How Affect and Repetition Influence Judgments of Truth

Patricia Garrido-Vásquez[1,2] *and Tanja Rock*[2]

[1] Department of Psychology, University of Concepción, Concepción, Chile

[2] Department of Experimental Psychology and Cognitive Science, Justus Liebig University Giessen, Giessen, Germany

ABSTRACT

People believe repeated statements more than new ones, a phenomenon called the repetition-induced truth effect. It is chiefly explained with the subjective processing ease (i.e., fluency) for repeated as compared to new information. To date, the role of affective processes for the repetition-induced truth effect is rather unclear. Different mechanisms may play a role: Affect influences processing styles, it may directly inform judgments, and positive affect may be misattributed to fluency/familiarity. In the current study, we compared mechanisms and tested whether a positive, neutral, or negative picture presented before a statement would influence the repetition-induced truth effect. Experiment 1 followed a classical repetition-induced truth effect procedure with two sessions that were a week apart. In the second session, each statement was preceded by an affective picture. We replicated the repetition-induced truth effect, and we observed a statistically significant main effect of affect—statements were rated as truer after a positive rather than a negative or neutral picture, but the interaction between repetition and affect was not statistically significant. In Experiment 2, we aimed to clarify the mechanism behind this finding using only new statements preceded by affective pictures. No statistically significant main effect of affect emerged. We conclude that the results in Experiment 1 were due to the misattribution of positive affect to fluency/familiarity, enhancing the perceived truth of the statements. In sum, our results suggest two factors that enhance truth judgments: repetition and positive affect, but the effects of affect depend on the exact paradigm used.

KEYWORDS

truth effect
repetition
affect
affective pictures
positivity
fluency

INTRODUCTION

People receive substantial amounts of information every day. With so much information, it is impossible to scrutinize the veracity of each piece of it. So, how do people decide what is true and what is not? One well-established effect in the literature is the repetition-induced truth effect: People believe more in information that they have encountered before compared to information that they see or hear for the first time (Dechêne et al., 2010). This effect is prominently attributed to increased processing fluency—the subjective ease of processing—for repeated statements compared to new ones (Dechêne et al., 2010).

Furthermore, affective processes influence judgments (Schwarz, 2012), but there has been little research to date on their role in the repetition-induced truth effect. The current study aimed to evaluate the effect of affective pictures on the repetition-induced truth effect.

The repetition-induced truth effect is a well-established phenomenon. It has been reported for different types of statements: trivia (e.g., Hasher et al., 1977), opinions (e.g., Arkes et al., 1991), or advertisements (e. g., Hawkins & Hoch, 1992). It works for both written (e.g., Arkes et al., 1991; Nadarevic & Erdfelder, 2014) and auditory (e.g., Garcia-Marques et al., 2015; Hasher et al., 1977) presentations of the statements. Dechêne et al. (2010) conducted a meta-analysis of studies that examined the repetition-induced truth effect and found that it is a robust phenomenon with medium effect sizes.

It was originally assumed that the repetition-induced truth effect would only work on ambiguous statements, that is, on statements people have no knowledge about, because otherwise, their background knowledge would override the effect (Dechêne et al., 2010). However, a study by Fazio et al. (2015; see also Fazio, 2020) showed that even when people have background knowledge about the statements (e.g., people who know that the Pacific Ocean is the largest ocean on earth), they tend to classify false information ("The Atlantic Ocean is the largest ocean on Earth") as truer when this information is repeated. Likewise, statements that change with respect to some detail into the opposite after the first presentation, are rated as more believable a few days later than completely new statements (Garcia-Marques et al., 2015). Thus, the repetition-induced truth effect has not only been replicated many times, but it is also a very robust effect (see Pillai & Fazio, 2021, for a review).

A mechanism that is commonly assumed to underlie the repetition-induced truth effect is processing fluency (Dechêne et al., 2010; Reber & Schwarz, 1999; Unkelbach, 2007): Repeated statements are processed more fluently than new ones, and processing them feels easier, which is

Corresponding author: Patricia Garrido-Vásquez Schmidt, Department of Psychology, University of Concepción, Concepción, Chile.

Email: patricia.garrido@udec.cl

used as a cue to infer the veracity of a statement (Oppenheimer, 2008). Some indication that processing fluency might affect truth judgments comes from studies that manipulated item fluency at the perceptual level, presenting the items with higher or lower contrast, and thus making them easier or more difficult to read, respectively. High-contrast items receive higher truth judgments than low-contrast items (Reber & Schwarz, 1999), which aligns with the fluency explanation. Other closely related mechanisms to explain the truth effect are explicit statement recognition (Bacon, 1979) or feelings of familiarity (Arkes et al., 1991; Begg et al., 1992), which enhance truth judgments for repeated statements.

A more recent account is the referential theory (Unkelbach & Rom, 2017), according to which a statement activates references in memory which are analyzed for their availability and coherence. If the references are coherent, people are more likely to judge a statement as true than when they are incoherent. According to this theory, repeated information activates more coherent references than new statements due to networks that form after the first presentation, and therefore, repeated information seems more acceptable or true than new information. In sum, although the repetition-induced truth effect has been replicated many times, it is not completely clear how it emerges. In this context, affective processes are one underinvestigated influence on truth judgments.

How could affective processes influence the truth effect? Based on more recent versions of the feelings-as-information theory (Schwarz, 2012), three mechanisms can be delineated, of which only the first would be expected to influence the magnitude of the repetition-induced truth effect: (a) feelings induce different processing styles, which may affect how people process the statements, (b) people use their current feelings as an additional information source when making judgments, which may apply to judgments of truth, and (c) fluency/familiarity and positive affect are tightly related such that positive affect may induce metacognitive experiences of stimulus fluency/familiarity, leading to misattributions of positive affect to fluency/familiarity and enhancing judgments of truth.

Regarding the first mechanism, processing becomes more systematic and bottom-up in the context of negative feelings, and people pay more attention to detail and external sources of information (Bless & Fiedler, 2006; Schwarz, 2012). In contrast, positive feelings promote top-down processing with less focused attention. In a seminal study (Mackie & Worth, 1989), a positive or neutral mood was induced, and then participants read either strong or weak arguments for a case. Whereas participants in the neutral mood condition changed their attitudes only after reading the strong arguments, happy participants did so also after reading the weak arguments when processing time was limited. Thus, apparently, they engaged in more heuristic processing during this task (Bless & Fiedler, 2006), but they could compensate for it when given unlimited processing time (Mackie & Worth, 1989).

Based on the idea of different processing styles induced by feelings, we would predict that people should trust information and their internal processes more under positive than under negative affect such that they should rely more on fluency as a cue to truth under positive than under negative affect.

Koch and Forgas (2012) tested the effect of mood induction on truth judgments for statements that varied in contrast and were, therefore, easy or hard to read—a manipulation of perceptual fluency. They induced positive, neutral, or negative mood with short video clips, hence, participants were aware of the procedure. Participants then proceeded to judge the truth of different statements. Koch and Forgas (2012) reported a statistically significant interaction between mood and fluency (operationalized by item contrast): Participants in a positive or neutral mood, but not those in a negative mood, relied on perceptual fluency as a cue to truth and judged high-contrast items as truer than low-contrast ones. The authors interpreted their findings in terms of different mood-dependent processing styles, with positive but not negative mood promoting reliance on fluency as a cue to truth. Another study (Garcia-Marques, Silva, et al., 2016) tested the repetition-induced and the perceptually induced truth effect under superficial and deep processing conditions. They found that the repetition-induced truth effect increased in more superficial processing contexts and that the perceptually induced truth effect only occurred under superficial, but not under deep processing conditions, where it was reversed.

To sum up, positive feelings induce more superficial processing (e.g., Mackie & Worth, 1989). Therefore, the prediction derived from this first mechanism is that a positive affective state should enhance the repetition-induced truth effect, as was observed by Koch and Forgas (2012) for the perceptually induced truth effect.

