The Effect of Evaluation on Co-occurrence Memory Judgment

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Abstract

Three experiments tested the effect of an attitude toward an object on the memory judgment of whether this object co-occurred with positive versus negative stimuli. We induced positive or negative attitudes toward novel male stimuli, and paired each man with an equal number of positive and negative animals. In a memory test, participants reported more co-occurrences of same-valence man/animal pairs than opposite-valence pairs. This valence-compatibility effect occurred even when attitudes were induced after the pairing (Experiment 1), when participants knew that each man occurred with an equal number of positive and negative animals (Experiment 2), and in reports of clear memory of pairs that did not co-occur (Experiment 3). The present findings suggest evaluation causes illusory correlation even when the co-occurring stimuli are not traits or behaviors attributed to the attitude object. The results question the validity of co-occurrence memory judgments as measures of co-occurrence awareness in evaluative conditioning research.

Key words: Evaluation; Person Memory; Illusory Correlation; Evaluative Conditioning

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The Effect of Evaluation on Co-occurrence Memory Judgment

Co-occurrence with affective stimuli is an important factor in attitude formation (Walther, Weil, & Langer, 2011). After perceiving co-occurrence of a neutral stimulus (the conditioned stimulus, CS) with an affective stimulus (the unconditioned stimulus, US) people’s evaluation of the CS becomes more similar to their evaluation of the US. This effect is called evaluative conditioning (EC; De Houwer, 2007; for a review, see De Houwer, Thomas & Baeyens, 2001). The present research investigated the relationship between co-occurrence and evaluation from a different causal direction: we examined the effect of evaluation on co-occurrence memory judgment. We presented item pairs comprised of a person and a cute or a scary animal without indicating any relation between the person and the animal. We then measured people’s memory judgment of whether each person co-occurred more often with cute or with scary animals. We tested whether a more positive evaluation of a stimulus (the target person) would bias people to report that the stimulus appeared more often with positive stimuli (cute animals) than with negative stimuli (scary animals).

Most knowledge relevant to the effect of evaluation on memory judgment comes from person memory research (e.g., Hastie & Kumar, 1979; Srull, Lichtenstein & Rothbart, 1985; Woll & Graesser, 1982). Studies in that research area present information about one or more persons and examine the participants’ memories of that information. One prominent line of investigation pertains to the effect of early expectations regarding the target person on memory of behaviors or traits attributed to the target (for a review, see Stangor & McMillan, 1992). Adding to previous research, the present research examined the effect of evaluation on people’s memory judgment of mere co-occurrence of the target persons with affective stimuli that were not traits or behaviors of the targets.

One main finding of person memory research is a compatibility effect: people tend to report that the target person performed behaviors that primarily fit the pre-existing impression of that person (Garcia-Marques, Hamilton, & Maddox, 2002; Hamilton & Rose, 1980; Kim & Baron, 1988; Meehan & Janik, 1990). For instance, after reading about a number of behaviors of a mathematician and a club bouncer, participants estimated that the mathematician performed more intelligent behaviors than the bouncer, although both persons performed an equal number of intelligent behaviors (Garcia-Marques, Hamilton, & Maddox, 2002).
The common account for this compatibility effect (often called *illusory correlation*) is that people’s frequency estimation is biased toward information that fits pre-existing schemas in their memory. People’s prior knowledge about the target persons may influence their guessing behavior (Locksley et al., 1984) and/or bias their information encoding or retrieval in compatibility with their expectations (Alba & Hasher, 1983; Srull & Wyer, 1989; Stangor, 1988). For instance, people would guess that a mathematician performed more intelligent behaviors. And people would more easily incorporate the mathematician’s intelligent behaviors into their memories because such behavior fits their schema regarding mathematicians.

In the context of mere co-occurrence—when one has little reason to suspect a causal connection between the person and the co-occurring stimuli—the schema approach would predict the compatibility bias only if people generally expect stimuli of similar valence to co-occur. If such expectations are uncommon, other findings in memory research lend support to the prediction that valence-compatibility would bias memory judgment of mere stimuli co-occurrence. In memory tests for co-occurrence of words, people show better recall and estimate more frequent co-occurrence of related than of unrelated word pairs (Chapman, 1967; Tversky & Kahneman, 1973). The relatedness can be by association (e.g., lion-tiger) or by a distinctive feature (e.g., two words of similar length). Stimuli of the same valence share many distinctive features: semantic meaning, affective responses, and action tendencies—approach for positive valence, avoidance for negative valence (Chen & Bargh, 1999; Eder & Rothermund, 2008). Therefore, people would likely recall same-valence pairs better than opposite-valence pairs, and estimate that same-valence pairs co-occurred more often than opposite-valence pairs.

**Co-occurrence Memory in EC Research**

In addition to extending previous research about illusory correlation from trait and behavior information to mere co-occurrence information, our research question also has important implications for EC research. A major question regarding EC is whether the effect can occur without people’s awareness of the CS-US co-occurrence during encoding (De Houwer et al., 2001; Walther et al., 2011). Co-occurrence memory judgment has been the main measure of co-occurrence awareness during the pairing. People who correctly remember with which USs the CS co-occurred are commonly considered aware of the co-occurrence. The possibility that evaluation influences co-occurrence memory is a grave threat to the validity of memory measures as measures of awareness. If evaluation influences co-occurrence memory judgment,
then EC without co-occurrence awareness could cause accurate co-occurrence memory judgment that would be wrongly interpreted as evidence of co-occurrence awareness (Bar-Anan, De Houwer, & Nosek, 2010; Gawronski & Walther, 2012; Hütter et al., 2012).

Considering the importance of the present research question for EC research, surprisingly little evidence exists that evaluation biases co-occurrence memory judgment in pairing procedures. Hütter et al. (2012) suggested that evaluation serves as a cue for co-occurrence memory, and demonstrated that possibility in a simulation. Hütter et al. (2012; and also Gawronski & Walther, 2012) based their assumption that evaluation may influence participants’ responses in co-occurrence memory questionnaires on findings by Bar-Anan, De Houwer, and Nosek (2010). Bar-Anan et al. measured the evaluation and co-occurrence memory judgment of CSs that were paired with neutral stimuli. The CSs were selected because they were fairly neutral, but individual differences were still present in their evaluation. That research found that stronger liking of a CS predicted remembering that the CS appeared more often with positive than with negative stimuli.

