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Is Evaluative Conditioning Really Uncontrollable? A Comparative Test of Three Emotion-Focused Strategies to Prevent the Acquisition of Conditioned Preferences

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Evaluative conditioning (EC) is defined as the change in the evaluation of a conditioned stimulus (CS) because of its pairing with a valenced unconditioned stimulus (US). Counter to views that EC is the product of automatic learning processes, recent research has revealed various characteristics of nonautomatic processing in EC. The current research investigated the controllability of EC by testing the effectiveness of 3 emotion-focused strategies in preventing the acquisition of conditioned preferences: (a) suppression of emotional reactions to the US, (b) reappraisal of the valence of the US, and (c) facial blocking of emotional responses. Although all 3 strategies reduced EC effects on self-reported evaluations by impairing recollective memory for CS-US pairings, they were ineffective in reducing EC effects on an evaluative priming measure. Regardless of the measure, effective control did not depend on the level of arousal elicited by the US. The results suggest that the 3 strategies can influence deliberate CS evaluations through memory-related processes, but they are ineffective in reducing EC effects on spontaneous evaluative responses. Implications for mental process theories of EC are discussed.

Keywords: arousal, automaticity, cognitive control, emotion regulation, evaluative conditioning

Many commercial advertisements are based on the idea that repeated pairings of a consumer product with a pleasant stimulus can enhance consumers' liking of the product, thereby increasing the likelihood that they will purchase it. Similarly, many negative political campaigns rely on the assumption that unfavorable depictions of a competing candidate lead voters to dislike that candidate, thereby undermining the competitor's success in garnering votes. What makes these examples so disturbing is the widespread intuition that people might be rather helpless in controlling the effects of repeated co-occurrences. Even if we reject the informational value of repeatedly encountered stimulus pairings, they might nevertheless influence spontaneous evaluative responses and these responses may guide judgments and decisions if we fail to monitor and control their impact (Gawronski & Bodenhausen, 2006).

The notion that repeated stimulus pairings can influence evaluative responses is most prominently reflected in research on *evaluative conditioning* (EC), which is defined as the change in the evaluation of a conditioned stimulus (CS) because of its pairing with a positive or negative unconditioned stimulus (US; De Houwer, 2007; for a meta-analysis, see Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). Conceptually, EC represents a special instance of Pavlovian conditioning (PC), which refers to changes in the response to a CS because of its pairing with a US. However, EC is more specific than PC, in that EC is particularly concerned with conditioned changes in evaluative responses, whereas PC concerns conditioned changes in any type of response (Hofmann et al., 2010). This distinction is important not only for conceptual reasons, but also because EC differs from other instances of PC in terms of its functional properties. For example, whereas many other instances of PC are reduced by subsequent unreinforced presentations of the CS without the US, EC has been found to be resistant to extinction (e.g., Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Baeyens, Díaz, & Ruiz, 2005; Dwyer, Jarratt, & Dick, 2007; Gawronski, Gast, & De Houwer, in press; Vansteenwegen, Francken, Vervliet, De Clercq, & Eelen, 2006).

Consistent with the idea of uncontrollable influences of CS-US pairings on evaluative responses, proponents of associative accounts (e.g., Gawronski & Bodenhausen, 2006; Rydell & McConnell, 2006) have argued that EC effects result from a process of automatic link formation, in which the mental representation of the

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CS becomes automatically associated with the representation of the US (e.g., Walther, Gawronski, Blank, & Langer, 2009) or the evaluative response elicited by the US (e.g., Sweldens, Van Osselaer, & Janiszewski, 2010). However, recent research inspired by propositional accounts (e.g., De Houwer, 2009; Mitchell, De Houwer, & Lovibond, 2009) suggests that the processes underlying EC effects are much less automatic than commonly assumed. Examples include studies showing that EC depends on the availability of cognitive resources (e.g., Davies, El-Deredy, Zandstra, & Blanchette, 2012; Pleyers, Corneille, Yzerbyt, & Luminet, 2009), momentary processing goals (e.g., Corneille, Yzerbyt, Pleyers, & Mussweiler, 2009; Gast & Rothermund, 2011), and the construal of CS-US relations (e.g., Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2012) during the encoding of CS-US pairings.[1] Based on these findings, one might conclude that there is no reason to be concerned about the effects of commercial advertisements and negative campaigns, given that their effects are presumably mediated by nonautomatic processes that can be intentionally controlled.

In the current research, we investigated the controllability of EC more directly by testing the effectiveness of different strategies in preventing the acquisition of conditioned preferences. Although the umbrella term *automatic* subsumes several distinct features (e.g., unawareness, unintentionality, efficiency, or uncontrollability), these features do not necessarily co-occur, which prohibits inferences about the presence versus absence of one feature from the presence versus absence of another feature (Bargh, 1994; Moors & De Houwer, 2006). Thus, although EC effects may depend on cognitive resources, processing goals, and the construal of CS-US relations, the acquisition of conditioned preferences may nevertheless be difficult to control, such that repeated CS-US pairings may influence subsequent responses toward the CS despite the intention not to be influenced by its co-occurrence with a US. Expanding on earlier evidence for limits in the controllability of EC (e.g., Balas & Gawronski, 2012; Gawronski, Balas, & Creighton, 2014), the current research tested the effectiveness of three emotion-focused strategies in preventing the acquisition of conditioned preferences: (a) suppression of one's emotional reaction to the US, (b) reappraisal of the valence of the US, and (c) facial blocking of emotional responses.

Controllability of EC

Despite the widely shared assumption that EC effects are the product of automatic learning processes, the accumulating body of evidence for nonautomatic features of EC has raised the question of whether EC can be intentionally controlled. In a first study to address this question, Balas and Gawronski (2012) asked participants to either prevent or promote the influence of previously presented CS-US pairings before they provided evaluative ratings of the CSs. Their results showed that instructions to either prevent or promote the influence of CS-US pairings moderated EC effects in line with task instructions. However, this moderation was observed only when participants were able to recall the valence of the US that had been paired with a given CS. When participants failed to remember the valence of the US, significant EC effects emerged regardless of control instructions. These results suggest that recollective memory for US valence is a necessary precondition for controlling the verbal expression of conditioned preferences. However, recollective memory for US valence does not seem to be a necessary precondition for the emergence of EC effects per se (see also Hütter et al., 2012).

Although Balas and Gawronski's (2012) findings provide valuable insights into the controllability of expressing conditioned preferences, their findings do not to address the issue of whether the acquisition of conditioned preferences can be intentionally controlled. To answer this question, Gawronski et al. (2014) instructed participants to either prevent or promote the influence of CS-US pairings before the presentation of the pairings. Their results showed that EC effects on self-reported evaluations were reduced when participants were instructed to prevent the influence of CS-US pairings and enhanced when they were instructed to promote the influence of CS-US pairings. However, EC effects on an evaluative priming task (Fazio, Jackson, Dunton, & Williams, 1995) remained unaffected by control instructions. To the extent that responses on evaluative priming tasks are much more difficult to control than evaluative ratings on traditional self-report measures (Gawronski & De Houwer, 2014), these results are consistent with the hypothesis that, although the expression of EC effects on self-reported evaluations can be intentionally controlled (cf. Balas & Gawronski, 2012), the acquisition of conditioned preferences is much more difficult to control.