The second mechanism of how affective processes could influence the repetition-induced truth effect is the direct impact of affect on judgments. This refers to the informative function of affect: When people make judgments, they take their current affective states into account to inform their decisions (Schwarz, 2012). Regarding the repetition-induced truth effect, affect manipulations can influence truth judgments directly. Stump et al. (2021), in their Experiment 1, reported that the repetition-induced truth effect was weakened after a retention interval of one week, but not after a few minutes, when a negative facial expression was presented after the statement and before the judgment, which was line with this second mechanism.

Furthermore, the feelings-as-information account posits that people need to be unaware of the sources of their affective states because otherwise, affective mechanisms do not impact cognitive processes (Schwarz & Clore, 1983). However, even when affect is overtly manipulated, it may influence judgments. For example, Topolinski and Strack (2009), in their Experiment 8, presented affectively laden word triads for coherence judgments, and therefore, did not conceal affective content. Positively valenced word triads were judged as more coherent than negative ones, even in a group that had been explicitly instructed about the affective content of the stimuli and the independence of affective content and coherence (Topolinski & Strack, 2009). Thus, even consciously perceived affective manipulations might influence cognitive processes. People likely perceive that their feelings are about the target of the judgment—they are sensitive to their feelings, but they normally do not pay attention to where they come from (Schwarz, 2012).

Unkelbach et al. (2011) tested whether item positivity influenced truth judgments and presented statements whose content could be

either positively or negatively framed. Although no main effect of statement valence on truth judgments was observed, the authors reported that the participants' truth judgments for positively framed items were positively correlated with valence judgments. Jaffé and Greifeneder (2019) reported higher truth judgments for positively framed than for negatively framed statements in their Experiment 1, but they also found evidence for a negativity bias in their follow-up experiments. Thus, these studies provide limited support for the assumption that affective mechanisms directly influence truth judgments. This direct influence of affect on judgments might be conditioned on feelings coming directly from the object of judgment, that is, the stimulus (integral) rather than from an unrelated (incidental) source (Schwarz, 2012).

The empirical evidence is still equivocal, but based on theoretical considerations, the prediction from this second mechanism is that positive affect should lead to higher truth judgments than negative affect, both for new and repeated statements.

Finally, the third mechanism of how affective processes could influence the repetition-induced truth effect relates to the link between fluency/familiarity and positivity and the potential misattribution of positive affect to these stimulus qualities. This link is bidirectional: on the one hand, easy processing induces a pleasant feeling because easy or fluent processing feels good and generates a positive affective experience (Reber et al., 2004; Winkielman & Cacioppo, 2001). Garcia-Marques, Prada, et al. (2016) reported direct evidence that repetition-induced fluency is experienced as positive, and that the mere repetition of stimuli induces positive affect, independently of the task and even in the absence of conscious awareness of the repetition. Perceived fluency may also indicate successful cognitive processing, which is experienced as rewarding and positive (Winkielman et al., 2003). Furthermore, fluency is related to familiarity, and familiar stimuli are processed more easily and fluently than unfamiliar ones, which, in turn, is experienced as positive (Garcia-Marques, Prada, et al., 2016). On the other hand, positive affect increases the likelihood of stimuli being judged as familiar (Garcia-Marques et al., 2004) or repeated (Monin, 2003), even when they have not been presented before. Thus, the link between positivity and fluency works in both directions.

Misattribution of positive affect plays a role in the influence of positivity on stimulus evaluation. Claypool et al. (2008) induced positive or neutral moods with stories, and mood influenced subsequent familiarity judgments for pictures such that people in a positive mood misclassified more stimuli as "old" than people in a neutral mood. The effect of positive mood disappeared only when participants were asked how they felt right after the mood induction, and were, therefore, able to attribute their mood to the induction procedure rather than coming from the stimuli. Stump et al. (2021; Experiment 2) showed that participants who received the bogus instruction that subliminal affective primes, which could induce affective changes, would be presented, showed a reduced repetition-induced truth effect compared to the group who did not receive this instruction and had no alternative source for affect attribution. Related research shows that a positive affective manipulation increases the perceived familiarity of faces and words, and the perceived truth of statements that allegedly were presented subliminally to participants (while no statements were actually shown; Garcia-Marques et al., 2004). This line of research suggests that positive affect could enhance truth judgments through an affective misattribution mechanism, making statements appear more fluent/familiar and thus more true under positive affect. In this case, feelings come from an unrelated (incidental) source and could mislead participants in their judgments (Schwarz, 2012). So far, this line of research has used actual (Phaf & Rotteveel, 2005; Stump et al., 2021) or alleged (Claypool et al., 2008; Garcia-Marques et al., 2004) stimulus repetition, which might be a boundary condition for inducing the perception of stimulus familiarity and related processes.

In sum, the third mechanism refers to the link between positivity and fluency/familiarity. Based on this mechanism, our prediction is that positive affect leads to statements being perceived as more familiar/fluent and thus more true—a misattribution of positive affect, which, however, only works if participants do not attribute their positive feelings as coming from the experimental manipulation (Schwarz, 2012; Stump et al., 2021). This third mechanism would predict enhanced truth judgments, both for new and repeated statements, in the positive affect condition.

In the current study, we compared these three mechanisms. We used statements with neutral semantic content and applied an affective manipulation with pictures to manipulate affect independently of the statements' content. Affective pictures have a long tradition in experimental psychology, and compared to mood induction procedures such as stories or videos presented at the beginning of an experimental session, they have several advantages: positive and negative conditions can be carefully matched for arousal, which otherwise could be a confounding factor, and their presentation can be exactly timed (Dan-Glauser & Scherer, 2011). Moreover, they allow for within-subject designs because positive, negative, and neutral material can be presented within the same experimental session due to their short-lived effects (Cuthbert et al., 2000). Event-related potential studies show that the neural response to these pictures can be clearly distinguished by picture valence and that the most pronounced changes occur during the first second of processing (Cuthbert et al., 2000; Zhu et al., 2015). In the current study, positive, negative, or neutral pictures were presented right before the statements. Due to the transient effects of affective pictures, we expected them to bias statement processing and, through that, to influence truth judgments, rather than directly influence truth judgments, as in Stump et al. (2021).

We aimed to investigate how affective processes modulate the repetition-induced truth effect, a topic which has been only sparsely investigated to date. Crucially, what has not been tested yet is how the repetition-induced truth effect for statements could be influenced by affective pictures presented directly and supraminally before the statements. Previous studies have manipulated the affective valence of the statement content (Unkelbach et al., 2011), presented subliminal affective cues between statements and judgments to influence judgments directly (Stump et al., 2021), used perceptual fluency manipulations after an initial mood induction phase (Koch & Forgas, 2012), or informed the participants that statements had been presented, while in reality, no

statements were shown (Garcia-Marques et al., 2004). Because many news articles are presented with pictures, and the pictures are often the first thing attended to before reading the article or even the headline, it would be interesting to learn about the effects that affective pictures might have on the evaluation of subsequently presented statements. Moreover, as outlined above, affective pictures have several advantages over other affect manipulation techniques. Most importantly, they allow for precisely presenting valenced material with a short-lived effect on the subsequent processing of the statements and for matching the positive and negative conditions for arousal to avoid potential confounds.

Based on the three mechanisms presented before, we arrived at different predictions: Mechanism 1 implies that affect influences processing style and that processing should be more heuristic and superficial in the positive condition, where people would rely more on fluency as a cue to truth under positive than negative affect. Thus, the truth effect should be stronger in the positive than in the negative context—an interaction between repetition and affect. Regarding the other two mechanisms, we expected a main effect of affect both if affect has a direct influence on judgments (Mechanism 2) and if positivity is misattributed to stimulus fluency/familiarity, which, in turn, enhances truth judgments (Mechanism 3), leading to enhanced truth judgments for both repeated and new stimuli under positive affect.

EXPERIMENT 1

Method

PARTICIPANTS

Thirty-five participants completed both sessions of the experiment in exchange for course credit. They had a mean age of 25.63 years (*SD* = 3.45). Twenty-three were women. All participants indicated that German was their native language. The study was approved by the local ethics committee at the Department of Psychology and Sports Science at Justus Liebig University Giessen, Germany, and all procedures followed the Declaration of Helsinki. Participants provided written informed consent prior to the experiment.