Because the influence of evaluation on memory judgment was only a minor question in Bar-Anan et al.’s research, their finding had a few weaknesses, fixed by the present research. First, the response options in the co-occurrence memory questionnaire forced participants to choose whether each CS co-occurred more often with positive or with negative stimuli, without allowing the correct response (the CS did not occur with any affective stimuli). Preventing participants from making the correct response biased them to the wrong belief that the CS co-occurred more often with stimuli of one valence. To eliminate that bias, the present research allowed participants to report that the CS did not co-occur more often with positive or with negative stimuli, and also to indicate they did not remember the co-occurrence.

Additionally, Bar-Anan et al.’s research did not rule out the possibility that the co-occurrence shifted participants’ evaluation of the neutral stimuli with which each CS appeared. Perhaps participants came to like neutral stimuli that co-occurred with slightly liked CSs and to dislike neutral stimuli that co-occurred with slightly disliked CSs. In that case, the memory judgment was accurate rather than biased. The present research eliminated that possibility by pairing the CSs with clearly positive and negative USs. Further, in the present experiments, all the CSs in the pairing procedure co-occurred with exactly the same USs—half of them positive and half negative (e.g., all CSs in Experiment 1 co-occurred twice with each of the three positive
USs and twice with each of the three negative USs). Therefore, a change in the evaluation of any US should have the same effect on memory judgment regarding liked CSs and disliked CSs.

Most importantly, the present experiments manipulated the CSs evaluation in a separate attitude-induction procedure. Inducing the attitudes provides an experimental test of the effect of evaluation on memory judgment, rather than a correlational test of whether memory judgment and evaluation are related. Finally, each experiment tested memory judgment differently: general estimates with which valence the CS co-occurred more often (Experiment 1), estimation of the number of times specific CS-US pairs co-occurred (Experiment 2), and reports of whether specific CS-US pairs co-occurred, accompanied by the level of confidence in that memory judgment (Experiment 3). The three measures would provide convergent evidence regarding the effect of evaluation on co-occurrence memory judgment.

**Summary**

The present research tested whether the evaluation of an object biases memory judgment of the co-occurrence of the object with affective stimuli. Extending previous research, the affective stimuli were not evaluative traits or behaviors that were attributed to the target object. Rather, the affective stimuli were only presented together with the target object, similarly to the procedure used in EC research, without providing any information about the relation between the co-occurring stimuli.

**Experiment 1**

Participants observed the pairing of four male faces with an equal number of pleasant and unpleasant animals. Participants also learned about a few behaviors two of these males performed. One person performed positive behaviors and the other performed negative behaviors. We examined whether participants would tend to report that the positively portrayed man co-occurred with pleasant animals more often than with unpleasant animals, and that the negatively portrayed man co-occurred more often with unpleasant animals than with pleasant animals.

We also manipulated the timing of the attitude induction: the induction occurred before or after the pairing. If the induction would influence memory judgment even when administrated after the pairing, then the effect does not depend solely on encoding during the pairing.
Method

Participants. Participants in all experiments were volunteers who completed the study over the Internet at the Project Implicit website (Nosek, 2005). To attain substantial power to detect the relevant effects, we attempted to run at least 300 participants for each experiment. We included only participants that completed all the measures. Experiment 1, had 300 participants (215 women, $M_{\text{age}} = 22.86$, $SD_{\text{age}} = 10.7$).

Materials. The USs were images from the International Affective Picture System (IAPS) CD-ROM (Lang, Bradley, & Cuthbert, 1988). The three $US_{\text{neg}}$s were images of negative animals (two angry dogs and a snake), and the three $US_{\text{pos}}$s were images of cute animals (kittens, puppies, and a rabbit). The neutral stimuli were facial images of four males from an open database of facial stimuli (Minear & Park, 2004). In a pilot study, participants rated a larger set of faces. For the present research, we selected faces that were relatively similar in valence and were rated near the neutral evaluation. We selected two of the four images of men to always appear in the attitude-induction task. The other two appeared only in the pairing task, as fillers.

Procedure. One group of participants observed the pairing followed by the attitude induction. Another group observed the attitude induction before the pairing. Next, participants reported their memory regarding the co-occurrence of the men with the animals in the pairing episode. Finally, participants rated all the men.

Pairing. Before the pairing, participants read the following instructions:

In the next task you will see images displayed together rapidly, two images at a time. Your task is to pay close attention to the images. Later, we will ask you to identify whether certain images appeared in the task, and how often they appeared. Focus on the images, register them in your memory, and try to get a sense of how often each of them appears.

In each trial, one of the four CSs appeared for 1200 ms alongside one of the six USs. The side (right or left) of each stimulus was selected randomly in each trial. Between trials, two gray rectangles appeared for 700ms. Each CS appeared twice with each of the six USs (in total, 48 trials).

Attitude induction. The instructions were as follows:

In the next part of the study you will read about typical behaviors of two men. Your task is to form an impression of these men, based on their behaviors. At the very end of the study, we will ask about your feelings toward each of these men.
One person (selected randomly) performed three positive behaviors and one neutral behavior. The other person performed three negative behaviors and one neutral behavior. Each behavior appeared with the man’s image for five seconds.

**Memory judgment.** Four questions appeared in a random order, each presenting the image of one of the four men, with the same question: “When pairs of images were presented to you, did this man appear more often with cute animals or scary animals?” The response options were “Much more often with cute animals than with scary animals,” “Slightly more often with cute animals than with scary animals,” “With an equal number of cute and scary animals,” “Slightly more often with scary animals than with cute animals,” “Much more often with scary animals than with cute animals,” and “I don't remember.” As a memory score, we recoded the first five response options as 2, 1, 0, -1, and -2. For most analyses, “I don’t remember” was coded as missing data.

**Attitude.** We presented on separate screens each of the four CSs and asked, “Based on your very first emotional response, how much do you like the person in the picture?” with the response options “Dislike strongly,” “Dislike moderately,” “Dislike slightly,” “Like slightly,” “Like moderately,” and “Like strongly” recoded to a 1-6 scale.