Control Strategies

Despite the reviewed evidence for limits in the controllability of EC, it would be premature to claim that effective control is impossible. After all, effective control depends not only on the presence of a corrective goal, but also on the employed strategy to achieve this goal. Thus, to the extent that the participants in earlier studies either lacked a suitable strategy or spontaneously utilized a suboptimal strategy, their attempts to control the acquisition of conditioned preferences could have been more effective by means of an appropriate strategy. In the current research, we were interested in the relative effectiveness of three strategies that involve a modulation of one's affective response to the US during the encoding of CS-US pairings. This focus was inspired by the idea that attempts to control the acquisition of conditioned preferences might be more effective with proactive strategies that prevent the elicitation of an affective response to the US compared with reactive strategies that aim at preventing the transfer of an elicited affective response to a co-occurring CS.

The first strategy, *emotion suppression*, involves the intentional inhibition of one's affective response to the US. Although the term *evaluative* may be interpreted to subsume both "cold" cognitive and "hot" affective processes, EC effects seem to be at least partially mediated by affective processes, in that repeated CS-US

[1] An important aspect of these studies is that the proposed boundary conditions were experimentally manipulated during the encoding of CS-US pairings, rather than measured on an individual basis after encoding. Although several studies suggest that recollective memory of CS-US pairings after encoding is not required for EC effects (e.g., Balas & Gawronski, 2012; Hütter, Sweldens, Stahl, Unkelbach, & Klauer, 2012), the question of whether EC requires awareness of CS-US pairings during encoding cannot be answered conclusively at this point, because of the scarcity of studies that experimentally manipulated awareness during encoding (for more detailed discussions, see Gawronski & Walther, 2012; Sweldens, Corneille, & Yzerbyt, 2014).

pairings involve a transfer of the affective quality of the US to the CS. Hence, to the extent that the affective response to the US can be effectively suppressed during the encoding of CS-US pairings, there should be no affective response that could transfer to the CS, thereby disrupting the emergence of an EC effect. However, an important boundary condition might be the level of arousal elicited by the US. Consistent with this assumption, Gawronski and Mitchell (2014) found that EC effects tend to be larger for high-arousal compared with low-arousal USs. Because affective responses might be more difficult to suppress for highly arousing stimuli, emotion suppression may be more effective in preventing EC effects resulting from pairings with low-arousal USs and less effective for USs that elicit high levels of arousal. Thus, in addition to investigating the effectiveness of emotion suppression as a potential strategy to control the acquisition of conditioned preferences, the current study also explored whether the effectiveness of this strategy depends on the level of arousal that is elicited by the US.

A potential concern about the effectiveness of emotion suppression is that it has been shown to be a suboptimal strategy in preventing the elicitation of affective responses (for a review, see Ochsner & Gross, 2005). In fact, there is evidence showing that sympathetic activation in response to emotional stimuli may increase (rather than decrease) as a result of emotion suppression (e.g., Gross, 1998). Although the impact of emotion suppression on EC is still an open question, an alternative strategy that might be more effective is *stimulus reappraisal*, which involves a different construal of the stimulus event (Ochsner & Gross, 2005). In line with this contention, several EC researchers have started to investigate the influence of construal processes on EC effects, focusing in particular on the construal of CS-US relations (e.g., Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2012; Gawronski, Walther, & Blank, 2005; Langer, Walther, Gawronski, & Blank, 2009; Moran & Bar-Anan, 2013; Zanon, De Houwer, & Gast, 2012; Zanon, De Houwer, Gast, & Smith, in press). In the present study, we were interested in testing the effectiveness of construal processes related to the US rather than CS-US relations. Because stimulus reappraisal has been found to be less effective in modulating responses to stimuli of high emotional intensity (e.g., Sheppes, Catran, & Meiran, 2009; Sheppes & Meiran, 2008), we were also interested in whether the effectiveness of this strategy depends on the level of arousal that is elicited by the US (see Gawronski & Mitchell, 2014).

Both emotion suppression and stimulus reappraisal involve the engagement of intentional processes, and thus executive control (Sheppes & Gross, 2011). Although these processes may be effective in preventing the acquisition of conditioned preferences, an interesting question is whether similar (or superior) outcomes can be achieved by disrupting affective responses to the US in an unintentional manner that does not involve executive control. An interesting possibility in this regard is *facial blocking*, which involves the disruption of overt emotional responses by blocking their facial expression. Based on earlier work on the facial-feedback hypothesis (Strack, Martin, & Stepper, 1988), several studies have shown that the elicitation of emotional experiences can be disrupted by blocking the facial expression of emotional responses (e.g., Hawk, Fischer, & Van Kleef, 2012; Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001; Oberman, Winkielman, & Ramachandran, 2007; see also Davis, Senghas, Brandt, & Ochsner, 2010). Thus, although facial blocking does not involve a goal to inhibit one's emotional responses, it may prevent the acquisition of conditioned preferences in an unintentional manner by disrupting the elicitation of an affective response to the US. However, the effectiveness of facial blocking may also depend on the level of arousal elicited by the US, raising further questions about the role of US arousal in the prevention of EC effects (see Gawronski & Mitchell, 2014).

The Present Research

To investigate the effectiveness of the three strategies in preventing the acquisition of conditioned preferences, participants were presented with repeated pairings of neutral CSs and positive or negative USs of either high or low arousal. As CSs, we used meaningless drawings; as USs we used standardized photographs from the International Affective Picture System (Lang, Bradley, & Cuthbert, 2008). Before the presentation of the CS-US pairings, participants were instructed to either (a) suppress their emotional reactions to the USs, (b) reappraise the valence of the US, or (c) hold a chopstick in their mouth while watching the CS-US pairings. To obtain a baseline measure of EC effects under regular conditions, participants in a fourth experimental group were instructed to simply watch the images on the computer screen. After the presentation of the pairings, participants were asked to rate their feelings toward the CSs and complete an evaluative priming task that included the CSs as prime stimuli (Fazio et al., 1995). Our main question was whether EC effects will be reduced for any of the three control strategies when they are compared with EC effects in our baseline condition. Because reduced EC effects on the self-report measure may reflect either (a) effective control during the encoding of CS-US pairings or (b) adjustments during the verbal expression of conditioned preferences, we were particularly interested in the whether the three strategies effectively reduce EC effects on the evaluative priming measure. Although evaluative priming tasks are not entirely immune to strategic influences, they are much less susceptible to deliberate adjustments than traditional self-report measures (see Gawronski & De Houwer, 2014), thereby allowing stronger conclusions about the relative effectiveness of the three control strategies in preventing the acquisition of conditioned preferences.