STIMULI

We created a pool of 210 statements from different knowledge domains (biology, geography, sports, physics, economics, history, etc.), of which 50% were true and 50% were false (e.g., "The New York Central Park is almost double the size of Monaco" [true] or "Patricio Rivas was the first president of Nicaragua" [false]). Some of our items were translated versions from the neutral items in Silva et al. (2016). Additional items were created by consulting encyclopedias and online sources. False items were generated by changing small details of originally true statements. Items were pretested on a sample of 22 participants who did not participate in the main experiment. Each item was evaluated by at least ten judges who made a binary decision ("true" or "false"). Six items (three true and three false), which had received over 85 % correct responses, were withdrawn from the item pool because their truth status was known to most participants. We used these statements as practice items, thus, the final number of items for the experiment was 204. For Session 1, 102 items (51 true and 51 false) were randomly drawn from the pool for each participant. In Session 2, all 204 items were presented, hence our proportion of repeated and new and of true and false statements was 50/50.

In Session 2, we used affective pictures from the Geneva Affective Picture Database (GAPED; Dan-Glauser & Scherer, 2011). Seventeen stimuli were selected for the positive, negative, and neutral categories, respectively. Because the GAPED contains four groups of negative pictures (snakes, spiders, animal mistreatment, and human concerns), we chose only the latter category for our experiment. To find the most adequate stimuli for each category, we relied on the valence and arousal ratings provided by Dan-Glauser and Scherer (2011), who used a 100-point continuous rating scale on a sample of 60 participants. For positive and negative pictures, we selected items that clearly represented the intended valence, but at the same time, we tried to avoid differences in arousal ratings between the two categories, which could be a confounding factor. Based on these assumptions, we used the following stimuli: P003, P011, P027, P034, P050, P053, P065, P070, P083, P088, P094, P097, P100, P102, P105, P106, and P124 for the positive category, and H009, H012, H024, H027, H029, H039, H047, H050, H052, H054, H059, H086, H095, H097, H100, H106, and H107 for the negative category. Furthermore, we selected 17 neutral pictures with valence ratings close to 50, which corresponds to the center of the valence scale and thus to neutral valence. Our stimuli selection included the following items: N011, N020, N025, N031, N033, N039, N061, N072, N081, N087, N089, N092, N094, N101, N106, N109, and N111.

Valence ratings from Dan-Glauser and Scherer (2011) for the selected pictures were: M = 85.41, SD = 8.07 for the positive pictures; M = 35.64, SD = 12.67 for the negative pictures; and M = 50.34, SD = 1.08 for the neutral pictures. Arousal ratings were as follows: M = 40.84, SD = 10.92 for the positive pictures; M = 43.76, SD = 8.30 for the negative pictures; and M = 21.71, SD = 5.16 for the neutral pictures.

PROCEDURE

The experiment was presented as a test of implicit knowledge, in which the truth status of different items had to be rated on a scale. We also informed participants that they would probably not know the answers to most of the items and that the items could be either true or false. Participants were tested individually in two sessions which were about one week apart (range: five to nine days). We did not run the whole experiment at once, which was mainly due to practical reasons (rating the 204 statements and the 51 affective pictures in Session 2 already took about one hour). Also, the repetition-induced truth effect cannot always be replicated if the exposure phase and the judgment phase are administered on the same day because participants might remember the statements and their judgments (Nadarevic & Erdfelder, 2014), and we wanted fluency and picture-induced affective mechanisms to be isolated from other memory influences such as explicit recognition. The positivity-familiarity link may be weakened when stimuli are explicitly remembered (Monin, 2003, Experiment 5).

Participants sat at approximately 50 cm from a 19 in. monitor, on which the items were displayed in black letters on a white background. They were left-justified and horizontally centered on the screen. In Session 1, each trial started with a central black fixation cross which remained on screen for 500 ms. It was immediately followed by one of the statements for 4 s, which was enough for the participants to comfortably read them. Then, the item disappeared from the screen, and a six-point Likert scale prompted participants to provide their respective truth rating by pressing the corresponding number on the computer keyboard. The scale also contained six verbal labels which ranged from "definitely true" to "definitely false," and its direction was counterbalanced across participants. There was no time limit. After each response, a new trial started. In the Session 2, the procedure was identical, only that after the fixation cross, an affective picture was presented for 1 s. At the beginning of Session 2, participants were instructed that the procedure would be identical to Session 1, only that now a picture would be shown before each statement and that they should look at the pictures attentively because they would become relevant for a later task. Pictures were followed by the statement for 4 s and then the rating scale was presented. Pictures were shown centrally in their original size (640 × 480 px).

In both sessions, the statements were presented in random order in blocks of 34 trials each. At the beginning of Session 1, participants completed six practice trials to become familiar with the procedure. Session 2 was divided into six 34-trial blocks. Two were run with positive, two with negative, and two with neutral pictures. Block sequence was randomized individually for each participant. Because we had 17 pictures for each category, we presented each picture twice within a block (four times in total).

At the end of the Session 2, participants evaluated the affective pictures. All 51 pictures were presented again in random order. Each trial started with a fixation cross for 500 ms, followed by an affective picture for 4 s. The picture then disappeared, and participants rated its arousal and valence by pressing the corresponding number buttons on the keyboard. We used a seven-point self-assessment manikin (SAM) scale (Bradley & Lang, 1994) for both decisions, and again, there was no time limit for responding.

At the end of Session 2, participants were asked whether they had looked up any of the statements after Session 1, thanked, and debriefed.

Results

ITEM ANALYSIS

Because we used newly created items that had not been extensively tested yet, we first analyzed their suitability for research on the truth effect. To this end, we used the truth ratings from Session 1. We refrained from including the new items from Session 2, because new items that appear together in a list with repeated items may be evaluated differently than in a list with only new items, which may be due to a subjective contrast in processing between the two item types (Dechêne et al., 2009). This could be a confound or there could be maturation effects between the two sessions, which is why we decided to only consider data from Session 1. Because only half (N = 102) of the statements were presented in Session 1, and they were randomly drawn from the item pool for each participant, the number of respondents per item differed between statements. It ranged from n = 9 up to n = 26 respondents per item (M = 17.5, SD = 2.96). Truth ratings were taken from the participants' truth judgments on the six-point Likert scale, with 1 coded as "definitely false" and 6 as "definitely true".

Across all 204 items, the mean truth rating was 3.59 (SD = 0.45), and therefore, close to the center (3.5) of the six-point scale. True items received slightly lower truth judgements (M = 3.54, SD = 0.44) than false ones (M = 3.64, SD = 0.49), but this difference was not statistically significant, $t(101) = 1.47$, $p = .145$, $d = 0.145$. This shows that our items were ambiguous regarding their truth status.

AFFECTIVE PICTURE RATINGS

Even though we carefully selected the affective pictures based on the original norming study (Dan-Glauser & Scherer, 2011), we wanted to ensure that in our sample (a) picture valence could be clearly distinguished between the three categories, and (b) that there would be no differences in rated arousal between positive and negative pictures. Therefore, we ran repeated-measures analyses of variance (ANOVAs) on valence and arousal ratings obtained at the end of Session 2.

Positive pictures (M = 5.62, SD = 0.52) obtained higher valence ratings than negative ones (M = 3.10, SD = 0.46), and the neutral category lied in between (M = 3.83, SD = 0.23). The main effect was statistically significant, $F(1.47, 50.12) = 349.30$, $p < .001$, $\eta^2_p = .91$ (Greenhouse-Geisser corrected), and all three categories differed statistically significantly from each other; positive versus negative: $t(34) = 20.41$, $p < .001$, $d = 3.45$; positive versus neutral: $t(34) = 20.20$, $p < .001$, $d = 3.41$; and neutral versus negative: $t(34) = 9.60$, $p < .001$, $d = 1.62$.