**Results**

Table 1 presents the average attitude and memory scores in each condition for each stimulus. We examined the effects on attitude and memory scores with a 2 (man’s description: positive, negative; within participants) X 2 (induction timing: before/after the pairing; between participants) mixed ANOVA.

**Manipulation check.** Participants liked the positively portrayed man \((M = 4.33; SD = 1.19)\) more than the negatively portrayed man \((M = 2.57; SD = 1.12)\), \(F(1, 298) = 261.84, p < .0001, \eta_p^2 = .47\). We also found an interaction, \(F(1, 298) = 11.92, p = .0006, \eta_p^2 = .04\), reflecting stronger induction when the induction occurred before the pairing, \(F(1, 150) = 199.09, p < .0001, \eta_p^2 = .57\), rather than after the pairing, \(F(1, 148) = 78.47, p < .0001, \eta_p^2 = .35\). Two follow-up experiments that investigated this unexpected moderation included conditions that replicated the present experiment \((ns = 225, 162)\), but the moderation did not reach significance \((\eta_p^2 = .01, .00, ps = .09, .86)\).
Table 1

<table>
<thead>
<tr>
<th>Neutral stimulus</th>
<th>Mean evaluation when portrayed positively</th>
<th>Mean evaluation when portrayed negatively</th>
<th>Mean memory when portrayed positively</th>
<th>Mean memory when portrayed negatively</th>
<th>Evaluation-memory correlation</th>
<th>Rate of “I don’t remember” response</th>
<th>Rate of “equal co-occurrence” response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude induction before pairing episode</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man1</td>
<td>4.41 (1.25)</td>
<td>2.29 (1.09)</td>
<td>0.25 (1.09)</td>
<td>-0.43 (1.17)</td>
<td>.386*** (143)</td>
<td>5.3%</td>
<td>29.8%</td>
</tr>
<tr>
<td>Man2</td>
<td>4.51 (1.21)</td>
<td>2.38 (0.98)</td>
<td>0.47 (1.16)</td>
<td>-0.45 (1.03)</td>
<td>.328*** (143)</td>
<td>5.3%</td>
<td>30.5%</td>
</tr>
<tr>
<td>Pairing episode before attitude induction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man1</td>
<td>4.10 (1.22)</td>
<td>2.67 (1.17)</td>
<td>0.01 (1.21)</td>
<td>-0.53 (0.96)</td>
<td>.352*** (132)</td>
<td>11.4%</td>
<td>24.8%</td>
</tr>
<tr>
<td>Man2</td>
<td>4.33 (1.04)</td>
<td>2.94 (1.14)</td>
<td>0.29 (1.10)</td>
<td>-0.07 (1.16)</td>
<td>.258** (132)</td>
<td>11.4%</td>
<td>31.5%</td>
</tr>
</tbody>
</table>

Notes. In the parentheses of the means: SDs; in the parentheses of the correlations: Ns; the Evaluation-Memory correlations are across attitude-induction conditions. **p < .001; ***p < .0001.

Memory reports. Positive memory scores reflected a judgment that the man co-occurred more often with positive than with negative animals. Reflecting the expected valence-compatibility effect, these scores were more positive for the positively portrayed man \((M = 0.26, SD = 1.15)\) than for the negatively portrayed man \((M = -0.36, SD = 1.10)\), \(F(1, 268) = 29.06, p < .0001\), \(\eta^2 = .10\). A marginally significant interaction, \(F(1, 268) = 3.17, p = .076\), \(\eta^2 = .01\), reflected a stronger valence-compatibility effect when the induction occurred before the pairing, \(F(1, 140) = 28.11, p < .0001\), \(\eta^2 = .17\), than when it occurred after the pairing, \(F(1, 128) = 5.97, p = .016\), \(\eta^2 = .04\).

The two above-mentioned follow-up experiments found the same order-effect pattern, but it was always too small to reach statistical significance \((ns = 197, 132; \eta^2 = .003, .01, ps = .52, .18)\). Those experiments replicated the main memory judgment valence-compatibility effect in the induction-before-pairing condition \((ns = 115, 70, \eta^2 = .16, .28, ps < .0001)\) and in the pairing-before-induction condition \((ns = 82, 62, \eta^2 = .11, .12, ps = .002, .006)\). In summary, the significant valence-compatibility effect when induction occurred after pairing indicates the effect was not driven solely by an encoding bias. Further, although the valence-compatibility effect seemed consistently stronger when the induction preceded the pairing, this moderation was always very small, suggesting only a small encoding bias, if any.

As detailed in Table 2, we also found a significant correlation between the evaluation and the co-occurrence memory judgment of the two filler men that appeared in the pairing but not in
the attitude induction. The correlation may reflect the effect of pre-existing attitudes toward these two men on memory judgment.

Table 2

<table>
<thead>
<tr>
<th>Neutral stimulus</th>
<th>Mean rating</th>
<th>Mean memory</th>
<th>Attitude-memory correlation</th>
<th>Rate of “I don’t remember” response</th>
<th>Rate of “equal co-occurrence” response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filler1</td>
<td>3.89 (0.94)</td>
<td>-0.11 (1.05)</td>
<td>.240*** (266)</td>
<td>11.3%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Filler2</td>
<td>3.93 (0.90)</td>
<td>0.11 (1.05)</td>
<td>.239*** (268)</td>
<td>10.7%</td>
<td>29.7%</td>
</tr>
</tbody>
</table>

Notes. In the parentheses of the means: SDs; in the parentheses of the correlations: Ns; *** p < .0001.

Experiment 2

Experiment 1 found an effect of evaluation on reported memory of co-occurrence. Participants indicated that positive men co-occurred more often with positive than with negative animals and that negative men co-occurred more often with negative than with positive animals. One possible reason for this effect is that participants assumed that after we presented certain behaviors regarding each person, we would also present the same men with animals of valence compatible with the valence of the behaviors. That is, participants might have constructed some of their reports based on their theory about the rules the researchers used when creating the experiment. To examine the effect of such strategic guessing, half of the participants in Experiment 2 were explicitly informed before the pairing that each man would co-occur with an equal number of positive and negative animals. Then we showed the participants specific man-animal pairs and asked them how many times each specific pair appeared during the pairing. Participants could not assume we presented pairs of compatible valence more often, because we explicitly informed them we did not. Therefore, any valence-compatibility bias in their estimation would not reflect strategic guessing.