Method

Participants and Design

In total, 320 undergraduate students (225 women, 87 men, and 8 missing) at The University of Western Ontario in Canada were recruited for a 1-hr battery entitled "Perception of Social Groups and Images" that included the present experiment and an additional study that was unrelated to the current topic. Participants received research credit for an introductory psychology course. The study included a 2 (US Valence: positive vs. negative) × 2 (US Arousal: high vs. low) × 4 (Task Instructions: visual perception vs. emotion suppression vs. stimulus reappraisal vs. facial blocking) × 2 (Measurement Order: evaluative rating first vs. evaluative priming first) mixed-model design with the first two variables as within-subjects factors and the other two as between-subjects factors. Three participants did not finish the experiment because of a fire alarm. Another five participants did not complete the current experiment, because they took too long in the first part of this battery, leaving insufficient time for the second part that included the current study. This left us with a final sample of 312 participants.[2]

Materials

As CSs we used eight computer-generated images of shapes with different color patterns (see Gawronski et al., 2014). As USs, we used eight pictures from the International Affective Picture System (IAPS) that were matched for valence and arousal (see Gawronski & Mitchell, 2014). The pictures were selected on the basis of Lang et al.'s (2008) normative data, such that they showed comparable ratings of valence and arousal for both men and women (see Appendix A). Four of the selected pictures were of positive valence and four were of negative valence. Orthogonal to the manipulation of valence, four of the selected pictures were characterized by high arousal and four by low arousal.

EC Procedure

The EC procedure included 10 presentations of each CS-US pair, summing up to a total of 80 trials. Each trial started with a fixation cross that was displayed for 250 ms in the center of the screen. The fixation cross was followed by the CS for 1,000 ms, which was replaced by the US for 1,000 ms. The intertrial interval was 1,500 ms. The images used as CSs were displayed in a size of 2.00 × 1.43 in. (300 × 215 pixels); the pictures used as USs were displayed in a size of 14.22 × 10.67 in. (1024 × 768 pixels). Each CS was presented with the same US. The particular pairings of CSs and USs were counterbalanced by means of a Latin square.

Task Instructions

To investigate the effectiveness of the three control strategies, participants were randomly assigned to one of four experimental conditions. In the *visual perception condition*, which served as the baseline to determine the size of EC effects under regular conditions, participants were told that the study is concerned with visual perception and that they will be presented with various pictures on the screen. The instructions further informed participants that some of the pictures will be neutral computer-generated drawings whereas others will be photographs. Participants' task was to pay close attention to the images. The instructions in the other three conditions were identical, the only difference being that participants received additional instructions regarding the respective control strategy. In the *emotion suppression condition*, participants were told that they should try their absolute best to suppress their emotional responses to the photographs. In the *stimulus reappraisal condition*, participants were instructed to form a positive (negative) impression of any negative (positive) photographs by interpreting the scenario depicted in negative (positive) terms. In the *facial blocking condition*, participants were asked to hold a chopstick in their mouth until they receive instructions that they can remove it.[3] The exact wording of the instructions in the four conditions is provided in Appendix B.

Measures

After completion of the EC task, participants were shown each of the eight CSs and asked to rate how pleasant or unpleasant each image made them feel on 7-point scales ranging from 1 (*very unpleasant*) to 7 (*very pleasant*). In addition, participants were asked to complete an evaluative priming task (Fazio et al., 1995) that included the CSs as primes and positive and negative adjectives as targets. The positive target words were: *pleasant*, *good*, *outstanding*, *beautiful*, *magnificent*, *marvelous*, *excellent*, *appealing*, *delightful*, and *nice*; the negative target words were: *unpleasant*, *bad*, *horrible*, *miserable*, *hideous*, *dreadful*, *painful*, *repulsive*, *awful*, and *ugly*. Each trial started with a fixation cross that was displayed for 500 ms in the center of the screen. The fixation cross was followed by a prime stimulus, which was replaced by the target word after 200 ms. Participants' task was to press a right-hand key (*Numpad 5*) as quickly as possible when the target word was positive and a left-hand key (*A*) when the target word was negative. The target words remained on the screen until participants made their response. Incorrect responses were followed by the word *ERROR!* for 1,500 ms. The intertrial interval was 500 ms. Each CS was presented once with each of the 10 positive target words and once with each of the 10 negative words, summing up to a total of 160 trials. The order of the evaluative rating measure and the evaluative priming task was counterbalanced across participants.

Supplementary Measures

In addition to the two evaluation measures, we assessed participants' recollective memory for the CS-US pairings and their motivation to avoid biasing effects of the USs on their responses to the CS. To assess participants' recollective memory for CS-US pairings, they were given an extended variant of the four-picture recognition task in which they were asked to identify which of the eight USs had been paired with which CS (Walther & Nagengast, 2006). For this purpose, participants were presented with the eight USs at the top of the screen and one of the CSs at the bottom of the screen. Each US was marked with a number from 1 to 8 and participants were asked to make their response by pressing the corresponding key on the keyboard. In addition to completing the memory task, participants were asked to rate how motivated they were to avoid biasing effects of the photographs on their evaluative responses to the computer-generated drawings. Self-reported motivation to avoid biasing effects was measured with a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

[2] The original sample size of 320 participants was determined on the basis of prior research in our lab using similar paradigms and availability of subjects. We report all data exclusions, all manipulations, and all measures. All materials and data are available from the authors upon request.

[3] Participants in the facial blocking condition were asked to remove the chopstick after the presentation of the CS-US pairings before they completed the dependent measures. To rule out any ambiguities about how participants were supposed to hold the chopstick in their mouth, an image was displayed during the instructions that showed the relevant details. The image is available from the authors upon request.