As expected, rated arousal was higher for positive (M = 3.90, SD = 1.19) and negative (M = 3.84, SD = 1.21) than for neutral pictures (M = 1.76, SD = 0.85). There was a statistically significant main effect in the ANOVA, $F(2, 68) = 129.23$, $p < .001$, $\eta^2_p = .79$. Positive pictures differed statistically significantly from neutral ones, $t(34) = 13.69$, $p < .001$, d = 2.31, and the same held true for the difference between negative and neutral, $t(34) = 12.22$, $p < .001$, $d = 2.07$. Positive and negative pictures did not significantly differ in arousal ratings, $t(34) = 0.45$, $p = .658$, $d = 0.08$.

MODULATION OF TRUTH JUDGMENTS BY AFFECT AND REPETITION

Because affective changes induced by pictures are short-lived and vanish after a few seconds (Cuthbert et al., 2000; Liu, 2022), because people in a positive mood can compensate for their shallower processing style by taking more time to make decisions (Mackie & Worth, 1989), and because time delay is an effective strategy to reduce the impact of emotional processes on decision making (Lerner et al., 2015), we first cleaned the data and eliminated all trials in which participants took more than 5 s to provide their truth statements (i.e., the cutoff was set at 10 s after picture onset). This criterion led to the exclusion of 11% of all trials. The results without data exclusion are presented at the end of the Results section. Furthermore, one participant admitted that she

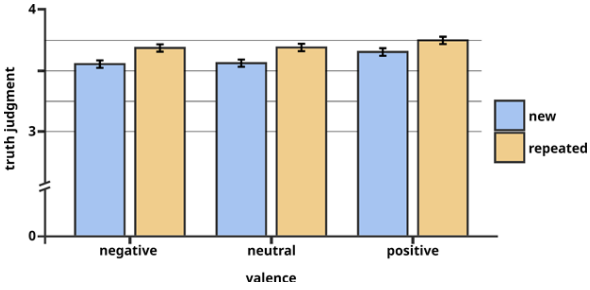

FIGURE 1.

Mean truth judgments in the six conditions of the present experiment. Error bars denote ± 1 *SD*.

had looked up the truth status of one item from Session 1. This item was excluded for this participant.

Figure 1 shows a graphical display of the results. We ran a linear mixed model analysis on the data using the *GAMLj* module in jamovi version 2.3 (The jamovi Project). Picture valence and repetition were included as fixed effects, and the intercepts of subject, statement, and picture ID were entered as random effects.

The main effect of repetition was statistically significant, $F(1, 6173.1) = 27.94$, $p < .001$ ($b = 0.122$; 2.5% CI = 0.077; 97.5% CI = 0.167; $SE = .023$). Repeated statements received higher truth ratings than new ones ($M = 3.71$, $SD = 0.99$ vs. $M = 3.59$, $SD = 0.97$), which was a replication of the repetition-induced truth effect. Response times were also faster for repeated than new statements, $F(1, 6255) = 230.43$, $p < .001$ ($b = -364.950$; 2.5% CI = -412.07; 97.5% CI =-317.83; $SE = 24.0$).

The main effect of picture valence was statistically significant, $F(2, 47.9) = 3.75$, $p = .031$ (b[neu-neg] = 0.001; 2.5% CI = -0.057; 97.5% CI = 0.059; $SE = .029$, b[pos-neg] = 0.071; 2.5% CI = 0.013; 97.5% CI = 0.128; $SE = .030$) . Post-hoc t tests (Bonferroni-Holm corrected) revealed that statements preceded by positive pictures received higher truth ratings than those preceded by negative pictures, $t(47.9) = 2.39$, $p = .021$ ($M = 3.70$, $SD = 0.99$ vs. $M = 3.62$, $SD = 0.99$). In neutral trials ($M = 3.63$, $SD = 0.97$), truth ratings were significantly lower than in positive trials, $t(48.4) = 2.35$, $p = .046$. Neutral and negative trials did not differ significantly, $t(47.4) = .03$, $p = .973$.

The effect of picture valence on response times was not statistically significant, although the p value was close to the 5% α threshold, $F(2, 6259) = 2.67$, $p = .069$. Responses were descriptively faster in the neutral condition ($M = 1492$ ms, $SD = 1102$) compared to the negative ($M = 1566$ ms, $SD = 1158$) and positive ($M = 1549$ ms, $SD = 1154$) conditions.

The interaction between picture valence and repetition was not statistically significant, $F(2, 6164.1) = 0.49$, $p = .613$. Because this non-significant result does not necessarily mean that the interaction between both factors is absent, we conducted a Bayesian repeated-measures ANOVA in Jasp (University of Amsterdam, NL), version 0.16.4, to quantify the evidence for no interaction effect, using the predefined uniform model prior. We compared the model that included the interaction to the model without the interaction. The latter model was almost 83 times more likely than the null model, which is very strong evidence for the two main effects (Andraszewicz et al., 2015). The Bayes factor in favor of the repetition × affect interaction was 0.1, which is considered strong evidence of a null effect (Andraszewicz et al., 2015).

There was no statistically significant repetition × affect interaction for response times either in the linear mixed model, $F(2, 6244) = 2.23$, $p = .107$.

ANALYSIS OF THE UNCORRECTED DATA SET

For the sake of transparency, we also report a linear mixed model analysis for the uncorrected data set, that is, without excluding trials with response times over five seconds. The uncorrected data had a mean response time of 2.54 s (Mdn. = 1.37; $SD = 5.16$). As in the corrected data, there was a statistically significant main effect of repetition, $F(1, 6963.9) = 32.29$, $p < .001$ ($b = 0.124$; 2.5% $CI = 0.081$; 97.5% $CI = 0.167$; $SE = 0.022$), with higher truth judgments for repeated than for new statements. The main effect of picture valence was no longer statistically significant, $F(2, 48.2) = 0.91$, $p = .409$, and, as in the analysis above, there was no statistically significant interaction between the two factors, $F(2, 6960) = 0.43$, $p = .650$. In other words, positive affect induced by the pictures had no significant effect on truth judgments when long response times were also considered.

There was a small but statistically significant negative correlation between response times and truth judgments, $r = -.06$, $p < .001$. Longer response times were associated with lower truth judgments.

Discussion

The interaction between affect and repetition was not significant in Experiment 1, which makes it unlikely that the first mechanism—more reliance on fluency as a cue to truth under positive than negative affect—was the underlying mechanism. However, the current results could be explained both with Mechanisms 2 (positive affect enhances truth judgments directly) and 3 (positive affect was misattributed to fluency/familiarity, which in turn led to higher truth judgments). Hence, we ran Experiment 2 to disentangle these two potentially underlying mechanisms further and presented the affective pictures before the statements at first exposure. That is, we used only new statements. If a direct effect of affect on judgments is a likely explanation for the results in Experiment 1, then the statements in the positive context should be judged as truer than in the negative or neutral context. On the other hand, if the misattribution of positive affect to stimulus familiarity/fluency is a more likely explanation for the results, then we should expect no statistically significant effect of the affective manipulation on truth judgments, because in a context of only new items, processing should be rather disfluent in general, and the absence of repeated stimuli should prevent participants from perceiving familiarity in the statements. Furthermore, no instructions or other cues were given that could indicate that the items had been presented before. As outlined in the Introduction section, the literature that shows affective misattribution effects has used actual (Phaf & Rotteveel, 2005; Stump et al., 2021) or alleged (Claypool et al., 2008; Garcia-Marques et al., 2004) stimulus repetition, which might be a boundary condition for inducing the perception of stimulus familiarity and related processes.

EXPERIMENT 2

We ran a second experiment of only one session, following the procedure of Session 2 in Experiment 1. We presented true and false statements whose truth status had to be judged, and each statement was preceded by a positive, negative, or neutral picture.

Method

PARTICIPANTS

Forty new participants completed Experiment 2 in exchange for course credit. They had a mean age of M = 20.95 years (SD = 2.41). Twenty were women. The study was approved by the central ethics committee at the University of Concepción in Chile, and all procedures followed the Declaration of Helsinki. Participants provided written informed consent before the experiment.

