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Overcoming Correlational Pitfalls: Experimental Evidence Suggests That Evaluative Conditioning Occurs for Explicit But Not Implicit Encoding of CS–US Pairings

Jonathan Dedonder[1], Olivier Corneille[1], Denis Bertinchamps[1], and Vincent Yzerbyt[1]

Abstract

Do people need to explicitly encode conditioned stimuli–unconditioned stimuli (CS–US) pairings for evaluative conditioning (EC) effects to emerge? Despite the large number of studies that addressed this issue, no simple answer has emerged yet. In part, this is due to the relative lack of experimental evidence for the role of awareness of the CS–US contingency at encoding in EC. In the present experiment, participants' encoding of the CS–US pairings was experimentally manipulated by relying on foveal and parafoveal presentations of the CSs. More specifically, spatial locations (i.e., foveal vs. parafoveal) of the CSs and US valence (i.e., positive vs. negative) were manipulated within participants, and CS–US pairings were counterbalanced across participants. Results reveal explicit encoding of the CSs and EC effects for the foveal CS presentations only. We discuss the implications of these experimental findings for the associative and propositional approach to EC.

Keywords

attitudes, affect–cognition interface, social cognition, automatic/implicit processes, dual-process models

Evaluative conditioning (EC) refers to the change in the valence of initially neutral stimuli (conditioned stimuli, or CSs) as a result of their pairing with positive or negative stimuli (unconditioned stimuli, or USs). EC has far-reaching implications and is also central to current theoretical debates, as it is usually considered the best empirical case for an associative form of attitudes formation (e.g., De Houwer, 2009; Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). A critical question for the latter debate is whether EC may emerge in the absence of awareness of the CS–US contingency at encoding (ACE). Collecting evidence for implicit EC would provide strong support for the view that attitudes can be formed through implicit processes that rely on nonpropositional learning mechanisms.

Unfortunately, the available research provides mixed evidence about the existence of contingency-unaware EC effects (e.g., Gast, Gawronski, & De Houwer, 2012). As Gawronski and Walther (2012) correctly noted, EC studies generally rely on correlational approaches when addressing this question, which prevents drawing any strong conclusions on the causal impact of ACE in EC. Depending on the specific correlational procedure used, conflicting findings tend to emerge. For instance, Pleyers, Corneille, Luminet, and Yzerbyt (2007) observed that EC is observed only for CSs that are associated with the US they were paired with, in the context of a postevaluative memory task. Later research provided evidence largely consistent with this observation, using meaningful (e.g., unfamiliar consumption products) or meaningless (e.g., meaningless letter strings) CSs, explicit or implicit evaluative measures, and identity-related or valence-related measures of awareness (e.g., Dawson, Rissling, Schell, & Wilcox, 2007; Kattner, 2011; Klucken et al., 2009; Lascelles & Davey, 2006; Lipp & Purkis, 2005; Lovibond & Shanks, 2002; Pleyers, Corneille, Luminet, & Yzerbyt, 2007; Stahl & Unkelbach, 2009; Stahl, Unkelbach, & Corneille, 2009; Wardle, Mitchell, & Lovibond, 2007; see, however, Balas & Gawronski, 2012). In contrast, a recent study relying on a process dissociation procedure suggests that EC may possibly emerge on a more implicit memory basis (Hütter, Sweldens, Stahl, Unkelbach, & Klauer, 2012).

[1] Université catholique de Louvain, Louvain-la-Neuve, Belgium

Corresponding Author:
Jonathan Dedonder, Université catholique de Louvain. IPSY. 10, Place du cardinal Mercier. B-1348 Louvain-la-Neuve, Belgium.
Email: jonathan.dedonder@uclouvain.be

In these and many other related studies, however, claims about the causal role of ACE in EC were raised based on a correlational procedure involving memory-based measures of explicit CS–US encoding. In other words, no experimental manipulation of ACE was involved and, as an additional concern, contingency awareness measures may have been partly contaminated by reconstructive memory processes. This led Gawronski and Walther (2012, p. 622) to recently argue that "memory performance data of the traditional correlational paradigm remain ambiguous about the exact role of contingency awareness during the encoding of CS–US pairings." The reader would also probably agree that experimental procedures have to be preferred over correlational procedures when it comes to addressing causal relations. Therefore, it is critical to turn to direct manipulations of CS–US contingency awareness.