Results

Evaluative Rating

Self-reported CS evaluations were aggregated by averaging participants' ratings of the two CSs that had been paired with a US of the same type (i.e., positive/low arousal; positive/high arousal; negative/low arousal; and negative/high arousal). Submitted to a 2 (US Valence) × 2 (US Arousal) × 4 (Task Instructions) mixed-model analysis of variance (ANOVA), these scores revealed a significant main effect of US Valence, $F(1, 308) = 124.38$, $p < .001$, $\eta_p^2 = .288$, indicating that CSs that had been paired with a positive US were rated more favorably than CSs that had been paired with a negative US (*M*s = 4.57 vs. 3.62, respectively; see Figure 1). There was also a significant main effect of US Arousal, $F(1, 308) = 36.45$, $p < .001$, $\eta_p^2 = .106$, which was qualified by a significant two-way interaction of US Valence and US Arousal, $F(1, 308) = 7.79$, $p = .006$, $\eta_p^2 = .025$. Replicating earlier findings by Gawronski and Mitchell (2014), this interaction indicated that the effect of US Valence was more pronounced for high arousal USs (*M*s = 4.46 vs. 3.37, respectively), $F(1, 308) = 104.77$, $p < .001$, $\eta_p^2 = .254$, compared with low arousal USs (*M*s = 4.67 vs. 3.87, respectively), $F(1, 308) = 79.19$, $p < .001$, $\eta_p^2 = .205$. More important for the current investigation, the main effect of US Valence was qualified by a significant two-way interaction with Task Instructions, $F(3, 308) = 5.07$, $p = .002$, $\eta_p^2 = .047$ (see Figure 1). Although evaluative ratings in all task instruction conditions revealed a significant difference between CSs that had been paired with positive versus negative USs, effect sizes of US Valence effects were largest in the visual perception condition, $F(1, 76) = 69.62$, $p < .001$, $\eta_p^2 = .478$, and smallest in the stimulus reappraisal condition, $F(1, 78) = 9.63$, $p = .003$, $\eta_p^2 = .110$. Participants in the emotion suppression condition, $F(1, 77) = 30.32$, $p < .001$, $\eta_p^2 = .283$, and the facial blocking condition, $F(1, 77) = 27.20$, $p < .001$, $\eta_p^2 = .261$, showed effect sizes of US Valence effects that fell in-between the two other conditions. Further analyses revealed that Task Instructions showed a significant effect on self-reported evaluations of CSs that had been paired with negative USs, $F(3, 308) = 5.43$, $p = .001$, $\eta_p^2 = .050$, and a marginally significant effect on self-reported evaluations of CSs that had been paired with positive USs, $F(3, 308) = 2.14$, $p = .09$, $\eta_p^2 = .020$. Using the visual perception condition as a baseline, post hoc LSD tests revealed that the size of EC effects—conceptualized as the difference in evaluations of CSs that had been paired with positive versus negative USs—was significantly reduced in the emotion suppression condition ($p = .04$), the stimulus reappraisal condition ($p < .001$), and the facial blocking condition ($p = .03$). Whereas EC effects in the stimulus reappraisal condition were marginally smaller than EC effects in the emotion suppression ($p = .08$) and facial blocking ($p = .09$) conditions, EC effects in the emotion suppression and the facial blocking conditions did not significantly differ from each other ($p = .96$). Counter to the hypothesis that the effectiveness of the three strategies might depend on the level of arousal elicited by the US, the moderating influence of Task Instructions on the effect of US Valence was not qualified by US Arousal, $F(1, 308) = 0.75$, $p = .52$, $\eta_p^2 = .007$.

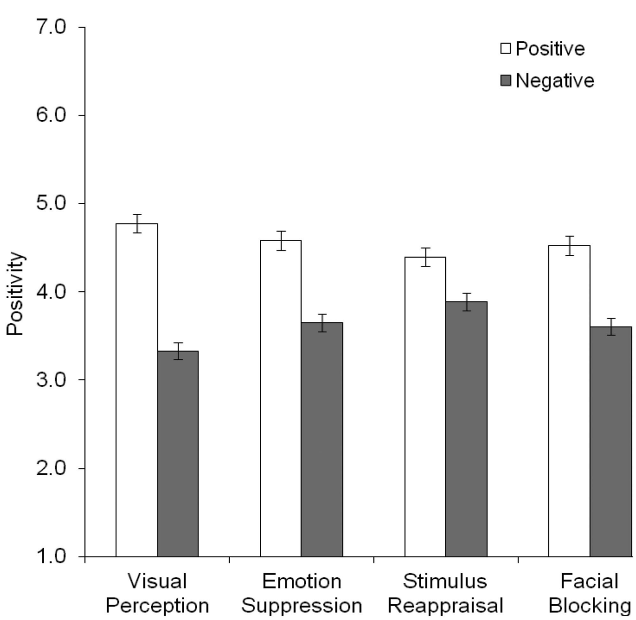

Figure 1. Self-reported conditioned stimulus evaluations as a function of unconditioned stimulus valence (positive vs. negative) and task instructions (visual perception vs. emotion suppression vs. stimulus reappraisal vs. facial blocking). Higher values indicate more favorable evaluations. Error bars depict *SE*s.

Evaluative Priming

Before aggregating the response latency data of the evaluative priming task, we excluded latencies from trials with incorrect responses (5.8%) and truncated latencies higher than 800 ms (see Gawronski et al., 2005). A positivity index was then calculated for each CS by subtracting the mean response latency to positive target words preceded by a given CS from the mean response latency to negative target words preceded by the same CS (Wentura & Degner, 2010). Thus, higher values indicate more favorable evaluations of the CS.[4] As with self-reported evaluations, the resulting difference scores were aggregated by averaging scores of the two CSs that had been paired with a US of the same type (i.e., positive/low arousal; positive/high arousal; negative/low arousal; and negative/high arousal). Submitted to a 2 (US Valence) × 2 (US Arousal) × 4 (Task Instructions) mixed-model ANOVA, these scores revealed a significant main effect of US Valence, $F(1, 308) = 18.03$, $p < .001$, $\eta_p^2 = .055$, indicating that CSs that had been paired with a positive US elicited more favorable responses than CSs that had been paired with a negative US (*M*s = 21.16 vs. 13.44, respectively; see Figure 2). There was also a significant main effect of US Arousal, $F(1, 308) = 6.31$, $p = .01$, $\eta_p^2 = .020$,

[4] Note that the current scores are not baseline-corrected, in that they reflect differences in responses to positive versus negative target words given a particular prime type rather than differences in responses to a particular target word depending on the type of prime stimulus. Because responses to positive target words tend to be faster than responses to negative target words (e.g., Unkelbach, Fiedler, Bayer, Stegmüller, & Danner, 2008), the current scores should be interpreted only in a relative manner (i.e., higher scores reflecting more favorable responses); it is not possible to interpret them in an absolute manner (e.g., a value of zero reflecting a neutral evaluation; see Wentura & Degner, 2010).

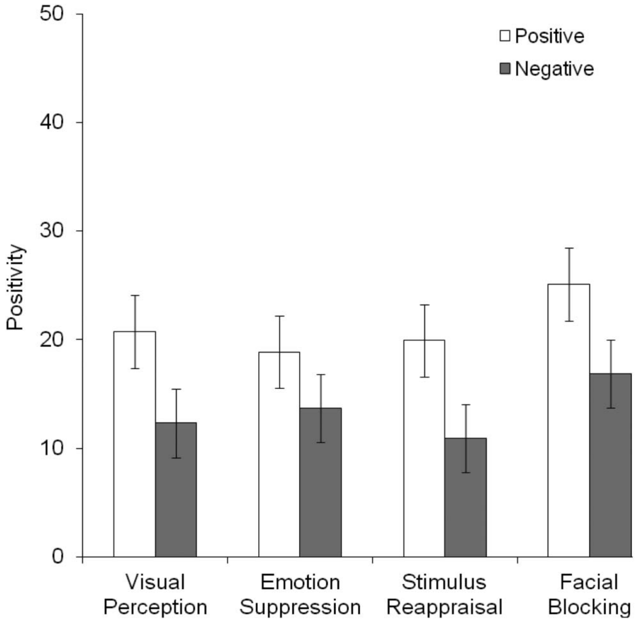

Figure 2. Evaluative priming effects of conditioned stimulus evaluations as a function of unconditioned stimulus valence (positive vs. negative) and task instructions (visual perception vs. emotion suppression vs. stimulus reappraisal vs. facial blocking). Higher values indicate more favorable affective responses. Error bars depict *SE*s.

indicating that CSs that had been paired with a high-arousal US elicited less favorable responses than CSs that had been paired with a low-arousal US (*M*s = 15.01 vs. 19.59, respectively). More important for the current investigation, Task Instructions failed to produce any significant main or interaction effect (all *F*s < 1, all *p*s > .45; see Figure 2). The overall size of EC effects did not statistically differ between any of the four Task Instruction conditions (all *ps* > .45). There was also no significant interaction involving US Arousal (all *F*s < 1, all *ps* > .84).