STIMULI

From the 204 statements used in Experiment 1, we selected 140 (half of them false) for translation, excluding items that were specific to the local German or European context, and also those items that proved to be the least ambiguous regarding their truth status in Experiment 1. The procedure for statement translation was as follows: All items were first translated from German to Spanish using translation software. These automatic translations were then checked by a group of native speakers of Spanish in terms of grammar and word use. The first author (a native speaker of German and highly proficient in Spanish) then compared the Spanish translations to the German originals, and any remaining issues were resolved together with the native speakers of Spanish. In a pretest, 20 participants evaluated these statements according to a binary decision criterion (true/false), with at least ten judges for each item. Based on the results, we selected the 120 most ambiguous statements for Experiment 2 and used six of the excluded statements (three of them false) as practice items.

We additionally used the affective pictures from the Geneva Affective Picture Database (GAPED) (Dan-Glauser & Scherer, 2011). These were the same ones as in Experiment 1, but we included three additional pictures for each category in order to have 20 pictures each. The additionally included pictures were: P078, P074, P113, H014, H028, H110, N032, N036, and N097.

PROCEDURE

The procedure was identical to Session 2 of Experiment 1, with a few differences: There was only one session, so all the presented statements were new to the participants. There were three blocks with 40 trials each, one with positive, one with negative, and one with neutral pictures. As in Experiment 1, block order and item order were randomized for each participant, and participants rated the affective pictures with respect to valence and arousal at the end of the session.

Results

ITEM ANALYSIS

True items received a mean truth rating of 3.66 (SD = 0.33) and false items 3.82 (SD = 0.30), hence, false items were judged as more true than true items, which was statistically significant, $F(2, 78) = 14.384$, $p < .001$, $\eta^2_p = .269$. Thus, the truth status of the statements was again unknown.

AFFECTIVE PICTURE RATINGS

Arousal ratings were as follows: positive pictures: M = 4.76, SD = 1.70; negative pictures: M = 4.57, SD = 1.17, and neutral pictures: M = 2.54, SD = 1.19. The ANOVA of arousal ratings yielded a statistically significant result, $F(1.739, 67.815) = 115.623$, $p < .001$, $\eta^2 = .441$. Positive and negative pictures did not differ significantly, $t(39) = 1.562$, $p = .126$, $d = 0.24$ while the difference between positive and neutral was statistically significant, $t(39) = 13.565$, $p < .001$, $d = 2.14$, and the same held true for the difference between negative and neutral, $t(39) = 10.872$, $p < .001$, d = 1.72.

Valence ratings yielded the following results: positive: M = 5.42, SD = 0.49; negative: M = 3.00, SD = 0.64, and neutral: M = 3.93, SD = 0.50. The ANOVA result was statistically significant, $F(1.604, 62.543) = 197.562$, $p < .001$, $\eta^2 = .772$, and all three categories differed significantly from each other: positive versus negative, $t(39) = 18.402$, $p < .001$, $d = 2.91$; positive versus neutral, $t(39) = 16.923$, $p < .001$, $d = 2.68$; and negative versus neutral, $t(39) = 6.525$, $p < .001$, $d = 1.03$. These results indicate that the pictures again were perceived as intended.

INFLUENCE OF AFFECT ON TRUTH JUDGMENTS

We conducted a linear mixed model as in Experiment 1, but this time, there was only one fixed effect (picture valence). The intercepts of subject, statement, and picture ID were again entered as random effects. We again excluded trials with response times over 5 s, which affected 10% of the data. Truth ratings were descriptively higher in the negative (M = 3.83, SD = 1.29) than in the positive (M = 3.75, SD = 1.28) and neutral (M = 3.74, SD = 1.26) conditions, but the main effect of picture valence on truth judgments was not statistically significant, $F(2, 4228) = 2.16$, $p = .116$. An additional Bayesian repeated-measures ANOVA in Jasp showed that the Bayes factor for the main effect of affect was 0.128, which is considered strong evidence for a null effect (Andraszewicz et al., 2015).

The linear mixed model analysis of the uncorrected data (i.e., without exclusion of trials) also revealed no statistically significant main effect, $F(2, 4685) = 1.58$, $p = .206$.

Discussion

Affect did not significantly influence truth judgments in a context of only new statements. This result rules out Mechanism 2, a direct influence of affect on judgments, based on which we would have expected higher truth judgments in the positive than the negative condition. Rather, it indicates that Mechanism 3 underlied the results of Experiment 1 and reveals some boundary conditions for affect misattribution to oc-

cur: both positive affect and the affect coming from an incidental source (unrelated to the target of judgment) are necessary preconditions, but they are not enough to trigger affect misattribution. Additionally, participants need to perceive fluency/familiarity in the stimuli, either due to actual (Phaf & Rotteveel, 2005; Stump et al., 2021) or alleged (Claypool et al., 2008; Garcia-Marques et al., 2004) stimulus repetition, as was the case in Experiment 1 but not in Experiment 2. Only if fluency/familiarity is perceived or expected, positive affect is misattributed to stimulus qualities, which, in turn, leads to enhanced truth judgments.

GENERAL DISCUSSION

The current study addressed an under-investigated topic: the role of affective mechanisms in the repetition-induced truth effect. We tested how affective pictures presented before repeated and new statements influenced truth judgments. Experiment 1 showed that both repetition and affect influenced truth judgments, but they did not interact significantly. In Experiment 2, to clarify the mechanism behind this finding, we tested whether positive affect alone is sufficient to enhance truth judgments, which was not the case. Thus, the effect of positive affect on truth judgments only occurred in a situation with repeated (familiar) and new stimuli, where the participants could perceive a contrast between rather fluent and rather disfluent processing. These results suggest that in a setting with new and repeated information, positive affect could be misattributed to stimulus fluency/familiarity, enhancing the perceived truth of a statement.

In addition to these findings, we showed that items repeated in the second session of Experiment 1 were rated as significantly more true than new items presented for the first time, which is a replication of the repetition-induced truth effect (Dechêne et al., 2010). Moreover, the main effect of affect in Experiment 1 was only statistically significant when participants responded quickly, but not for slower responses. This is in line with Mackie and Worth (1989), who reported that people in a positive mood changed their attitudes based on weak arguments only when they had limited processing time, but not when the time was unlimited, because with more time they could compensate for affective influences on their decisions.

In the current study, we add to the evidence about how affective processes could influence the repetition-induced truth effect, based on three potential mechanisms which we tried to disentangle: (a) more superficial and heuristic information processing under positive affect, which, in the case of the repetition-induced truth effect, implies that people rely more on fluency as a cue to truth and thus show a greater truth effect under positive than under negative affect; (b) a direct enhancement of truth judgments under positive affect; and (c) misattribution of positive affect to stimulus fluency/familiarity, which implies that under positive affect, repeated and new statements are perceived as more familiar or fluent than under negative affect, enhancing truth judgments for both.

Mechanism 1 predicted an interaction between repetition and affect, which did not occur. This is at odds with Koch and Forgas (2012), who showed that easy-to-read (fluently processed) statements were judged as truer than statements that were hard to read (disfluently processed) under positive or neutral but not under negative mood. Thus, the truth effect was specific to positive and neutral affective states in their study, but it was generalized in the present study, and we observed the truth effect also for statements primed with negative pictures. Furthermore, in our study, there was no statistically significant difference between the negative and the neutral condition, indicating that negative affective cues did not reduce the repetition-induced truth effect. In sum, our results disagree with the notion that people rely more on fluency as a cue to truth under positive than under negative affect (Mechanism 1). The key difference between the two studies is that Koch and Forgas (2012) used a mood induction procedure with more prolonged effects, which potentially influenced processing style, as opposed to the weaker and more transient effects of affective pictures in the present study.