So far, three experimental approaches have been used to examine the causal influence of ACE in EC. A first experimental approach consisted of instructing participants to either look for contingencies or simply watch the screen (e.g., Baeyens, Eelen, & Van den Bergh, 1990; Fulcher & Hammerl, 2001). This procedure had an impact on both EC and awareness, although a dissociative one. When participant's attention was explicitly directed toward CS–US contingencies, contingency awareness increased but EC was reduced. However, recent evidence suggests that contingencies-monitoring instructions may have distracted participants from the evaluative information (Spruyt, De Houwer, & Hermans, 2009; see also Gast & Rothermund, 2011). Hence, this finding still awaits a clear interpretation.

A second experimental strategy relied on subliminal presentations. The idea here is that CS–US pairings should not enter explicit memory if they cannot be consciously processed. Unfortunately, results from subliminal studies proved to be generally weak and inconsistent (De Houwer, Thomas, & Baeyens, 2001; Hofmann et al., 2010). In addition, several subliminal studies came with critical confounds. Many subliminal studies finding unconscious EC effects manipulated US valence between participants rather than within them (Dijksterhuis, 2004; Krosnick, Betz, Jussim, & Lynn, 1992; Niedenthal, 1990; for a discussion, see Pleyers et al., 2007), thereby perhaps inducing nonassociative changes in affects (Lovibond & Shanks, 2002). Most of the subliminal studies also assumed rather than empirically tested with sensitive methods that CS–US pairings were actually presented below awareness (for a notable exception, see, however, Rydell, McConnell, Mackie, & Strain, 2006).

A third approach consisted of manipulating participants' attentional resources. The idea is that the conscious encoding of the CS–US pairings should be impaired when participants' attentional resources are reduced at encoding. Consistent with this claim, recent studies found that the conditioning of both meaningful CSs (Pleyers, Corneille, Yzerbyt, & Luminet, 2009) and meaningless CSs (Dedonder, Corneille, Yzerbyt, & Kuppens, 2010) to be reduced under high attentional load. One critical limitation with the latter studies, however, is that attentional load was manipulated *between* participants. Because EC is sensitive to processing goals (Corneille, Yzerbyt, Pleyers, & Mussweiler, 2009; Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2012; Gast & Rothermund, 2011), there remains a possibility that goal priming rather than resource depletion drove the effects. For instance, participants completing a numerical 2-back task (high-load condition) rather than listening to neutral music (low-load condition) during their exposure to the CS–US pairings may be more concerned with calculation than with evaluation. Hence, one may argue that goal priming rather than attentional load was responsible for the effects. This important limitation, inherent to between-participants manipulations of awareness, was also present in earlier attentional studies that provided inconsistent evidence about the role of awareness in EC (i.e., Field & Moore, 2005; Fulcher & Hammerl, 2001; Walther, 2002).

To sum up, we have seen (1) that experimental rather than correlational evidence is needed in addressing the causal role of ACE in EC and (2) that prior experimental evidence faced limitations due to the manipulation of contingency awareness between rather than within participants, or to the lack of sensitive measures probing the effectiveness of the manipulation of contingency awareness.

The present research sought to overcome these various issues. First, we directly manipulated ACE through a novel procedure (foveal vs. parafoveal CSs presentations). Second, we implemented this manipulation within rather than between participants. We predicted that parafoveal presentations would reduce ACE. Consistent with the view that EC involves the explicit encoding of CS–US pairings, we also predicted reduced EC for parafoveally presented CSs. Of critical importance, the presentation of the CSs (foveal vs. parafoveal) was varied *within* participants, thus ruling out possible mood, mind-set, or processing goal confounds in the interpretation of the effects. Finally, we checked for the effectiveness of our manipulation of ACE both using offline (memory-based) and online (encoding-based) awareness measures (see the general discussion for this complementary evidence).