Comparison of Evaluative Rating and Evaluative Priming

Overall, EC effects on the two evaluation measures showed a significant positive correlation, $r = .18$, $p = .001$. To test whether the effect of Task Instructions differed for self-reported evaluations and evaluative priming effects, we *z*-transformed the difference scores reflecting the overall size of EC effects and submitted them to a 2 (Measure) × 4 (Task Instructions) mixed-model ANOVA. The hypothesized difference was confirmed by a statistically significant two-way interaction between Measure and Task Instructions, $F(3, 308) = 3.33$, $p = .02$, $\eta_p^2 = .031$, indicating that Task Instructions moderated EC effects on the self-report measure, $F(3, 308) = 5.07$, $p = .002$, $\eta_p^2 = .047$, but not EC effects on the evaluative priming task, $F(3, 308) = 0.22$, $p = .88$, $\eta_p^2 = .002$.[5]

Control Motivation

Self-reported control motivation showed a marginally significant negative correlation with EC effects on the evaluative rating measure, $r = -.11$, $p = .06$, but it was uncorrelated with EC effects on the evaluative priming measure, $r = .02$, $p = .76$. Submitted to a univariate ANOVA with Task Instructions as independent variable, self-reported control motivation revealed significant differences across the four experimental conditions, $F(3, 308) = 8.45$, $p < .001$, $\eta_p^2 = .079$ (see Table 1). Post hoc LSD tests indicated that participants in the emotion suppression condition showed significantly stronger control motivation than participants in the visual perception condition ($p = .02$). The same was true for participants in the stimulus reappraisal condition, who also showed significantly stronger control motivation than participants in the visual perception condition ($p = .004$). Self-reported control motivation in the facial blocking condition was slightly lower compared with the visual perception condition, but this difference failed to reach statistical significance ($p = .12$). However, participants in the facial blocking condition did show significantly lower control motivation than participants in the emotion suppression condition ($p < .001$) and the stimulus reappraisal condition ($p < .001$). Participants in the emotion suppression and stimulus reappraisal conditions did not significantly differ in their levels of self-reported control motivation ($p = .62$). These results are consistent with the assumption that the effects of emotion suppression and stimulus reappraisal involved intentional processes, whereas the effect of facial blocking involved unintentional processes.

Recollective Memory

To investigate potential effects of task instructions on participants' memory for CS-US pairings, we calculated a score reflecting the proportion of correct responses on the recognition task.[6] Overall, recognition memory was significantly above the chance-level of 12.5% with an average of 64%, $t(307) = 23.31$, $p < .001$. However, recognition memory varied considerably with a minimum of 0% and a maximum of 100% ($SD = .38$). Overall, recollective memory was positively correlated with EC effects on the evaluative rating measure, $r = .51$, $p < .001$ and with EC effects on the evaluative priming measure, $r = .20$, $p < .001$, with the former correlation being significantly larger than the latter ($Z = 6.48$, $p < .001$). Submitted to a univariate ANOVA with Task Instructions as independent variable, recollective memory scores revealed significant differences across the four experimental conditions, $F(3, 304) = 3.34$, $p = .02$, $\eta_p^2 = .032$ (see Table 1). Post hoc LSD tests indicated that recollective memory was more accurate in the visual perception condition compared with the other three conditions (all *p*s < .05). There were no significant differences in recollective memory between the emotion suppression, stimulus reappraisal, and facial blocking conditions (all *ps* > .34).

[5] To provide further support for our conclusion that the three control strategies failed to reduce EC effects on the evaluative priming measure, we calculated Bayes factors for differences in EC effects in each of the three experimental conditions compared with baseline (see Rouder, Speckman, Sun, Morey, & Iverson, 2009). Using the recommended default of $r = .707$, scaled JZS Bayes factors in favor of the null hypothesis ranged between 4.74 and 5.77 and Scaled-Information Bayes factors in favor of the null hypothesis ranged from 5.11 to 6.30. Based on Jeffreys's (1961) scale of evidence, these data suggest substantial evidence in favor of a null effect.

[6] Four participants pressed the "Esc" key during the recollective memory task, which skipped to next part of the experiment before they completed the memory task. Because of the incomplete memory data, these participants were excluded from the following analyses.

Table 1
Means and SDs of Self-Reported Control Motivation and Recollective Memory for CS-US Pairings as a Function of Task Instructions (Visual Perception, Emotion Suppression, Stimulus Reappraisal, and Facial Blocking)

	Visual perception	Emotion suppression	Stimulus reappraisal	Facial blocking
Control motivation	4.16[a] (1.61)	4.78[b] (1.69)	4.91[b] (1.27)	3.76[a] (1.82)
Recollective memory	0.75[a] (0.36)	0.60[b] (0.39)	0.57[b] (0.38)	0.62[b] (0.39)

Note. *SD*s are printed in brackets. Mean values within rows that do not share the same superscript are significantly different from each other. CS-US = conditioned stimulus-unconditioned stimulus.

Supplementary Analyses

Earlier findings by Gawronski et al. (2014) suggest that EC effects on self-reported evaluations can be the result of two functionally distinct processes: (a) a memory-related process that involves the use of one's recollective memory for CS-US pairings in judging the valence of the CS, and (b) a response-related process that involves the reliance on one's spontaneous evaluative response to the CS in judging the valence of the CS. This distinction between memory-related and response-related processes is consistent with the current findings, showing that the three control strategies reduced recollective memory for CS-US pairings and EC effects on self-reported evaluations without affecting spontaneous responses to the CSs in the evaluative priming task. Moreover, the corresponding pattern for recollective memory and EC effects on self-reported evaluations suggests that reduced levels of recollective memory may at least partially account for the obtained reductions in EC effects on the self-report measure. To test this hypothesis, we conducted an analysis of covariance (ANCOVA) with Task Instructions as a fixed factor and EC effects on self-reported evaluations as a dependent variable including recollective memory as a covariate. Consistent with the hypothesized contribution of memory-related processes to self-reported CS evaluations, recollective memory showed a statistically significant main effect in the ANCOVA, $F(1, 303) = 99.98$, $p < .001$, $\eta_p^2 = .248$. However, the effect of Task Instructions was still marginally significant after controlling for recollective memory, $F(3, 303) = 2.60$, $p = .05$, $\eta_p^2 = .025$, suggesting that variations in recollective memory do not fully account for the obtained effects of task instructions. Indeed, whereas EC effects in the emotion suppression and facial blocking conditions did not significantly differ from EC effects in the visual perception condition after controlling for recollective memory (*p*s = .44 and .18, respectively), EC effects in the stimulus reappraisal condition were still significantly different from baseline ($p = .007$). Nevertheless, the involvement of recollective memory as a mediator of the obtained reductions in EC effects was supported by a series of Sobel tests, showing significant indirect paths via recollective memory for stimulus reappraisal ($Z = 3.34$, $p < .001$) and facial blocking ($Z = 2.06$, $p = .04$) and a marginally significant indirect path for emotion suppression ($Z = 1.84$, $p = .07$). Taken together, these results suggest that the three control strategies influenced EC effects on self-reported evaluations by reducing recollective memory for CS-US pairings, although stimulus reappraisal had an additional influence on EC effects that was unrelated to recollective memory.