Method

Participants. Four hundred and ninety-nine participants (327 women, M_age = 28.2, SD_age = 14.1) completed all the measures.

Materials. The stimuli were the same as in Experiment 1. However, in this experiment, all four male stimuli appeared both in the attitude induction and the pairing tasks.

Attitude induction. The experiment always started with the induction procedure, presenting four behaviors for each of the four men. Two men performed only positive behaviors
and two performed only negative behaviors. As in Experiment 1, each behavior appeared with
the man’s image for five seconds. The 16 behaviors were presented in a random order.

**Pairing.** Next came the pairing procedure, identical to the one used in Experiment 1. The
instructions were slightly different and included a manipulation that informed half of the
participants about the equal pairing (added below in brackets):

In the next task you will see images displayed together rapidly, two images at a time. Your task is
to pay close attention to the images. In each pair, you will see one man and one animal. Some of
the animals will be cute and some will be scary. [You will see four men. Each man will appear 6
times with cute animals and 6 times with scary animals.] Your task is to pay close attention to the
images. Later, we will ask you to identify whether certain images appeared in the task, and how
often they appeared. Focus on the images, register them in your memory, and try to get a sense of
how often each of them appears.

To ensure participants in the *informed* condition read and understood that information,
below the instructions, we presented a few statements about the frequencies of the man-animal
pairs and participants had to choose the correct statement (“All of the men will appear an equal
number of times with cute animals and with scary animals”) in order to proceed from the
instructions page to the pairing procedure.

**Memory judgment.** After the pairing, eight questions accompanied a man-animal pair
and asked, “How many times did this man and that image appear together?” with seven response
options, ranging from 0 to 6. Each of the four men appeared in two of the eight questions, once
with a cute animal and once with a scary animal. We did not present each man with each of the
six animals in order to prevent participants in the *informed* condition from “balancing” their
estimates to fit those estimates to their knowledge that overall, each man co-occurred six times
with positive animals and six times with negative animals.

**Attitude measure.** Finally, participants completed the same attitude measure as in
Experiment 1, only with a range of 11 response options instead of six.

**Design.** The design was 2 (pairing information: informed/uninformed, between
participants) x 2 (men’s description: positive/negative, within participants) x 2 (animal’s valence:
positive/negative, within participants).

**Results**

**Manipulation check.** We averaged the ratings of the two positively portrayed men and
the two negatively portrayed men, and submitted these two scores to a 2 (pairing information) x
2 (men’s description) mixed ANOVA. Participants rated the two positively portrayed men \((M = 8.29; SD = 1.83)\) more positively than the two negatively portrayed men \((M = 4.71; SD = 3.18)\), \(F(1, 497) = 1113.98, p < .0001, \eta_p^2 = .96\). An unexpected significant interaction, \(F(1, 497) = 8.03, p = .005, \eta_p^2 = .02\), indicated the induction was weaker when the participants were informed that each man co-occurred six times with positive and six times with negative stimuli \((d = 2.29)\) than when they were not informed \((d = 2.89)\).

**Memory reports.** We submitted the average frequency estimation in each man-animal valence combination to a 2 (pairing information) x 2 (man’s valence) x 2 (animal’s valence) mixed ANOVA. That ANOVA found an unexpected main effect of information condition, \(F(1, 497) = 29.14, p < .0001, \eta_p^2 = .06\), reflecting higher estimates in the uninformed condition \((M = 3.01; SD = 0.94)\) than in the informed condition \((M = 2.56; SD = 0.94)\). Participants had a tendency to overestimate the frequency (each man-image pair co-occurred twice during the pairing), and the information about the real number of presentations of each man (12 times) attenuated that estimation. This effect confirms that participants indeed understood the frequency information because they used it as an anchor for their estimates.

We found no other significant effect in the ANOVA, \(ps > .28\), excluding the predicted man-valence by animal-valence interaction, \(F(1, 497) = 47.89, p < .0001, \eta_p^2 = .09\). This interaction reflected the valence compatibility effect: participants estimated that negatively portrayed men occurred more often with negative animals \((M = 2.92; SD = 1.21)\) than with positive animals \((M = 2.67; SD = 1.15)\), \(F(1, 497) = 22.17, p < .0001, \eta_p^2 = .04\); by contrast, participants estimated that positively portrayed men occurred more often with cute animals \((M = 2.91; SD = 1.16)\) than with scary animals \((M = 2.63; SD = 1.15)\), \(F(1, 497) = 39.79, p < .0001, \eta_p^2 = .06\).

Importantly, the information condition did not qualify the interaction effect, \(F(1, 497) = 0.20, p = .658\). A 2 (man valence) x 2 (animal valence) repeated-measures ANOVA among participants in the informed condition found a strong and significant interaction, \(F(1, 250) = 31.56, p < .0001, \eta_p^2 = .11\), reflecting the expected effect of evaluation on memory judgment. The effect in the uninformed condition was numerically smaller, \(F(1, 247) = 18.33, p < .0001, \eta_p^2 = .07\). The absence of moderation by information suggests that the compatibility bias was not the
result of a strategic guess, based on a belief that the researchers would present compatible pairs more often. Further, these results replicate the effect of evaluation on co-occurrence memory judgment with a frequency-estimation measure, extending the generality of our findings.

**Experiment 3**

To further investigate the effect of valence compatibility on co-occurrence memory judgment, Experiment 3 tested whether the findings reflect an effect of valence compatibility on the ability to discriminate between old and novel pairs, or on the judgment criterion of whether a stimulus pair has been seen before. Valence compatibility might affect the judgment criterion if it activates an experience that is felt as a valid cue for the recognition judgment. In that case, evaluation should influence memory judgment of pairs that did not co-occur, and not only pairs that did co-occur. By contrast, if valence compatibility only improves or impairs the retrieval of memory traces, it should not influence memory judgment regarding novel pairs. To test these two possibilities, participants in Experiment 3 judged whether specific man-animal pairs co-occurred earlier—some pairs co-occurred during the pairing and some did not. We also asked participants to indicate their level of confidence in each memory judgment. We thought that valence compatibility might influence only low-confidence judgments but not the experience of clear recollection.

**Participants.** Three hundred and eighty-one (242 women, $M_{age} = 31.4$, $SD_{age} = 13.4$) participants completed all the measures.