Method

Participants and Design

Fifty-eight undergraduate students (32 women; mean age = 21.36, *SD* = 2.07) participated for a €3 remuneration. The experiment adopted a 2 (CS type: CS associated with a positive US or CS+ vs. CS associated with a negative US, or CS−) by 2 (CS presentation: foveal vs. parafoveal) within-subject design.

Conditioning Materials

CSs: Stimuli were taken from Pleyers et al. (2007). The CSs consisted of eight photographs of standard consumption products, whose brands were unknown to the participants.

USs: Schematic faces taken from Vermeulen, Luminet, and Corneille (2006) were used as USs: a happy face (US+) and an angry face (US−).

Procedure

Participants were tested individually and seated in front of a computer. A chin rest was placed at a distance of 70 cm of a 15-in. cathode ray tube (CRT) monitor with 60-Hz refresh rate computer CRT monitor. Participants were instructed to focus on the screen, as various stimuli would be presented. They were told that they would be asked to complete a series of questions about the stimuli right after the stimuli presentation. The procedure involved three phases: a conditioning phase, an evaluation phase, and a memory phase.

During the conditioning phase of the study, participants saw eight CS–US pairings on the computer screen. Each CS–US pairing presentation was preceded by a fixation point presented in the center of the screen for 1500 ms. Then CS–US pairings were presented together on the screen for 60 ms. For the foveal presentations, the CSs appeared at 2.5° (left or right) from the fixation point. For the parafoveal presentations, CSs were placed at 11.5° (left or right) from the fixation point. All CS–US presentations were directly covered, following their 60-ms appearance, by a colored visual mask. The visual mask remained for 150 ms on the screen and it entirely covered the parafoveal or foveal CS–US displays. Importantly, the USs always appeared in the center of the screen.

Within participants, four CSs (two of which were paired with USs−) were shown in the foveal field and four CSs (two of which were paired with USs−) were shown in the parafoveal field. Each pairing was presented 10 times resulting in a total of 80 presentations appearing in a random order. For both foveal and parafoveal presentations, the CS appeared randomly on the right or the left of the US for an equal number of times. For a given participant, a given CS was always paired with the US− or with the US+. CS–US pairings were counterbalanced between participants.

Before the conditioning procedure, participants were given 10 practice trials aimed at familiarizing them with the procedure. For these practice trials, the CSs and USs were replaced by two neutral stimuli and participants were simply asked to look at the screen.

All participants then proceeded to the evaluation phase of the experiment. They first completed an affective priming task aimed at collecting implicit evaluative measures about the CSs. The procedure closely followed the one used by Pleyers et al. (2007). On each trial, a CS prime was displayed for 120 ms and directly replaced by a blank screen for 50 ms. A target word was then presented for 200 ms. Participants had to judge as fast and accurately as possible whether the target word was positive or negative (a special keyboard from empirisoft® was used to enhance precision in response recording). The next trial started after a delay of 2000 ms. During this affective priming task, each CS appeared 4 times, followed twice by positive and twice by negative words.

Following the completion of the affective priming task, participants were asked to report their explicit evaluative ratings of the CSs. In this second evaluation task, each CS appeared in the upper center of the screen, and participants were asked to spontaneously express their "*global feelings*" toward the CSs (see Pleyers et al., 2007, Experiment 1) on a scale ranging from 1 (*I don't like it*) to 8 (*I really like it*).

The final phase of the study consisted of an identification task, which served as a manipulation check for assessing the effectiveness of the presentation manipulation. In this task, each CS appeared in the upper center of the screen along with the two US faces. Participants had to link each CS with one of the two USs. Participants could answer "I don't know" if they had no recollection of the pairing. CS order was randomized between the evaluative and identification tasks. Finally, participants were debriefed, paid, thanked, and dismissed.

Results

Manipulation Check

We first examined identification accuracy as a function of CS presentation (foveal vs. parafoveal). As expected, explicit memory for the CS–US pairings was higher for foveal ($M = 2.29$, $SD = 1.03$) than parafoveal ($M = 1.91$, $SD = 1.05$) CS presentations, $t(57) = 2.01$, $p < .05$, $\eta^2 = .07$. In addition, explicit memory for the CS–US pairings was above chance (i.e., two correct identifications out of a maximum of four) for the foveal presentations ($M = 2.29$, $SD = 1.03$), $t(57) = 2.18$, $p < .04$, $\eta^2 = .08$, but not for the parafoveal presentations ($M = 1.91$, $SD = 1.05$), $t(57) < 1$, *ns*, $\eta^2 < .1$. Admittedly, any memory measure should be treated with caution when it comes to interpreting the effectiveness of ACE (see also the general discussion). Having said this, the obtained pattern strongly supports the view that we were successful at manipulating, within participants, the explicit encoding of the CS–US pairings.