To further explore the contribution of memory-related and response-related processes to EC effects on self-reported evaluations, we also conducted a second ANCOVA that included EC effects on the evaluative priming task as an additional covariate over and above recollective memory. Consistent with the assumption that recollective memory for CS-US pairings and spontaneous evaluative responses to the CSs can independently contribute to EC effects on self-reported evaluations, the ANCOVA showed a significant effect of recollective memory, $F(1, 302) = 89.98$, $p < .001$, $\eta_p^2 = .230$, and a marginally significant effect of EC effects on the evaluative priming task, $F(1, 302) = 2.95$, $p = .09$, $\eta_p^2 = .010$. The effect of Task Instructions remained statistically significant after controlling for recollective memory and EC effects on the evaluative priming task, $F(3, 302) = 2.73$, $p = .04$, $\eta_p^2 = .026$. Replicating the pattern obtained in the ANCOVA using recollective memory as a covariate, EC effects in the emotion suppression and facial blocking conditions did not significantly differ from EC effects in the visual perception condition after controlling for recollective memory and EC effects on the evaluative priming task (*p*s = .43 and .17, respectively). However, EC effects in the stimulus reappraisal condition were still significantly different from baseline ($p = .006$). The involvement of recollective memory as a mediator of control effects was again supported by a series of Sobel tests, showing significant indirect paths via recollective memory for stimulus reappraisal ($Z = 3.33$, $p < .001$) and facial blocking ($Z = 2.07$, $p = .04$) and a marginally significant indirect path for emotion suppression ($Z = 1.78$, $p = .07$). In addition to corroborating the mediating role of recollective memory for the effects of the three control strategies, these results provide further support for the assumption that recollective memory for CS-US pairings and spontaneous evaluative responses to the CSs can serve as functionally independent sources of EC effects on self-reported evaluations (see Gawronski et al., 2014).[7]

[7] Because some research suggests that EC effects depend on recollective memory for the valence of the US that had been paired with a given CS rather than memory for the nominal US (e.g., Stahl, Unkelbach, & Corneille, 2009), we also calculated an index of US valence memory on the basis of US recognition judgments that were consistent with the valence of the US that had been paired with a given CS (see Walther & Nagengast, 2006). The results for US valence memory replicated the ones obtained for US identity memory. Nevertheless, we consider US identity memory the more diagnostic measure, because (a) US identity memory has been shown to capture the same variance that is shared between US valence memory and EC effects (see Stahl et al., 2009), and (b) measures of US valence memory can be contaminated by valence-based guessing on the basis of the evaluative response that is elicited by the CS (see Bar-Anan & Amzaleg-David, in press).

Discussion

The main goal of the current research was to investigate the controllability of EC by testing the effectiveness of three emotion-focused strategies in preventing the acquisition of conditioned preferences: (a) suppression of emotional reactions to the US, (b) reappraisal of the valence of the US, and (c) facial blocking of emotional responses. Our results showed that, although all three strategies reduced EC effects on self-reported evaluations, EC effects on an evaluative priming task remained unaffected. These findings suggest that emotion-focused control strategies during the encoding of CS-US pairings can influence the expression of CS evaluations through judgment-related processes. However, these strategies seem to be ineffective in preventing the acquisition of conditioned preferences, in that they fail to reduce EC effects on spontaneous evaluative responses. Thus, counter to recent claims that EC effects are the result of nonautomatic learning processes (e.g., De Houwer, 2009; Mitchell et al., 2009), the current findings provide further evidence that the acquisition of conditioned preferences is rather difficult to control.

The current research expands on earlier findings by Gawronski et al. (2014) showing a similar dissociation when participants were instructed to either prevent or promote the influence of CS-US pairings. Whereas EC effects on self-reported evaluations varied in line with instructions to prevent or promote the influence of CS-US pairings, EC effects on an evaluative priming measure remained unaffected by control instructions. However, a potential concern about Gawronski et al.'s finding is that participants were not provided with any information on how to control effects of CS-US pairings. Thus, although participants had the goal to control the acquisition of conditioned preferences, their success in accomplishing this task might have been undermined by the lack of a suitable strategy or the spontaneous use a suboptimal strategy. The current study addressed this limitation by investigating the effectiveness of three specific strategies in preventing the acquisition of conditioned preferences. All three of these strategies produced the same pattern of results obtained by Gawronski et al., such that they reduced EC effects on self-reported evaluations, but not EC effects on an evaluative priming measure.

Another noteworthy aspect of our findings is that the effectiveness of the three control strategies did not depend on the level of arousal that was elicited by the US. Based on earlier evidence for valence-arousal interactions in EC (Gawronski & Mitchell, 2014), we were also interested in whether the three control strategies would be less effective for EC effects resulting from USs that elicit high levels of arousal. This hypothesis was based on the assumptions that it might be more difficult to (a) suppress emotional reactions to highly arousing stimuli, (b) reappraise the valence of highly arousing stimuli, and (c) block facial expressions of emotional reactions to highly arousing stimuli. These hypotheses were not supported in the current study. Although we did replicate Gawronski and Mitchell's (2014) finding that EC effects on self-reported evaluations were larger for high-arousal USs than low-arousal USs, the effectiveness of the three control strategies did not depend on the level of arousal elicited by the US.

The current research expands on earlier findings by Delgado, Nearing, LeDoux, and Phelps (2008) showing that reappraisal can effectively reduce the acquisition of skin conductance responses (SCR) in fear conditioning. However, different from Delgado et al.'s focus on conditioned changes in arousal responses, the current research was concerned with conditioned changes in evaluative responses. This difference is important, because the two kinds of conditioning effects are characterized by distinct functional properties (Gawronski & Mitchell, 2014). The current findings provide further evidence for their functional differences, in that reappraisal seems to be effective in preventing the acquisition of conditioned arousal responses (Delgado et al., 2008), but not the acquisition of conditioned preferences. This conclusion has significant implications for applications of conditioning research in clinical contexts (e.g., reduction of fear responses), because it suggests that evaluative responses and arousal responses may have to be targeted independently with distinct treatments. Future research combining measures of evaluative responses and arousal responses in the same study may help to provide deeper insights into the relative effectiveness of different strategies in preventing the acquisition of conditioned responses.