The procedure, attitude induction, and attitude measure and the male stimuli were the same as in Experiment 2. The affective stimuli were two positive animals (puppies and a baby seal) and two negative animals (cockroaches and an angry dog).

**Pairing.** The pairing procedure was similar to the one in Experiment 1; only the pairing schedule differed: each man occurred four times with one positive animal and four times with one negative animal (total of 32 trials). One positively portrayed and one negatively portrayed man co-occurred with the same pair of positive and negative animals, and the other two men co-occurred with the other two animals. The specific man-animal pairing was selected randomly for each participant.

**Memory measure.** We presented all the possible man-animal pairs (each man with the four animals), one pair at a time, in a random order and asked, “Did this man and that animal appear together?” with seven response options: “Yes (I remember clearly),” “Yes (I remember
vaguely), “Yes (only guessing),” “I don’t remember,” and three “No” options that mirrored the “Yes” options.

**Design.** Two man-animal pairs represented each of the eight conditions in a 2 (man’s description: positive/negative) X 2 (animal’s valence: positive/negative) X 2 (co-occurred: yes/no [old/novel]) within-participants design. For instance, memory in the positive man–negative animal-novel pair condition was measured with the questions that presented each of the two positively portrayed men with the scary animal with which that man did not co-occur during the pairing. Figure 1 illustrates the pairing design and the design of the memory questionnaire.

<table>
<thead>
<tr>
<th>Pairs presented in the pairing procedure</th>
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<tbody>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-1}$-$\text{Animal}</em>{\text{pos}}^{-1}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-1}$-$\text{Animal}</em>{\text{neg}}^{-1}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-2}$-$\text{Animal}</em>{\text{pos}}^{-2}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-2}$-$\text{Animal}</em>{\text{neg}}^{-2}$</td>
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</tbody>
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<thead>
<tr>
<th>Pairs presented in the memory test</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-1}$-$\text{Animal}</em>{\text{pos}}^{-1}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-1}$-$\text{Animal}</em>{\text{neg}}^{-1}$</td>
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<tr>
<td>$\text{Man}<em>{\text{pos}}^{-2}$-$\text{Animal}</em>{\text{pos}}^{-2}$</td>
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</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-1}$-$\text{Animal}</em>{\text{neg}}^{-2}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-2}$-$\text{Animal}</em>{\text{pos}}^{-1}$</td>
</tr>
<tr>
<td>$\text{Man}<em>{\text{pos}}^{-2}$-$\text{Animal}</em>{\text{neg}}^{-1}$</td>
</tr>
</tbody>
</table>

**Figure 1.** An illustration of the design of the pairs used in the pairing procedure and the memory test of Experiment 3. The subscripts indicate the valence of the stimulus (e.g., $\text{Man}_{\text{pos}}^{-1}$ and $\text{Man}_{\text{pos}}^{-2}$ were the two positively portrayed male stimuli). In the memory test, to indicate the two levels in each of the three independent factors: dashed frames represent novel pairs (solid frames represent old pairs), bold font represents positively portrayed men (non-bold font represents negatively portrayed men), and gray background represents negative animals (white background represents positive animals). Two pairs belong to each of the eight experimental conditions.

**Results**

**Manipulation check.** Participants liked the positively portrayed men more ($M = 8.60$; $SD = 1.83$) than the negatively portrayed men ($M = 3.67$; $SD = 1.94$), $t(380) = 30.82$, $p < .0001$, $d = 2.61$.

**Memory reports.** On average, 8% of the participants’ responses were “I don’t remember”, 16% indicated guesses, 28% indicated vague memory, and 49% indicated clear memory.
The memory score ranged from clear memory that the pair was novel (did not co-occur previously, recoded as -2.5) to clear memory that the pair was old (recoded as 2.5). “I don’t remember” responses were recoded as missing data. We submitted the average memory score in each condition to a 2 (man’s valence) x 2 (animal’s valence) x 2 (actual occurrence in the pairing procedure) ANOVA. A main effect of actual occurrence, $F(1, 339) = 326.48, p < .0001, \eta^2_p = .49$, reflected more certainty that old pairs co-occurred ($M = 1.87, SD = 0.66$) than that novel pairs co-occurred ($M = 0.72, SD = 1.14$). A couple of unexpected effects were unrelated to the research questions: A main effect of animal-valence, $F(1, 339) = 15.03, p = .0001, \eta^2_p = .04$, reflected more certainty that pairs that included a positive animal co-occurred ($M = 1.38, SD = 0.74$) than that pairs that included a negative animal co-occurred ($M = 1.24, SD = 0.83$). This animal-valence effect was moderated by actual occurrence, $F(1, 339) = 34.06, p < .0001, \eta^2_p = .09$, reflecting a stronger animal-valence effect for old than for novel pairs. The man-valence and actual occurrence interaction failed to reach statistical significance, $F(1, 339) = 3.42, p = .06, \eta^2_p < .01$, and so failed the main effect of man-valence, $F < 1$.

The most important effect was the man-valence by animal-valence interaction, $F(1, 339) = 18.78, p < .0001, \eta^2_p = .05$, reflecting the expected valence-compatibility effect. The memory score reflected stronger certainty that the pair co-occurred during pairing when the pair included a positive animal and a positively portrayed man ($M = 1.46, SD = 0.87$) as opposed to a positive animal and a negatively portrayed man ($M = 1.30, SD = 0.91$), $F(1, 339) = 12.61, p = .0004, \eta^2_p = .04$, and when the pair included a negatively portrayed man and a negative animal ($M = 1.33, SD = 0.92$) as opposed to a negatively portrayed man and a positive animal ($M = 1.17, SD = 1.01$), $F(1, 339) = 36.23, p = .002, \eta^2_p = .03$.