EC Effects

Affective Priming Task. Trials with incorrect responses (3.17%) or response latencies slower than 2000 ms (0.47%) were excluded. Remaining response latencies were log transformed. A 2 (CS presentation: foveal vs. parafoveal) × 2 (Congruency: CS primes whose associated US was affectively congruent vs. incongruent with the valence of the target word) analysis of variance was conducted. No effect was observed, that is, presentation, $F(1, 57) = 1.074$, $p > .1$, $\eta^2 = .018$; congruency $F(1, 57) = 0.118$, $p > .1$, $\eta^2 = .002$; interaction $F(1, 57) = 0.016$, $p > .1$, $\eta^2 < .001$. It should be noted here that the number of pairing presentations used in the present study was higher than in Pleyers et al. (2007) and that the indirect evaluative measure was pretty similar to the one used in Pleyers et al. Thus, it seems unlikely that the absence of significant results was due to a lack of sensitivity in our procedure.

Evaluative Ratings. No effect was observed for CS type (Cs+ vs. CS−), $F(1, 57) = 0.61$, $p > .1$, $\eta^2 = .01$, or for CS presentation (foveal vs. parafoveal), $F(1, 57) = 1.78$, $p > .1$, $\eta^2 = .03$. As predicted, however, there was a significant interaction between CS presentation and CS type, $F(1, 57) = 7.54$, $p < .01$, $\eta^2 = .117$ (see Figure 1). Planned comparisons confirmed that CSs+

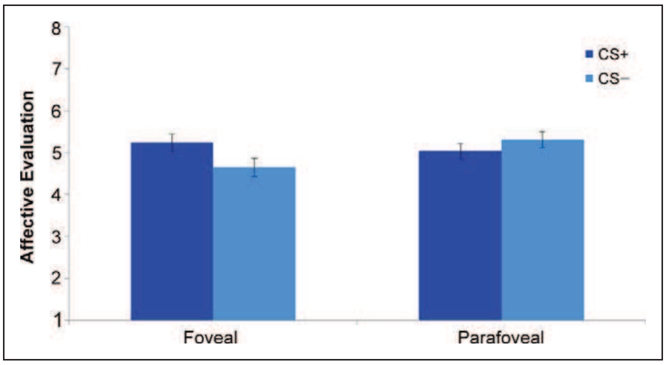

Figure 1. Mean evaluation (standard errors as whiskers) of the CSs as a function of CS type and presentation.

were evaluated more favorably than CSs− for the foveal CS presentations (M = 5.24, SD = 1.60 vs. M = 4.66, SD = 1.69, respectively), $t(57) = 2.19$, $p < .05$, $\eta^2 = .078$, but not for the parafoveal CS presentations (M = 5.04, SD = 1.40 vs. M = 5.31, SD = 1.50, respectively), $t(57) = -0.96$, $p > .1$, $\eta^2 = .016$.

Complementary Analyses About the Explicit Evaluations of the CSs. The primary goal of this article was to follow recent recommendations to go away from a correlational approach in examining the role of awareness in EC and to switch to experimental evidence in order to address this question. The above findings support the hypothesized causal relation: EC is reduced under conditions that prevent an explicit encoding of the CS–US pairings. Although we are highly reluctant to rely on correlational analyses when the very purpose of the present research is to overcome their limitations, we understand that curious readers may nevertheless wonder about the correlations between EC and the memory-based measure of contingency awareness.

In order to address this correlational question, CS evaluations were submitted to a multilevel analysis (SAS PROC MIXED; see Dedonder et al., 2010, for a similar analysis). In this model, we considered US valence (negative = −1 and positive = +1) as the Level-1 factor and presentation (*parafoveal* = −1 and *foveal* = +1) as the Level-2 factor. The "Don't know" answer was used 60 times over 464 answers. These answers were considered as contingency unaware.