Effects on Self-Reported Evaluations

Although the primary goal of the current research was to investigate the effectiveness of emotion-focused strategies in preventing the acquisition of conditioned preferences, our supplementary analyses also provide some insights into the mechanisms by which these strategies influenced self-reported CS evaluations. Specifically, our findings indicate that all three strategies impaired recollective memory for CS-US pairings, which in turn reduced EC effects on self-reported evaluations. However, an open question is why the three strategies affected participants' memory in the observed manner. One possibility is that the additional task requirements imposed a higher load on participants' cognitive capacity, thereby reducing their residual capacity for the processing of the CS-US pairings (see Davies et al., 2012; Pleyers et al., 2009). Such an interpretation seems quite plausible for the effects of emotion suppression and stimulus reappraisal, both of which involve the engagement of executive control. However, cognitive load seems less likely to account for the effects of facial blocking, given that passively holding a chopstick in one's mouth does not require a large amount of cognitive capacity.[8]

An alternative mechanism is implied by research showing that the identification of emotional stimuli is impaired when the elicitation of emotional responses is disrupted (e.g., Davis et al., 2010; Hawk et al., 2012; Niedenthal et al., 2001; Oberman et al., 2007). To the extent that the disruption of emotional responses undermined the identification of the USs, recollective memory for the CS-US pairings should be impaired, thereby undermining the emergence of EC effects resulting from the use of recollective memory in judging the valence of the CSs. However, such memory impairments do not seem to disrupt the acquisition of conditioned preferences, in that they did not reduce EC effects on spontaneous evaluative responses. This finding is consistent with evidence showing that, although

[8] An alternative possibility is that the facial blocking instructions interfered with the preceding visual perception instructions, in that they directed participants' attention away from the CS-US pairings. However, such attentional shifts should reduce EC effects on both the evaluative rating and the evaluative priming measure, given that even lower-level associative processes depend on attention to the relevant stimuli (see Rescorla & Wagner, 1972).

recollective memory can contribute to EC effects, it is not required for the emergence of EC effects (e.g., Balas & Gawronski, 2012; Hütter et al., 2012).

Another interesting question concerns the mechanisms by which stimulus reappraisal reduced EC effects on self-reported evaluations over and above the mediating role of recollective memory. One possibility is that participants in the reappraisal condition felt ambivalent about the CSs because of the conflicting implications of actual US valence and the outcome of their reappraisal. Such ambivalence could lead to confusion about how to respond on the self-report measure, thereby reducing the size of EC effects. Although the mediating mechanisms of reduced EC effects on self-reported evaluations were not the primary focus of the current research, it is important to reiterate that neither of the three control strategies qualified EC effects on spontaneous evaluative responses. Thus, regardless of the mechanisms that led to stronger reductions of EC effects on self-reported evaluations in the reappraisal condition, these mechanisms seem to be ineffective in preventing the acquisition of conditioned preferences.

Theoretical Implications

The current findings have two major implications. First, they provide further evidence for the hypothesis that the acquisition of conditioned preferences is rather difficult to control (see Gawronski et al., 2014), counter to what might be expected on the basis of recent research showing that the mechanisms underlying EC are characterized by various features of nonautomatic processing (e.g., Corneille et al., 2009; Davies et al., 2012; Pleyers et al., 2009). Second, the differential effects of task instructions provide further support for functionally distinct contributions of memory-related and response-related processes to EC effects (see Gawronski et al., 2014). Although the three control strategies reduced recollective memory for CS-US pairings, none of them reduced EC effects on the evaluative priming measure. Together, these findings suggest that EC effects on the evaluative priming measure are functionally independent of recollective memory for CS-US pairings, in that reductions in recollective memory do not necessarily lead to corresponding changes in spontaneous evaluative responses to the CSs (for related findings, see Fulcher & Cocks, 1997; Hütter et al., 2012). At the same time, recollective memory for CS-US pairings and spontaneous evaluative responses to the CS may independently contribute to EC effects on self-reported evaluations, such that either one of them may serve as a basis for evaluative judgments of the CS. That is, people may use either (a) their recollective memory for CS-US pairings or (b) their spontaneous evaluative responses to the CS (or both) when judging the valence of the CS.

In our view, the independent contributions of memory-related and response-related processes are most parsimoniously explained by the distinction between associative and propositional processes (Gawronski & Bodenhausen, 2011). According to this interpretation, uncontrollable effects of CS-US pairings on spontaneous evaluative responses may be driven by an associative process of automatic link formation, whereas the contribution of recollective memory to self-reported CS evaluations reflects the nonautomatic use of propositional knowledge about CS-US relations. These two processes seem to be characterized by different functional properties, in that emotion-related control strategies undermine the acquisition of propositional knowledge about CS-US relations without disrupting the formation of evaluative associations. This conclusion is consistent with recent findings by Moran and Bar-Anan (2013), showing that repeated CS-US pairings can influence spontaneous evaluative responses even when self-reported evaluative judgments are qualified by propositional knowledge about the particular relation between the CS and the US (e.g., whether the CS causes or prevents the US). Together, these findings suggest that mental transformations of CS-US pairings during encoding (e.g., stimulus reappraisal, inferences about CS-US relations) may qualify the content of stored propositional knowledge about CS-US relations, but such transformations seem to be ineffective in disrupting the formation of unqualified associations. Thus, future research might benefit from treating EC as the product of multiple processes with distinct functional properties rather than the outcome of a single process (see De Houwer, 2007; Gawronski & Bodenhausen, 2011; Jones, Olson, & Fazio, 2010).

Potential Objections and Future Directions

Although the current findings suggest that the three strategies are ineffective in preventing the acquisition of conditioned preferences, it is important to address a few potential objections against this interpretation. First, one could argue that the current study did not include direct manipulation checks for the implementation of the three control strategies; therefore, leaving the possibility that participants did not follow our instructions during the encoding of CS-US pairings. In response to this concern, it is important to note that the three strategies effectively reduced recollective memory for CS-US pairings. In our view, the most parsimonious explanation for this finding is that participants did follow our instructions and that their efforts influenced the encoding of the CS-US pairings. Otherwise, there should have been no impairments of recollective memory resulting from the three control strategies. Thus, although there is no direct evidence in the form of corresponding manipulation checks, the current findings provide compelling indirect evidence that participants complied with our instructions.

Second, one could argue that the evaluative priming measure may have been insufficiently reliable, thereby undermining the possibility to detect effects of the three strategies. Although it is correct that priming tasks tend to suffer from low reliability (Gawronski & De Houwer, 2014), the evaluative priming measure in the current study showed reliable effects of CS-US pairings and significant correlations with self-reported CS evaluations. Neither of these outcomes should emerge if the priming measure suffered from low reliability. Moreover, the sample size of the current study ($N = 312$) was more than six times larger than the average sample size of approximately 50 participants in prototypical EC studies (see Hofmann et al., 2010), thereby providing high statistical power to detect even small effects of the three control strategies. Thus, low reliability of the evaluative priming measure seems unlikely to account for the obtained pattern of results. Nevertheless, future research using different measures of spontaneous evaluative responses may help to corroborate the generality of the obtained effects.