Another reason for the difference between the results of the current study and of Koch and Forgas (2012) could be that the mechanisms triggered by a statement's repetition were stronger than the perceptually induced fluency in Koch and Forgas (2012) and rather unaffected by affect. This is in line with Silva et al. (2016), who directly compared both types of fluency manipulations (perceptually induced and repetition-induced) and reported that the effects of fluency induced by item repetition were stronger than perceptually induced fluency effects. Extending this further and considering that fluent processing feels pleasant and might therefore constitute another way of inducing affect (Reber et al., 2004; Winkielman & Cacioppo, 2001), the affective consequences of fluency manipulations in the current study were probably stronger than in the study by Koch and Forgas (2012), and they influenced truth judgments more—there was a statistically significant truth effect in all three affect conditions. The highest truth ratings were observed for repeated items in the positive condition, but this can be considered an additive effect of repetition and affect.

Having ruled out Mechanism 1, we can also largely rule out Mechanism 2—a direct influence of affect on truth judgments. Even though Mechanism 2 would predict the same result as Mechanism 3 for Experiment 1 (two main effects and no interaction), we discard this mechanism due to several reasons: On the one hand, we presented the affective pictures before the statements. Due to the short-lived effects of these pictures (Cuthbert et al., 2000), they likely influenced statement processing, but at the moment of judgment, their influence had probably vanished, making a direct impact on truth judgments unlikely. Stump et al. (2021), who found that negative affective cues reduced the repetition-induced truth effect, used a different procedure. They presented the affective cues after the statements and before the judgments, and thus, did not manipulate statement processing, but rather biased the truth ratings directly. Moreover, they presented the affective cues subliminally, and participants were unaware of them. Thus, in the case of negative affective stimuli, participants might have felt that something was wrong when they were prompted to provide their truth judgments, and they used this feeling to inform their judgments directly (Schwarz, 2012). The temporal sequence may be key here because, in Stump et al. (2021), the participants first experienced a slight positivity when reading a repeated statement, but the subse-

quent negative prime weakened this pleasant state, and thus repetition had a lower impact on judged truth. In the current study, the affective pictures were shown before the statements, thus, the negative pictures could also have induced an unpleasant state in participants, but the positivity induced by fluent processing of repeated stimuli might have overridden the effects of previously presented negative pictures, and so, the repetition-induced truth effect was not weakened. Also, a direct effect of affect on judgments would have predicted a statistically significant main effect of affect in Experiment 2, which we did not find. This relates to the results of Experiment 1 by Unkelbach et al. (2011), who reported that affective framing of statement content alone did not significantly influence truth judgments. A less likely explanation could be that because we showed the pictures supraliminally, participants attributed their negative feelings to the pictures, and therefore, did not rely less on the felt ease of processing for repeated as compared to new statements. We consider this a less likely option because typically people are sensitive to their feelings, but not to where they come from (Schwarz, 2012). Thus, this discounting explanation seems less adequate considering that in the positive condition, our data did not suggest that the affective influence from the pictures was discounted while participants were processing the statements and providing their judgments. Previous evidence also shows that people normally do not discount the potential affective influences on their cognitive processes, even if affect is overtly manipulated (Claypool et al., 2008; Koch & Forgas, 2012; Sweklej et al., 2014; Topolinski & Strack, 2009).

The results of Experiment 1 align with research that shows enhanced truth or familiarity judgments for new stimuli under positive mood (Claypool et al., 2008; Garcia-Marques et al., 2004). We assume that in the current study, a misattribution mechanism increased truth judgments in the positive condition, in that participants misattributed their positive feelings to feelings of fluency/familiarity, affecting the perceived truth of statements (Claypool et al., 2008; Stump et al., 2021). For example, Garcia-Marques et al. (2004, Experiment 3) induced either positive or neutral mood in their participants, who then had to make true/false decisions on statements that allegedly had been presented before in a subliminal manner (while no statements were shown). Participants in the positive condition judged more statements as true than those in the neutral condition. Related research shows an increase in familiarity judgments under positive affect (Claypool et al., 2008; Phaf & Rotteveel, 2005), but only if the positive affect is not attributed to the mood induction procedure (Claypool et al., 2008). In a similar vein, in Stump et al.'s (2021) Experiment 2, participants who were falsely informed that subliminal affective primes would be presented, which could induce changes in their affective states, showed a reduced truth effect, that is, lower truth judgments for repeated items, than the uninstructed group. Thus, the slight positivity induced by fluent processing of repeated statements was discounted more in the instructed group and had less impact on truth judgments. Note that in these studies, there were either repeated and new stimuli (Phaf & Rotteveel, 2005; Stump et al., 2021) or participants received the bogus instruction that some stimuli had been presented to them before (Claypool et al., 2008; Garcia-Marques et al., 2004), which seems to be essential for a misattribution of positive affect to stimulus familiarity/fluency, and which could be why, in the current study, we found a statistically significant effect of affect on truth judgments in Experiment 1, but not in Experiment 2.

Because we observed that in Experiment 1, truth judgments were higher for statements in the positive affective condition, whereas the difference between the neutral and the negative condition was not statistically significant, we conclude that the positive pictures had an impact on truth judgments, but the negative ones did not. In other words, positive affect increased subjective truth, but negative affect did not decrease it. We would like to point out again that negative and positive pictures were carefully matched for arousal, both regarding the arousal ratings from the original norming study (Dan-Glauser & Scherer, 2011) and the arousal ratings obtained from our samples. This is a strength of the current study, because in other studies, differences between positive and negative conditions could also be due to arousal differences between the two categories (e.g., Gokce et al., 2021). In the present study, such an alternative explanation seems unlikely, and we can safely attribute the observed effects in the positive affective condition to valence.

Another potential explanation for why the negative condition was not significantly different from the neutral one in Experiment 1 might be a floor effect. Because people generally assume that they are confronted with more true than false information, which may induce an a priori bias for truth judgments due to assumed base rates (Brashier & Marsh, 2020), the truth judgments in the neutral condition ($M = 3.63$) were already close to the scale's center at 3.5, and thus, a further reduction of the truth judgments in the negative condition was relatively unlikely. The absence of a difference between the neutral and negative conditions is not due to the perceived affective valence of the pictures because the negative pictures were rated as significantly more negative than the neutral ones.

The failure to modulate the repetition-induced truth effect with affective pictures once more demonstrates the robustness of the effect, which has been shown for different types of statements and in different modalities (Arkes et al., 1989, 1991; Garcia-Marques et al., 2015; Hasher et al., 1977; Hawkins & Hoch, 1992; Nadarevic & Erdfelder, 2014), and even when people know that a statement's content is false (Fazio, 2020; Fazio et al., 2015). Likewise, a large study with seven experiments revealed that personality differences in cognitive ability, cognitive style, and need for cognitive closure are not systematically related to the magnitude of the repetition-induced truth effect (De keersmaecker et al., 2020). Thus, the current study complements previous research by showing that the repetition-induced truth effect is largely unaffected by affective priming with pictures, at least in the way we manipulated this in Experiment 1.

The affective modulation of truth judgments relates to the body of research on affect–cognition interactions, for example, the stronger proneness to deception in interpersonal interactions under positive versus negative mood (Forgas, 2019) or to the finding that a positive mood makes people more creative and flexible and promotes finding unusual word associations (Isen et al., 1985). Positive mood also enhances intuitive coherence judgments (Bolte et al., 2003; Topolinski

& Strack, 2009). Thus, a different reading of the results could be that participants had more associations and activated broader semantic networks when positive pictures preceded the statements. They might have perceived stronger coherence within the statements, and thereby, judged the items as truer than in the neutral or negative conditions. This aligns with the referential theory by Unkelbach and Rom (2017), which predicts that the more coherent references can be activated in memory while processing a statement, the truer it will appear to the person (Unkelbach et al., 2019; Unkelbach & Rom, 2017). Although the theory refers mainly to the repetition-induced truth effect, the authors claim that it could also explain other results, more precisely, the increase in truth judgments for statements presented along with pictures compared to those without pictures, and for statements that use more concrete as compared to more abstract language, because in both cases more coherent references can be activated in memory. Hence, the current results may add further theoretical considerations to the referential theory, in that positive affect could also help people activate more coherent references in memory, which increases judgments of truth. A boundary condition for this seems to be a setting where rather disfluent and rather fluent processing coexist, because in Experiment 2, with only new stimuli, positive affect did not enhance truth judgments.