Importantly, the man-valence by animal-valence interaction was not moderated by actual occurrence, $F(1, 339) = 1.47, p = .23, \eta^2_p < .01$. The valence-compatibility interaction effect was similar for old pairs, $F(1, 339) = 11.40, p = .0008, \eta^2_p = .03$, and for novel pairs, $F(1, 339) = 13.48, p = .0003, \eta^2_p = .04$. The lack of moderation by actual occurrence suggests that the compatibility effect is on the memory judgment and not on the accessibility or clarity of the memory traces left by the actual co-occurrences.
To test whether the valence-compatibility effect was equal in all certainty levels, we submitted the rate of Yes (i.e., old pair) responses to a 2 (man’s valence) x 2 (animal’s valence) x 2 (actual occurrence) x 3 (certainty level) repeated-measures ANOVA. The 24 means of the conditions in the ANOVA are presented in Table 3, and the results of the ANOVA are detailed in Table 4. We found a man-valence by animal-valence interaction, $F(1, 380) = 20.17, p < .0001, \eta_p^2 = .05$, that reflected the expected valence-compatibility effect (see Table 4). Importantly, this interaction was further moderated by certainty level, $F(2, 760) = 11.08, p < .0001, \eta_p^2 = .03$.

Three separate three-way ANOVAs, one for each certainty level, specified that moderation. We found that the moderation reflected the compatibility (man-valence by animal-valence interaction) effect only when participants reported clear memory, $F(1, 380) = 23.91, p < .0001, \eta_p^2 = .06$, but not vague memory, or guessing, $Fs < 1$.

Table 3
**Experiment 3: Rates of “Yes” Responses for Each Certainty Level, in Each Pair Condition**

| Animal’s valence | | Man’s valence | | Positive | Positive | Negative | Negative |
|------------------|-----------|--------------|----------|----------|----------|----------|
| Co-occurred (hit) | | Positive | | .07 (.20) | .08 (.21) | .06 (1.8) | .07 (.19) |
| No co-occurrence (false alarm) | | Positive | | .13 (.26) | .13 (.26) | .11 (2.5) | .11 (.23) |
| Diff. | | | | -.06 (.28) | -.05 (.30) | -.05 (2.7) | -.04 (.25) |

| Vague memory responses | | Co-occurred (hit) | | .20 (.31) | .23 (.33) | .18 (.31) | .16 (.27) |
| No co-occurrence (false alarm) | | .23 (.32) | .25 (.33) | .19 (.31) | .22 (.32) |
| Diff. | | | | -.03 (.37) | -.02 (.40) | -.01 (.37) | -.06 (.35) |

| Clear memory responses | | Co-occurred (hit) | | .64 (.37) | .56 (.39) | .63 (.38) | .68 (.38) |
| No co-occurrence (false alarm) | | .30 (.39) | .25 (.35) | .22 (.35) | .27 (.36) |
| Diff. | | | | .34 (.44) | .31 (.45) | .41 (.44) | .41 (.43) |

Notes. Diff is the difference between rates pertaining to pairs that co-occurred during pairing and pairs that did not co-occur (i.e., the difference between hit rates and false alarm rates); in the parentheses: SD.

The man-valence by animal-valence interaction effect on clear memory reflected that participants were more likely to report clear memory that a pair appeared if the pair included a positive animal and a positively portrayed man than if the pair included a positive animal and a negatively portrayed man, $F(1, 380) = 19.86, p < .0001, \eta_p^2 = .05$, and when the pair included a negative animal and a negatively portrayed man than when it included a negative animal and a positively portrayed man, $F(1, 380) = 8.53, p = .004, \eta_p^2 = .02$ (see bottom section of Table 3 for the relevant means).
We found no evidence that the valence interaction found when testing only clear-memory responses was further moderated by the actual occurrence factor, $F < 1$. Rather, when participants reported clear memory, we found the man-valence by animal-valence interaction even when we analyzed only animal-man pairs that did not co-occur in the pairing, $F(1, 380) = 12.43, p = .0005, \eta_p^2 = .03$. That interaction reflects a compatibility effect on false alarms, suggesting a judgment bias that is not related to memory traces formed by the pairing procedure.

The same judgment bias can also explain the compatibility effect found for pairs that co-occurred during the pairing, $F(1, 380) = 18.39, p < .0001, \eta_p^2 = .05$ (clear-memory responses only). To examine whether valence compatibility influenced true discriminability and not only memory judgment, we computed scores that reflected the difference between the rates of old responses for old pairs and for novel pairs. For each man-valence/animal-valence combination, we computed a score that reflected the difference between hit and false alarm rates (bottom row of Table 3) of clear-memory responses. We submitted that score to a 2 (man valence) x 2 (animal valence) repeated-measure ANOVA (only clear-memory responses) and did not find an interaction, $F < 1$. That is, we found no evidence for an effect of valence compatibility on the accessibility or clarity of true memory traces of the co-occurrences during pairing.

<table>
<thead>
<tr>
<th>Effect</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta_p^2$</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty</td>
<td>248.76</td>
<td>&lt;.0001</td>
<td>.40</td>
<td>Higher rate of yes responses in the confidence-level “clear memory” ($M = .44, SD = .24$) than in the confidence-level “vague” ($M = .21, SD = .19$) and “guess” ($M = .10, SD = .13$).</td>
</tr>
<tr>
<td>Occurrence</td>
<td>342.15</td>
<td>&lt;.0001</td>
<td>.47</td>
<td>Higher rate of yes responses for pairs the co-occurred ($M = .30, SD = .05$) than for pairs that did not co-occur ($M = .20, SD = .10$).</td>
</tr>
<tr>
<td>Animal valence</td>
<td>27.83</td>
<td>&lt;.0001</td>
<td>.07</td>
<td>Higher rate of yes responses for pairs that included cute animals ($M = .332, SD = .117$) than pairs that included scary animals ($M = .317, SD = .117$).</td>
</tr>
<tr>
<td>Man valence</td>
<td>0.02</td>
<td>.8897</td>
<td>&lt;.01</td>
<td></td>
</tr>
<tr>
<td>Certainty X occurrence</td>
<td>344.12</td>
<td>&lt;.0001</td>
<td></td>
<td>Larger certainty effect when the pairs co-occurred during acquisition ($F = 56.13, p &lt; .0001, \eta_p^2 = .13$) than when they did not co-occur ($F = 43.49, p &lt; .0001, \eta_p^2 = .10$).</td>
</tr>
<tr>
<td>Certainty X animal valence</td>
<td>5.25</td>
<td>.0054</td>
<td>.01</td>
<td>Larger certainty effect when the pairs included a scary animal ($F = 239.60, p &lt; .0001, \eta_p^2 = .39$) versus a cute animal ($F = 169.89, p &lt; .0001, \eta_p^2 = .31$).</td>
</tr>
<tr>
<td>Certainty X man valence</td>
<td>1.43</td>
<td>.2403</td>
<td>&lt;.01</td>
<td></td>
</tr>
</tbody>
</table>
### Evaluation and Memory