Third, one might wonder if memory-related reductions in EC effects on self-reported evaluations indicate a potential contribution of experimenter demand. In line with this concern, it is possible that participants relied on their recollective memory, because they assumed that the experimenter expected them to evaluate the CSs on the basis of the CS-US pairings. To the extent that the three control strategies interfered with the encoding of the pairings, recollective memory should be reduced, thereby reducing demand effects resulting from the use of recollective memory. In response to this concern, it is worth noting that the use of recollective memory for evaluative judgments is perfectly consistent with propositional accounts of EC and does not necessarily indicate a demand effect (De Houwer, 2007). More important, the possibility of a demand effect on self-reported evaluations does not qualify our main conclusion that the acquisition of conditioned preferences is rather difficult to control. After all, EC effects on the evaluative priming measure were (a) unaffected by the three control strategies and (b) unrelated to the observed reductions in recollective memory. Thus, although more research is needed to clarify the psychological nature of memory-related reductions in EC effects on self-reported evaluations, the current findings provide clear evidence for the ineffectiveness of the three control strategies in preventing the acquisition of conditioned preferences.

Finally, the current research focused on three specific strategies, and therefore, does not rule out the possibility that other strategies are more effective in preventing the acquisition of conditioned preferences. Our concern with emotion-focused strategies was inspired by the idea that attempts to control the acquisition of conditioned preferences might be more effective with proactive strategies that prevent the elicitation of an affective response to the US compared with reactive strategies that aim at preventing the transfer of an elicited affective response to a co-occurring CS. Our findings suggest that even proactive strategies are suboptimal, in that they reduce EC effects on verbal judgments, but not EC effects on spontaneous evaluative responses. Nevertheless, future research may help to further clarify the (un)controllability of EC by testing the effectiveness of other strategies. Potential candidates in this regard might be attempts to deliberately disengage attention from emotional processing (Sheppes & Gross, 2011) and viewing the USs from a removed, objective point of view (Kross & Ayduk, 2011).

Conclusion

In summary, the current findings suggest that repeatedly encountered stimulus pairings can influence spontaneous evaluative responses in a manner that is rather difficult to control. Although it is possible to monitor and control the impact of these responses on judgments and decisions, preventing the acquisition of conditioned preferences seems to be a much more challenging task. From this perspective, the accumulating evidence for nonautomatic features of EC does not mean that we can ignore concerns about the effects of repeated stimulus pairings in commercial advertisements and negative campaigns. Even if we are able to suppress our emotional experiences, reappraise the stimulus event, or successfully block the facial expression of emotional responses, repeated co-occurrences of stimuli may nevertheless influence our spontaneous evaluative responses in a manner that is consistent with the observed pairings.

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Appendix A

Normative Ratings of Valence and Arousal of the International Affective Picture System Images Used as Unconditioned Stimuli (Lang, Bradley, & Cuthbert, 2008)

			All subjects		Men		Women	
US valence	US arousal	Image	Valence	Arousal	Valence	Arousal	Valence	Arousal
Positive	Low	Girl (2,035)	7.52	3.69	7.07	3.34	7.79	3.90
		Nature (5,760)	8.05	3.22	7.69	2.77	8.41	3.67
Positive	High	Sky Divers (5,621)	7.57	6.99	7.28	6.96	7.80	7.00
		Rollercoaster (8,492)	7.21	7.31	7.36	7.07	7.11	7.48
Negative	Low	Elderly woman (2,590)	3.26	3.93	3.04	4.00	3.46	3.86
		Cemetery (9,001)	3.10	3.67	3.41	3.74	2.82	3.60
Negative	High	Snake (1,050)	3.46	6.87	3.90	6.84	3.02	6.90
		Aimed gun (6230)	2.37	7.35	2.73	7.10	2.06	7.56

(*Appendices continue*)

Appendix B

Instructions for the Evaluative Conditioning Task in the Four Experimental Conditions

Visual Perception

The current study investigates visual perception. For this purpose, you will be presented with images that will appear sequentially on the screen. Some of the images will be computer-generated drawings; other images will be photographs. Your task is to pay close attention to these images. We will later ask you a number of questions about the images that you have seen. The visual perception task will take approximately 5 min. Please pay close attention to the images throughout the entire task. When you are ready to start, please click "continue."

Emotion Suppression

The current study investigates visual perception. For this purpose, you will be presented with images that will appear sequentially on the screen. Some of the images will be computer-generated drawings; other images will be photographs. Your task is to pay close attention to these images. We will later ask you a number of questions about the images that you have seen. The visual perception task will take approximately 5 min. Please pay close attention to the images throughout the entire task. VERY IMPORTANT: Please note that the feelings elicited by the photographs can influence subsequent responses to the computer-generated drawings. In the current study, we are interested in how well people can avoid such biasing effects. For this purpose, please try your absolute best to SUPPRESS your emotional responses to the photographs. To accomplish this, please use a specific strategy whereby you do your best not to show any feelings in response to the photographs. Please hide your emotions so that an observer would not know you were feeling anything at all. In other words, when viewing the photographs, please keep your face still so that someone watching your face would be unable to detect what you are experiencing subjectively. When you are ready to start, please click "continue."

Stimulus Reappraisal

The current study investigates visual perception. For this purpose, you will be presented with images that will appear sequentially on the screen. Some of the images will be computer-generated drawings; other images will be photographs. Your task is to pay close attention to these images. We will later ask you a number of questions about the images that you have seen. The visual perception task will take approximately 5 min. Please pay close attention to the images throughout the entire task. VERY IMPORTANT: Please note that the feelings elicited by the photographs can influence subsequent responses to the computer-generated drawings. In the current study, we are interested in how well people can avoid such biasing effects. For this purpose, please try to form a POSITIVE impression of any NEGATIVE photographs by interpreting the scenario depicted in positive terms. And please try to form a NEGATIVE impression of any POSITIVE photographs by interpreting the scenario depicted in negative terms. When you are ready to start, please click "continue."

Facial Blocking

The current study investigates visual perception. For this purpose, you will be presented with images that will appear sequentially on the screen. Some of the images will be computer-generated drawings; other images will be photographs. Your task is to pay close attention to these images. We will later ask you a number of questions about the images that you have seen. The visual perception task will take approximately 5 min. Please pay close attention to the images throughout the entire task. VERY IMPORTANT: Before you begin, please take the chopsticks beside the monitor and remove them from the paper packaging. Put the chopsticks horizontally in your mouth as shown in the image below [*PICTURE DISPLAYED*]. Please hold the chopsticks with your lips (not with your teeth). It is important that you keep the chopsticks in your mouth until we tell you that you can throw them away. When you are ready to start, please click "continue."

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