The current study has some limitations. One of them is the relatively small (N = 35) sample size in Experiment 1. However, we adopted several measures to compensate for this limitation. One is that we used a within-subjects design, meaning that each participant was exposed to all six experimental conditions. Within-subjects designs need fewer participants than between-subjects designs and have additional benefits for study power (Lakens, 2022). Besides, the inclusion of more items also reduces measurement error and increases the reliability of the data without increasing sample size, and in Experiment 1, we had a relatively high number of trials (204 in total; Lakens, 2022; McClelland, 2000). Nevertheless, as in the case of any study, replication of the present results is highly warranted.

Another potential limitation is that we decided to present the affective pictures separately from the statements to maximize control over the timing of events during the experiment and to avoid participants being distracted by the pictures while reading the statements. However, a concurrent presentation of affective pictures and statements would be closer to a real-life setting and to how the news is generally presented. Presenting statements and pictures together is also the procedure used in experiments investigating truthiness, the phenomenon that people judge statements accompanied by pictures as truer than statements presented without any pictures (Fenn et al., 2013; Newman et al., 2012). Moreover, we did not limit response time for the truth judgments, although it is widely acknowledged that the effects of affective pictures are very short-lived (Cuthbert et al., 2000), and the impact of the positive affect manipulation on truth judgments in Experiment 1 was statistically significant only when slower judgments (> 5 s) are excluded from the data. This is in line with Mackie and Worth (1989), who reported that people in a positive mood changed their attitudes based on weak arguments only when they had limited processing time, but not when time was unlimited, because they could compensate for their more heuristic processing style by taking additional time for deliberation. Results could be different if participants were obliged to make quicker truth judgments. Based on a study that shows that the repetition-induced truth effect is unaffected by time pressure (Nadarevic et al., 2021), combining repetition and additional affective manipulations under time pressure may help to further dissociate repetition-induced fluency from other affective mechanisms during judgments of truth.

The supraliminal presentation of the pictures could potentially also induce some demand problems, in that participants may have tried to relate the pictures to the task and changed their behavior because they assumed that this was expected from them depending on picture valence (for example that in the case of positive pictures, they should believe the statements more). While we cannot completely discard this possibility based on the present data, we consider it rather unlikely because in Experiment 2, the main effect of affect on truth judgments was not statistically significant.

Finally, our conclusions are based on a significant effect in Experiment 1 and the absence of a significant effect in Experiment 2. Even though we used Bayesian statistics to strengthen these results, it is important to acknowledge that the two experiments were independent of each other and used different samples. Moreover, the population and language changed between Experiments 1 and 2.

In sum, we showed two factors that could enhance truth judgments: (a) statement repetition and (b) the presentation of positive affective pictures right before the statements. While the former is a well-established phenomenon, the modulation of truth judgments by additional affective cues is more variable across experiments and more sensitive to the exact manipulations that are implemented. As our experiments and others show, it involves an affective misattribution process, which may only work in a context where differences in stimulus fluency/familiarity can be perceived or are expected by the participants. More studies are needed to gain a better understanding of the mechanisms by which affective processes influence judgments of truth.

ACKNOWLEDGEMENTS

The authors thank Camila Anríquez, Massiel Cerna, Arantzazu Larraza, and Matías Véliz for their help in item translation and data acquisition for Experiment 2. They also thank three anonymous reviewers for helpful comments and suggestions on previous versions of this manuscript and Lisa Fazio for valuable feedback on the first draft.

The authors have no financial or non-financial interests to disclose.

The study was approved by the local ethics committee at the Department of Psychology and Sports Science at Justus Liebig University Giessen, Germany (Experiment 1) and by the central University ethics committee at the University of Concepción, Chile (Experiment 2).

DATA AVAILABILITY

Stimuli, data, and analysis files are available from https://osf.io/jty53/. The preprint can be found at https://psyarxiv.com/qajkb/.

REFERENCES

Andraszewicz, S., Scheibehenne, B., Rieskamp, J., Grasman, R., Verhagen, J., & Wagenmakers, E.-J. (2015). An introduction to Bayesian hypothesis testing for management research. *Journal of Management, 41*(2), 521–543. https://doi.org/10.1177/0149206314560412

Arkes, H. R., Boehm, L. E., & Xu, G. (1991). Determinants of judged validity. *Journal of Experimental Social Psychology, 27*, 576–605. https://doi.org/10.1016/0022-1031(91)90026-3

Arkes, H. R., Hackett, C., & Boehm, L. (1989). The generality of the relation between familiarity and judged validity. *Journal of Behavioral Decision Making, 2*(2), 81–94. https://doi.org/10.1002/bdm.3960020203

Bacon, F. T. (1979). Credibility of repeated statements: Memory for trivia. *Journal of Experimental Psychology: Human Learning and Memory, 5*(3), 241–252. https://doi.org/10.1037/0278-7393.5.3.241

Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General, 121*(4), 446–458. https://doi.org/10.1037/0096-3445.121.4.446

Bless, H., & Fiedler, K. (2006). Mood and the regulation of information processing and behavior. In J. P. Forgas (Ed.), *The Sydney symposium of social psychology series* (Vol. 8, pp. 65–84). Psychology Press.

Bolte, A., Goschke, T., & Kuhl, J. (2003). Emotion and intuition: Effects of positive and negative mood on implicit judgments of semantic coherence. *Psychological Science, 14*(5), 416–421. https://doi.org/10.1111/1467-9280.01456

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry, 25*(1), 49–59. https://doi.org/10.1016/0005-7916(94)90063-9

Brashier, N. M., & Marsh, E. J. (2020). Judging truth. *Annual Review of Psychology, 71*(1), 499–515. https://doi.org/10.1146/annurev-psych-010419-050807

Claypool, H. M., Hall, C. E., Mackie, D. M., & Garcia-Marques, T. (2008). Positive mood, attribution, and the illusion of familiarity. *Journal of Experimental Social Psychology, 44*(3), 721–728. https://doi.org/10.1016/j.jesp.2007.05.001

Cuthbert, B. N., Schupp, H. T., Bradley, M. M., Birbaumer, N., & Lang, P. J. (2000). Brain potentials in affective picture processing: Covariation with autonomic arousal and affective report. *Biological Psychology, 52*(2), 95–111. https://doi.org/10.1016/S0301-0511(99)00044-7

Dan-Glauser, E. S., & Scherer, K. R. (2011). The Geneva affective picture database (GAPED): A new 730-picture database focusing on valence and normative significance. *Behavior Research Methods, 43*(2), 468. https://doi.org/10.3758/s13428-011-0064-1

De keersmaecker, J., Dunning, D., Pennycook, G., Rand, D. G., Sanchez, C., Unkelbach, C., & Roets, A. (2020). Investigating the robustness of the illusory truth effect across individual differences in cognitive ability, need for cognitive closure, and cognitive style. *Personality and Social Psychology Bulletin, 46*(2), 204–215. https://doi.org/10.1177/0146167219853844

Dechêne, A., Stahl, C., Hansen, J., & Wänke, M. (2010). The truth about the truth: A meta-analytic review of the truth effect. *Personality and Social Psychology Review, 14*(2), 238–257. https://doi.org/10.1177/1088868309352251

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. https://doi.org/10.3758/bf03193146

Fazio, L. K. (2020). Repetition increases perceived truth even for known falsehoods. *Collabra: Psychology, 6*(1). https://doi.org/10.1525/collabra.347

Fazio, L. K., Brashier, N. M., Payne, B. K., & Marsh, E. J. (2015). Knowledge does not protect against illusory truth. *Journal of Experimental Psychology: General, 144*(5), 993–1002. https://doi.org/10.1037/xge0000098

Fenn, E., Newman, E. J., Pezdek, K., & Garry, M. (2013). The effect of nonprobative photographs on truthiness persists over time. *Acta Psychologica, 144*(1), 207–211. https://doi.org/10.1016/j.actpsy.2013.06.004