<table>
<thead>
<tr>
<th>Table</th>
<th>Value</th>
<th>p-value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrence X animal valence</td>
<td>21.85</td>
<td>&lt;.0001</td>
<td>Smaller actual co-occurrence effect when the pairs included a cute animal ($F = 218.88, p &lt; .0001, \eta^2 = .37$) versus a scary animal ($F = 319.36, p &lt; .0001, \eta^2 = .46$).</td>
</tr>
<tr>
<td>Occurrence X man valence</td>
<td>2.07</td>
<td>.1513</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Animal valence X man valence</td>
<td>20.17</td>
<td>&lt;.0001</td>
<td>The valence-compatibility effect: for pairs with positive animals, the rate of yes responses was higher when the man’s valence was positive ($M = .254, SD = .081$) than when the man’s valence was negative ($M = .240, SD = .093$), $F(1, 380) = , p = .0016, \eta^2 = .03$. For pairs with negative animals, the rate of yes responses was higher when the man’s valence was negative ($M = .242, SD = .093$) than when the man’s valence was positive ($M = .223, SD = .093$), $F(1, 380) = 12.37, p = .0005, \eta^2 = .03$.</td>
</tr>
<tr>
<td>Certainty X occurrence x animal valence</td>
<td>6.68</td>
<td>.0013</td>
<td>The occurrence X animal-valence interaction was significant only for ‘yes (I remember clearly)’ responses ($F = 19.98, p &lt; .0001, \eta^2 = .05$), but not for ‘yes (I remember vaguely)’ responses ($F = 0.49, p = .4847, \eta^2 &lt; .01$), or for ‘yes (only guessing)’ responses ($F = 0.35, p = .5551, \eta^2 &lt; .01$).</td>
</tr>
<tr>
<td>Certainty X occurrence X man valence</td>
<td>0.69</td>
<td>.5037</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Certainty X animal valence X man valence</td>
<td>11.08</td>
<td>&lt;.0001</td>
<td>.03</td>
</tr>
<tr>
<td>Occurrence X animal valence X man valence</td>
<td>0.74</td>
<td>.3909</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Occurrence X animal valence X certainty</td>
<td>1.34</td>
<td>.2620</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

**Notes.** Degrees of freedom for main effects: 1,380. For all the interactions: 2, 760.

In summary, Experiment 3 found that induced attitudes biased memory judgment. People reported more clear memory of the co-occurrence of man-animal pairs that were compatible in their valence than incompatible pairs. We found this effect only when participants reported clear memory, and not when they reported vague memory or guessing. Additionally, this effect was the same for pairs that co-occurred during the pairing and pairs that did not co-occur. These results suggest that evaluation influenced memory judgment in a way that participants...
experienced as clear memory, although it was only a reconstructed memory judgment based on evaluative information rather than true memory traces of past events.

**General Discussion**

Three experiments found that the evaluation of an object biases memory judgment of whether the object appeared more often with positive versus negative stimuli. We induced attitudes toward men, paired photos of the men with an equal number of photos of positive and negative animals, and measured memory judgment regarding the pairings. In Experiment 1, participants were more likely to report that a man co-occurred more often with positive animals than with negative animals if the man was portrayed positively as opposed to negatively. That effect was the same regardless of whether we induced attitudes toward the men before and after the pairing. In Experiment 2, participants indicated how many times specific man-animal pairs occurred. Participants tended to indicate more frequent co-occurrence of same-valence pairs than opposite-valence pairs. This effect was not smaller among participants who were explicitly informed that overall, each man occurred six times with positive and six times with negative animals. In Experiment 3, participants indicated whether specific man-animal pairs co-occurred during the pairing, and also indicated their confidence level in the memory. Participants were more likely to report clear memory of pairs of compatible than incompatible valence. Whether the pair actually co-occurred did not moderate this judgment bias.

The present results extend previous findings from person memory research. Previous research found that people tend to remember that target persons performed more behaviors that match the pre-existing knowledge about the targets than behaviors that do not match prior expectations (e.g., Garcia-Marques & Hamilton, 1996). Similar results were obtained when the information was traits attributed to the target persons (e.g., Hamilton & Rose, 1980). The present research replicated those illusory correlation findings with evaluative information that was not an obvious attribute of the targets. Co-occurrence with an affective stimulus (e.g., a puppy) in a computer task does not suggest the affective stimulus is a part of the person’s character or personality. And yet our findings are similar to those found when the stimulus pairs are meaningful descriptions of a target person.

As in person memory research, valence compatibility in our research influenced frequency estimates (Experiments 1 and 2) and also recognition of specific pairs (Experiment 3).
As in person memory research (Dodson, Darragh, & Williams, 2008), the effect on recognition was stronger when people reported clear memory. Finally, because in Experiment 3 valence compatibility had no effect on recognition corrected for criterion bias (the difference between hit rate and false-alarm rate), just as in person memory research, valence-compatibility seems to reflect lower criterion for judging compatible-valence pairs as old than for judging incompatible-valence pairs as old, rather than an effect on true discriminability between old and novel items (Stangor & McMillan, 1992).

Previous person memory research has found that in free-recall tests, people are better at recalling trait and behavioral information that is inconsistent with their expectations than expectancy-inconsistent information (Stangor & McMillan, 1992). An investigation of whether that effect exists when the information is mere co-occurrence of affective stimuli would be of interest.

**Explaining the Present Findings**

The present findings are probably not the result of explicit strategic guessing. In Experiment 2, the bias in memory judgment was not reduced among participants who were explicitly informed that each man occurred an equal number of times with positive and with negative stimuli. And in Experiment 3, we did not find the effect when participants indicated guessing or vague memory. Biased encoding probably cannot explain the results either. In Experiment 1, valence compatibility influenced memory judgment even when we induced the men’s valence after the encoding of the pairs. Inducing the attitudes toward the men before the pairing hardly increased the valence-compatibility effect. Additionally, in Experiment 3, we found no evidence that valence compatibility had a stronger influence on pairs that co-occurred (i.e., were encoded) than on pairs that did not co-occur (were not encoded at all).