For the *contingency aware* CS–US pairings, a significant main effect of CS type was observed, $F(1, 183) = 17.24$, $p < .001$, $\eta^2 = .085$, with more positive ratings of CSs+ than CSs−. A main effect of CS presentation also emerged, with more positive ratings of parafoveal than foveal CS presentation, $F(1, 183) = 4.69$, $p = .04$, $\eta^2 = .025$. More importantly, a CS type by CS presentation interaction emerged, $F(1, 183) = 5.75$, $p = .02$, $\eta^2 = .03$. Examination of the simple effects revealed higher evaluative ratings of CSs+ than CSs− (EC effect) when CSs were presented foveally ($p < .0001$) but not when CSs were presented parafoveally ($p > .1$).

For the *contingency-unaware* CS–US pairings (i.e., CSs associated with a "I don't know" or with an incorrect response in the identification task), only a significant main effect of CS type emerged, $F(1, 159) = 13.04$, $p < .001$, $\eta^2 = .075$. Surprisingly enough, the evaluation of the CSs− was higher than that of the CSs+. One possibility is that the memory-based measure of awareness was contaminated by evaluative processes (i.e., participants may have inferred their evaluation of the US based on their—incorrect—recollection of the US valence), at least when participants did not hold a correct memory of the CS–US pairings. If anything, this again supports our and other's recommendation to rely on experimental manipulations of ACE rather than memory-based correlational analyses, when examining the role of ACE is EC. Considering only CSs associated with an incorrect US valence, excluding "I don't know" answers, similar results were observed. Only a main effect of CS type emerged, $F(1, 100) = 11.73$, $p < .001$, $\eta^2 = .069$, with CSs− being rated higher than CSs+. Finally, when considering only "I don't know" answers, neither main nor interaction effects were observed (all ps > .1).

Discussion

Prominent supporters of dual model of attitudes learning recently noted: "We suggested that researchers move beyond the traditional correlational paradigm, which remains inherently ambiguous about the causal relation between memory performance and evaluation. We hope that the current analysis will inspire the development of experimental approaches to study of the role of contingency awareness in EC, which may help to provide deeper insights into this notoriously recurring, but fascinating question" (Gawronski & Walther, 2012, p. 622).

The present research was precisely aimed at meeting this recommendation to go beyond correlational procedures and turn to experimental procedures for addressing the role of contingency awareness in EC. Results indicated EC effects occur under experimental conditions that allowed for an explicit encoding of the CS–US presentations (i.e., foveal CS presentations), but no EC was observed under experimental conditions preventing an explicit encoding of the CS–US contingencies (i.e., parafoveal CS presentations). This experimental instead of correlational finding clearly supports the view that there is a causal relation between awareness and EC. This is fully consistent with recent experimental evidence showing no EC under conditions of attentional load at encoding (Dedonder et al., 2010; Pleyers et al., 2009), but this time excluding the possibility that the effects emerged because of the activation of different mind-sets, mood states, or processing goals across different groups of participants. Again, it is important to stress that contingency awareness was manipulated *within* participants in the present experiment, whereas it was manipulated between participants in prior attentional load studies.

Admittedly, we used a memory-based manipulation check for ACE. Hence, this manipulation check provides only partial and possibly biased information regarding participants' CS–US encoding performances. We fully agree with the limitations inherent to such a manipulation check (Balas & Gawronski, 2012; Gawronski & Walther, 2012; Hütter et al., 2012). That we obtained no EC on parafoveal presentations associated with a “hit” on the memory-based awareness measure indeed confirms that this measure should be interpreted with some caution, at least under conditions in which explicit memory is unlikely to be achieved (i.e., parafoveal presentations). As a matter of fact, this is one of the reasons why we chose to turn to an experimental manipulation of awareness: Memory-based awareness measures may be partly contaminated and correlational analyses based on these measures are potentially misleading.