Forgas, J. P. (2019). On the role of affect in gullibility. *Current Directions in Psychological Science, 28*(3), 179–197. https://doi.org/10.4324/9780429203787-10

Garcia-Marques, T., Mackie, D. M., Claypool, H. M., & Garcia-Marques, L. (2004). Positivity can cue familiarity. *Personality and Social Psychology Bulletin, 30*(5), 585–593. https://doi.org/10.1177/0146167203262856

Garcia-Marques, T., Prada, M., & Mackie, D. M. (2016). Familiarity increases subjective positive affect even in non-affective and non-evaluative contexts. *Motivation and Emotion, 40*(4), 638–645. https://doi.org/10.1007/s11031-016-9555-9

Garcia-Marques, T., Silva, R. R., & Mello, J. (2016). Judging the truth-value of a statement in and out of a deep processing context. *Social Cognition, 34*(1), 40–54. https://doi.org/10.1521/soco.2016.34.1.40

Garcia-Marques, T., Silva, R. R., Reber, R., & Unkelbach, C. (2015). Hearing a statement now and believing the opposite later. Journal of Experimental Social Psychology, 56, 126–129. https://doi.org/10.1016/j.jesp.2014.09.015

Gokce, A., Zinchenko, A., Annac, E., Conci, M., & Geyer, T. (2021). Affective modulation of working memory maintenance: The role of positive and negative emotions. *Advances in Cognitive Psychology, 17*(2), 107–116. https://doi.org/10.5709/acp-0321-7

Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal of Verbal Learning and Verbal Behavior, 16*(1), 107–112. https://doi.org/10.1016/S0022-5371(77)80012-1

Hawkins, S. A., & Hoch, S. J. (1992). Low-involvement learning: Memory without evaluation. *Journal of Consumer Research, 19*(2), 212–225. https://doi.org/10.1086/209297

Isen, A. M., Johnson, M. M., Mertz, E., & Robinson, G. F. (1985). The influence of positive affect on the unusualness of word associations. *Journal of Personality and Social Psychology, 48*(6), 1413–1426.

https://doi.org/10.1037//0022-3514.48.6.1413

Jaffé, M. E., & Greifeneder, R. (2019). Less than I expected and oh so true? On the interplay between expectations and framing effects in judgments of truth. *Journal of Language and Social Psychology, 38*(5–6), 735–755. https://doi.org/10.1177/0261927X19869392

Koch, A. S., & Forgas, J. P. (2012). Feeling good and feeling truth: The interactive effects of mood and processing fluency on truth judgments. *Journal of Experimental Social Psychology, 48*(2), 481–485. https://doi.org/10.1016/j.jesp.2011.10.006

Lakens, D. (2022). Sample size justification. *Collabra: Psychology, 8*(1), 33267. https://doi.org/10.1525/collabra.33267

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual Review of Psychology, 66*, 799–823. https://doi.org/10.1146/annurev-psych-010213-115043

Liu, J. (2022). Psychophysiological responses to still vs. animated pictures with different levels of emotional valence. *Advances in Cognitive Psychology, 18*(2), 106-112. https://doi.org/10.5709/acp-0352-2

Mackie, D. M., & Worth, L. T. (1989). Processing deficits and the mediation of positive affect in persuasion. *Journal of Personality and Social Psychology, 57*, 27–40. https://doi.org/10.1037/0022-3514.57.1.27

McClelland, G. H. (2000). Increasing statistical power without increasing sample size. *American Psychologist, 55*, 963–964. https://doi.org/10.1037/0003-066X.55.8.963

Monin, B. (2003). The warm glow heuristic: When liking leads to familiarity. *Journal of Personality and Social Psychology, 85*, 1035–1048. https://doi.org/10.1037/0022-3514.85.6.1035

Nadarevic, L., & Erdfelder, E. (2014). Initial judgment task and delay of the final validity-rating task moderate the truth effect. *Consciousness & Cognition, 23*, 74–84. https://doi.org/10.1016/j.concog.2013.12.002

Nadarevic, L., Schnuerch, M., & Stegemann, M. J. (2021). Judging fast and slow: The truth effect does not increase under time-pressure conditions. *PsyArXiv.*

Newman, E. J., Garry, M., Bernstein, D. M., Kantner, J., & Lindsay, D. S. (2012). Nonprobative photographs (or words) inflate truthiness. *Psychonomic Bulletin & Review, 19*(5), 969–974. https://doi.org/10.3758/s13423-012-0292-0

Oppenheimer, D. M. (2008). The secret life of fluency. *Trends in Cognitive Sciences, 12*(6), 237–241. https://doi.org/10.1016/j.tics.2008.02.014

Phaf, R. H., & Rotteveel, M. (2005). Affective modulation of recognition bias. *Emotion, 5*, 309–318. https://doi.org/10.1037/1528-3542.5.3.309

Pillai, R. M., & Fazio, L. K. (2021). The effects of repeating false and misleading information on belief. *WIREs Cognitive Science, 12*(6), e1573. https://doi.org/10.1002/wcs.1573

Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8*(3), 338–342. https://doi.org/10.1006/ccog.1999.0386

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review, 8*(4), 364–382. https://doi.org/10.1207/s15327957pspr0804_3

Schwarz, N. (2012). Feelings-as-information theory. In *Handbook of theories of social psychology, Vol. 1* (pp. 289–308). Sage Publications .

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*(3), 513–523. https://doi.org/10.1037/0022-3514.45.3.513

Silva, R. R., Garcia-Marques, T., & Mello, J. (2016). The differential effects of fluency due to repetition and fluency due to color contrast on judgments of truth. *Psychological Research, 80*(5), 821–837. https://doi.org/10.1007/s00426-015-0692-7

Stump, A., Rummel, J., & Voss, A. (2021). Is it all about the feeling? Affective and (meta-)cognitive mechanisms underlying the truth effect. *Psychological Research, 86*, 12–36. https://doi.org/10.1007/s00426-020-01459-1

Sweklej, J., Balas, R., Pochwatko, G., & Godlewska, M. (2014). Intuitive (in)coherence judgments are guided by processing fluency, mood and affect. *Psychological Research, 78*(1), 141–149. https://doi.org/10.1007/s00426-013-0487-7

Topolinski, S., & Strack, F. (2009). The architecture of intuition: Fluency and affect determine intuitive judgments of semantic and visual coherence and judgments of grammaticality in artificial grammar learning. *Journal of Experimental Psychology: General, 138*(1), 39–63. https://doi.org/10.1037/a0014678

Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(1), 219–230. https://doi.org/10.1037/0278-7393.33.1.219

Unkelbach, C., Bayer, M., Alves, H., Koch, A., & Stahl, C. (2011). Fluency and positivity as possible causes of the truth effect. *Consciousness & Cognition, 20*(3), 594–602. https://doi.org/10.1016/j.concog.2010.09.015

Unkelbach, C., Koch, A., Silva, R. R., & Garcia-Marques, T. (2019). Truth by repetition: Explanations and implications. *Current Directions in Psychological Science, 28*(3), 247–253. https://doi.org/10.1177/0954 10.1177/096372

Unkelbach, C., & Rom, S. C. (2017). A referential theory of the repetition-induced truth effect. *Cognition, 160*, 110–126. https://doi.org/10.1016/j.cognition.2016.12.016

Winkielman, P., & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation elicits positive affect. *Journal of Personality and Social Psychology, 81*(6), 989–1000. https://doi.org/10.1037/0022-3514.81.6.989

Winkielman, P., Schwarz, N., Fazendeiro, T. A., & Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In Jochen Musch & Karl Christoph Klauer (Eds.), *The osychology of evaluation: Affective processes in cognition and emotion* (pp. 195–223). Lawrence Erlbaum.

Zhu, C., He, W., Qi, Z., Wang, L., Song, D., Zhan, L., Yi, S., Luo, Y., & Luo, W. (2015). The time course of emotional picture processing: An event-related potential study using a rapid serial visual presentation paradigm. *Frontiers in Psychology, 6*, 954. https://doi.org/10.3389/fpsyg.2015.00954

RECEIVED 21.06.2022 | ACCEPTED 15.05.2023