provides first evidence that related photos can produce falseness effects. In research with non-comparative claims, falseness effects were only observed for unrelated photos (Newman et al., 2015, experiments 5 and 6), that is, photos that had no substantive relationship to the claim (e.g., a photo of a pig shown with a claim about shoelaces). Note that falseness effects of unrelated photos are compatible with a fluency as well as an illusion-of-evidence account. From an illusion-of-evidence perspective, a clearly unrelated photo surely cannot be evidence for the claim and calls the communicator's cooperativeness into question, triggering a more skeptical analysis of the claim. In contrast, photos of the referent of a comparative claim are related to the substance of the claim and hence could serve as evidence. From a fluency perspective, an unrelated photo impairs processing of the claim by introducing a distractor. Similarly, a photo of the referent impairs processing of comparative

claims because comparative processing starts with the subject of the claim, not the referent. In both cases, the emergence of falseness effects can be plausibly traced to low processing fluency.

Third, truthiness as well as falseness effects were moderated by imageability and familiarity, consistent with the relative nature of the informational value of fluency experiences (Newman et al., 2015; Wänke & Hansen, 2015). Presenting a comparative claim with a nonprobative photo of the subject increased acceptance of the claim relative to a no-photo condition when the subject was difficult to imagine; however, it did not influence acceptance relative to a no-photo condition when the subject was already easy to imagine (Fig. 3b). Conversely, presenting a comparative claim with a photo of the referent decreased acceptance of the claim relative to a no-photo condition when the subject would otherwise have been easy to imagine; however, it did not influence judgment relative to a no-photo condition when the subject was expected to be difficult to imagine to begin with (Fig. 3c). Throughout, photos influenced judgments of truth when the resulting fluency experience deviated from what it would have been without a photo but not otherwise.

6.1. Limitations and future directions

Some limitations are worth noting. First, we used statements about commodities because they allowed us to have an objective standard to manipulate imageability/familiarity based on the ratings in the MRC Psycholinguistic Database (Wilson, 1988). Future research may test the robustness of the observed effects in other domains, including comparative claims about persons. Second, imageability/familiarity was manipulated as a between-subject variable to avoid large discrepancies in the imageability of the items that participants were asked to compare. Theoretically, within-subject variations in imageability would further add to item-to-item changes in fluency, which may attenuate or enhance the observed effects depending on the resulting change in processing fluency. Finally, as is common in this type of research, participants made numerous truth judgments within a short time, often bearing on unfamiliar targets. Both of these aspects may have reduced task engagement compared to naturalistic conditions under which a recipient may only be exposed to one or two claims at a time. Future research may fruitfully address the role of task engagement by varying the number of claims and their personal relevance.

Despite these caveats, our findings add to the converging evidence that processing fluency is likely the main mechanism underlying the influence of nonprobative photos on the acceptance and rejection of claims. They also suggest that much can be learned by moving from omnibus manipulations of fluency (such as repetition, print font, color contrast, auditory quality) to manipulations that differentially affect specific components of a statement. By showing that a photo of the subject can facilitate, and a photo of the referent impair, acceptance of a comparative claim, our findings challenge the assumption that easy processing of the parts always fosters easy processing and acceptance of the whole. Future research may fruitfully explore how the differential fluency of components of complex materials affects metacognitive experience and judgment in other domains.

Open practices

We have made the stimuli and the data of all experiments publicly available at the Open Science Framework. They can be viewed from the following link. https://osf.io/5rtz8/?view_only=217e3ba9c7864146abf692d183357658. We confirm that the information and files uploaded to the Open Science Framework is sufficient for an independent researcher to reproduce the reported methodology and results.

Appendix A. Supplementary materials

Supplementary materials to this article can be found online at <https://doi.org/10.1016/j.jesp.2020.104054>.

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