At the same time, several comments are in order. Although the measure we selected is clearly not devoid of error, it nevertheless provides very useful information regarding the contours of our manipulation. First, it confirmed that there was a significant explicit memory difference resulting from our two modes of presentation. This is fully consistent with the view that parafoveal stimuli are less likely to enter explicit memory. This is also consistent with prior works that found memory-based measures of awareness to strongly depend on the availability of attentional resources at encoding. Second, the data also revealed that participants were unable to indicate the correct associations for the CSs presented parafoveally, whereas they remained able to provide a decent number of correct answers for the CSs presented foveally. At the very least, this pattern suggests that stimuli associations were not so blatant and easy to remember that one could invoke a demand effect in the case of foveal presentations.

Conversely, it is difficult to argue that neither EC nor contingency awareness was observed in the parafoveal condition because participants “did not see the CSs.” Although it is clear, given the presentation parameters that we used, that the CSs hit the retina of our participants in the present experiment, we decided to conduct a follow-up study aimed at confirming that the CS could be perceptually discriminated with the presentation parameters we used. Specifically, we ran a perceptual discrimination version of this study, this time leaving out the evaluative tasks and asking participants to identify, after each trial, which of the eight CSs had just been displayed on the computer screen. Besides this change, all presentation parameters remained the same for this follow-up study (size, identity, frequency of exposure, exposure time, and visual angles of the stimuli).

Results of this follow-up study, conducted on 20 participants in our lab (10 females; mean age: 23.30, $SD = 3.74$), showed 75.85% ($SD = 14.49$) correct identification for the foveal CS presentations and 36.5% ($SD = 18.79$) correct identifications for the parafoveal presentations. These identification rates differ significantly from each other, $t(19) = 10.08$, $p < .0001$, $\eta^2 = .84$, and both are significantly above chance, that is, 12.5% was the chance level; foveal: $t(19) = 19.55$, $p < .0001$, $\eta^2 = .95$; parafoveal: $t(19) = 5.71$, $p < .0001$, $\eta^2 = .63$. This pattern confirms that participants were able to extract at least superficial (e.g., color, general shape) features of the CSs both for the foveal and parafoveal presentations. This also rules out concerns that no EC was found because CSs were not seen at all: Parafoveally presented CSs were parafoveally seen, allowing for above-chance perceptual discrimination scores (as confirmed in this follow-up) but leading to poor explicit encoding performances (as revealed by the memory performances observed in the main study). It should also be noted here that results from this online awareness procedure fully confirmed, and more sensitively so, the impact of our experimental manipulation on encoding performances.

More generally, because parafoveal presentations have been shown to influence affective and cognitive processes in a number of psychological studies (e.g., Aarts et al., 2010; Chartrand & Bargh, 1996; Felisberti, Solomon, & Morgan, 2005; Juola, Cooper, Warner, & Bouwhuis, 1991), it is unreasonable to claim that EC did not occur simply because participants “did not see” the CS–US pairings. Rather, one may reasonably assume that the explicit encoding of the CS–US pairings was needed for EC to emerge. This is consistent with a propositional approach to EC, which claims that devoting one’s attention to the CS–US pairings and contingencies is critically needed for evaluative learning to be observed in the EC paradigm (see also, Blask, Walther, Halbeisen, & Weil, 2012; Kattner, 2011). This is also consistent with past (Rescorla & Wagner, 1972; Schwartz, 1989) and more recent (Jones, Fazio, & Olson, 2009) work showing that stimuli salience and frequent visual connections between CS and USs facilitate evaluative learning.

In sum, our strategy was twofold First, we considered the memory-based measure as a good-enough manipulation check for ACE, which it actually turned out to be because above-chance explicit memory scores were observed only for the foveal presentations. Second, we collected an online measure of awareness which again confirmed the effectiveness of our experimental manipulation. This evidence, in addition to prior memory-based awareness data that proved sensitive to attentional load at encoding, collectively suggest that memory-based measures do tap on (not only but partly) ACE, and by the way that attention is related to awareness (otherwise why would attentional load and peripheral stimulations impact the memory measure?) Although we agree that the procedure we used here was not ideal, we believe it is sufficiently sensible and also definitely better than most of the previously published EC work that relied on correlational procedures or used between-participants manipulations of awareness or did not probe awareness using both online and offline awareness measures.