One family of accounts researchers have used to explain compatibility bias in memory judgment regarding persons is schema-based accounts (Alba & Hasher, 1983; Rumelhart & Ortony, 1977; Srull & Wyer, 1989; Stangor, 1988). Schema theories suggest that memory is organized around generic knowledge structures that shape interpretations, inferences, expectations, and attention (Graesser & Nakamura, 1982). For instance, a schema regarding mathematicians would include the trait intelligent because mathematicians are typically intelligent. Schema accounts posit that encoding and memory judgments are biased to prefer information that is compatible with the schema over information that violates the expectations
defined by the schema. Schema accounts can explain the current results only inasmuch as people assume stimuli of the same valence tend to co-occur more often than stimuli of different valence. People surely assume that when one stimulus is an attribute of the other (e.g., good people hold positive traits). However, whether people make this assumption when the stimuli have no specific relation other than co-occurrence is unknown.

Another possible challenge our results present to schema-based accounts is that Experiments 2 and 3 failed to find evidence that valence compatibility influenced conscious guessing. Schema accounts should predict that people would rely on their expectations when they have no other reliable information (Ross & Conway, 1986). On the other hand, Dodson, Darragh, and Williams (2008) used a schema-based account to explain stereotype-consistent bias in memory reports that, as in the current research, was found only when participants reported clear memory, and not when they reported vague memory. According to these authors, during retrieval, schema information produces expectation-consistent illusory recollection.

Another family of accounts for the present findings proposes that valence compatibility activates an experience that is misidentified as recollection. Concepts of similar valence elicit similar behavioral and affective responses, and also share semantic meaning. All these shared features may facilitate recall and frequency judgment of co-occurrence (Chapman, 1967; Tversky & Kahneman, 1973). The shared features may constitute a conceptual compatibility, which influences recognition tests: people tend to judge that an item in a memory test was presented earlier if the item is conceptually compatible with a cue that also appears in the test (Whittlesea, 1993; Whittlesea & Williams, 2001). Perhaps the conceptual compatibility between same-valence stimuli had a similar effect on the recognition tests in the present experiments. That is, similar-valence pairs induced a feeling of fluency that participants confused with familiarity.

Klauer and Stern’s (1992) hypothesis that people automatically compare the affective consistency of pair stimuli, and that consistent pairs activate an automatic affirmative response, suggests another possible source for the present findings. If recognition judgments are translated into a question of whether the pair occurred, the affirmative or negative response activated by the automatic affect comparison can lead to a valence-compatibility bias in the memory judgment.
Implications for EC research

The present results pose a grave threat to the validity of memory measures as measures of awareness of CS-US co-occurrence in EC research. The threat is that people may show accurate co-occurrence memory even if they were unaware of the co-occurrence during the pairing procedure. An EC effect without awareness may lead to accurate memory of the co-occurrence of the CS with stimuli of a certain valence. Some recent evidence suggests that EC occurs only if people show accurate memory judgment regarding the valence of the stimuli with which that CS co-occurred (Bar-Anan et al., 2010; Stahl & Unkelbach, 2009; Stahl, Unkelbach, & Corneille, 2009). The present results suggest this evidence should not be interpreted as a strong support to the claim that EC requires valence awareness (Mitchell, De Houwer, & Lovibond, 2009). In that regard, the present research provides clear-cut findings in support of claims against the usage of co-occurrence memory measures as measures of CS-US awareness (Gawronski & Walther, 2012; Hütter et al., 2012).

The main difference between the present experiments and typical EC experiments is that we paired the man stimuli with both positive and negative stimuli, whereas EC experiments pair each stimulus with stimuli of one valence. Our pairing was similar to the pairing used in other tests of illusory correlations (e.g., Dodson et al., 2008), and it enabled us to separate the pairing from the attitude formation. From that separation, we learned that evaluation influences co-occurrence memory judgment even when the evaluation is induced after the encoding phase. In typical EC procedures, the pairing likely influences co-occurrence memory and evaluation at the same time, and memory and evaluation may have mutual effects on each other. In that respect, our findings speak only to one of these effects; namely, our findings support the possibility that the evaluation induced by EC would later influence memory judgment.

Another methodological difference between the present experiments and typical EC experiments pertains to the memory measures. Stahl, Unkelbach, and Corneille (2009) distinguished between “valence-awareness” measures that ask participants to indicate the valence with which the CS co-occurred during the pairing task and “identity-awareness” measures that ask participants to indicate the specific US with which the CS occurred. In the present research, the memory measure in Experiment 1 was a “valence-awareness” measure, whereas the measures in Experiments 2 and 3 were “identity-awareness” measures. However, our memory measures differed slightly from those typically used in EC experiments, because we did not want
to mislead our participants by suggesting each man co-occurred with stimuli of only one valence or with only one US (animal). Specifically, our measures included response options that could indicate the man co-occurred with one valence more than the other (but still co-occurred with stimuli of both valences), and asked participants separately about the co-occurrence of a few different man-animal pairs (rather than asking participants to choose one animal for each man).

Because our pairing schedule and memory measures differed somewhat from those used in typical EC research, a cautious conclusion would be that although our results suggest evaluation influences co-occurrence memory judgment, the procedures used in some EC research might be more immune to this effect than the procedures used in the present research. Further, as Hütter et al. (2012) demonstrated, developing procedural innovations specifically designed to separate co-occurrence memory from evaluation is also possible. The present findings may suggest such innovations are well needed. However, just as our findings support the assertion that accurate co-occurrence memory judgment does not equal awareness during the pairing, one should also note that EC without accurate co-occurrence memory does not indubitably prove unawareness during the pairing. Rather, even when accurate co-occurrence memory is not detected, people might still have been aware of the co-occurrence during the pairing that induced the EC, but forgot that co-occurrence before the memory test.
A common misconception is that illusory correlation refers only to the tendency to attribute non-common attributes to non-common groups (see Hamilton & Rose, 1980, for an example that used this term for the congruency bias effect discussed in the present article).

As could be expected, the results of the analysis of the No response rates mirrored the analysis of the Yes responses, with significant compatibility effects only for clear-memory responses.
References