It is also worth discussing the present findings in light of the fact that Jones, Fazio, and Olson (2009; see also Jones, Olson, & Fazio, 2010) found enhanced EC for CSs and USs appearing closer to each other in participants’ visual field. According to Jones and colleagues, closer presentations increase the probability of implicitly misattributing the affective reaction elicited by the US to the CS. Of importance, the implicit misattribution theory holds that the emotional component of the US is transferred to the CS when participants *do not* relate their feelings to the CS–US pairings, which they are presumably unaware of.

As it appears, this theory can hardly explain the evidence collected here. First, the experimental procedure used here ensured that the US was always presented at the fore of participants’ visual attention. It is highly unlikely that participants would misattribute their affective experience to a CS (e.g., a toothpaste) when a US (e.g., an angry face) is the most salient information in their visual environment (because of its affective value, its central location, and its priming with a fixation point). In other words, why would participants misattribute their feelings to the CS (1) when the most salient information in their environment is the US and when (2) misattribution effects assume attribution ambiguity? Second, in contrast to this recent account of EC, we found EC *only* under conditions that made it possible for the participants to *explicitly* encode the CS–US contingencies. We deem it reasonable to explain the obtained pattern in terms of ACE (rather than implicit misattribution), as this factor strongly varied across presentation conditions in our study (whereas it was reported to be kept constant in Jones and colleagues' research). This being said, it is interesting to note that in experiments conducted in our lab, the US was generally more salient than the CS when the opposite tended to be true in Fazio's experiments (see Olson & Fazio, 2001). Therefore, one possibility may be that Fazio's model applies to specific cases of low US salience.

As a further note of caution, one should not conclude from the present findings that EC is never to be obtained under parafoveal presentation conditions. Implicit evaluative measures (which proved inconclusive in the present study) might have revealed successful parafoveal effects. Such a finding would be consistent with the view that EC may be established unconsciously but is best assessed through indirect evaluative measures (Rydell et al., 2006). In the same vein, parafoveal conditioning effects might have been found on meaningless stimuli (such as meaningless letter strings) or for the transfer of semantic US meaning to the CS (e.g., Galli & Gorn, 2011), or might have been observed with a more diverse set of US stimuli. Regarding the latter point, Sweldens, Van Osselaere, and Janiszewski (2010) recently found evidence suggesting implicit EC effects when simultaneously pairing CSs with various (instead of a single) USs.

Given the current evidence, however, we believe that one should be extremely cautious in claiming that EC may occur in the absence of awareness at encoding. In our view, stronger evidence is needed that would deliver more compelling support to this idea. A strong experiment may for instance consist of crossing a process dissociation procedure with a within-participants manipulation of attentional load. Dual attitude learning theorists would predict load to impact the explicit but not the implicit memory component, yet EC to be associated with both memory modes.

In the current absence of such strong dissociative evidence, involving sensitive identification measures for encoding awareness, the principle of parsimony invites to favor single over dual theories of evaluative learning. That EC effects appear to be so strongly sensitive to experimental manipulations of attentional resources, presentation mode, mind-sets, task instructions, goals, and semantic qualifiers certainly is more consistent with the view that EC is based on propositional rather than automatic associative processes.

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Author Biographies

Jonathan Dedonder is a PhD Student at the Université Catholique de Louvain. His research deals with social cognition, with a special interest for attitudes learning and attitudes change. He is currently offering statistical and methodological support for social science research at the IACCHOS, ESPOLE and IL&C Institutes.

Olivier Corneille is professor of social psychology at the Université Catholique de Louvain. His research deals with social cognition and cognitive psychology, with a special interest for attitudes learning and face perception. He has served as Associate Editor for Social Cognition and for Social Psychological and Personality Science.

Denis Bertinchamps is a master student in psychology at the Université catholique de Louvain.

Vincent Yzerbyt is professor of social psychology at the Université Catholique de Louvain. His research deals with social cognition, stereotyping, as well as with intergroup relations and emotions. He also focuses on methods and statistics with a particular interest for the use of ANCOVA and mediation analysis. A former President of the European Association of Social Psychology and the current chair of the European Social Cognition Network, he served as the founding chief editor of the Social Psychological and Personality Science (2009-2013).