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What You See Is What Will Change:  
Evaluative Conditioning Effects Depend on a Focus on Valence

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## Abstract

It was investigated whether evaluative conditioning (EC) effects depend on an evaluative focus during the learning phase. An EC effect is a valence change of an originally neutral stimulus (conditioned stimulus or CS) that is due to the former pairing with a positive or negative stimulus (unconditioned stimulus or US). In three experiments the task focus during the conditioning phase was manipulated. Participants judged CS-US pairings either with respect to their valence or with respect to another stimulus dimension. EC effects on explicit and implicit measures were found when valence was task relevant but not when the non-valent stimulus dimension was task relevant. Two accounts for the valence focus effect are proposed: (1) An additional direct learning of the relation of CS and evaluative responses in the valence focus condition, or (2) a stronger activation of US valence in the valence focus condition compared to the non-valent focus condition.

## What You See Is What Will Change:

## Evaluative Conditioning Effects Depend on a Focus on Valence

Imagine that you walk through your hometown and suddenly you observe your hated landlord talking to your new colleague, whom you do not really know yet. If, after this observation you find your new colleague dislikeable, it could be due to evaluative conditioning (EC). An EC effect is the valence change of an originally neutral stimulus (conditioned stimulus or CS, or in this case the colleague) that is due to the former joint presentation with a positive or negative stimulus (unconditioned stimulus or US, or in this case the landlord). Typically, the valence of the CS changes into the direction of the US (for a review see for example De Houwer, Thomas, and Baeyens, 2001).

EC effects, however, are not entirely robust, and some authors report failures to find them (Rozin, Wrzesniewski, & Byrnes, 1998). The preconditions under which EC effects are found are not yet fully understood (De Houwer, Baeyens, & Field, 2005). Although some authors assume that EC effects are based on entirely automatic association formation, they could depend on an evaluative goal or evaluative task focus during the learning phase. We will argue that an evaluative goal or task induces a “valence focus”, a generalized tendency to attend to valent features of an object and to evaluate objects. This valence focus might increase evaluative conditioning effects. As far as we know, this possibility has not been addressed yet.

In our example, this would mean that you are more likely to change the evaluation of your colleague due to observing him with the landlord if you are in a valence focus. The valence focus might be due to being asked about the likeability of the landlord and the colleague, but it might also be due to some other evaluative task or goal that you were busy with when you noticed the colleague and the landlord. For example, considering whether you

like a pair of shoes that you just saw, or how you should rate a student's thesis might increase your valence focus and therefore the EC effect on the colleague. If, on the other hand, you were busy with some less evaluative task – returning empty bottles to the supermarket for example – it might be less likely that your colleague is evaluatively conditioned.

Why, however, should EC effects depend on an evaluative focus? It is often claimed that stimuli are evaluated automatically (e.g. Bargh, Chaiken, Govender, & Pratto, 1992; Murphy & Zajonc, 1993; Zajonc, 1980). Specifically, it has been argued that a goal to evaluate is not necessary for evaluation (Bargh, Chaiken, Raymond, & Hymes, 1996). If stimuli are evaluated independently from a goal to evaluate, there is no reason to assume that EC effects depend on such a goal.<sup>1</sup>

Yet, the opinions on whether stimulus evaluation is goal dependent are mixed. Several studies showed that affective priming effects occur only if the response task is to evaluate the targets and not if the response task is to judge a non-valent stimulus feature (De Houwer, Hermans, Rothermund, & Wentura, 2002; Klauer & Musch, 2002). Recent work by Spruyt and colleagues indicates that automatic evaluation as shown by an affective priming effect depends on a context in which evaluation is required as a default task (Spruyt, De Houwer, Hermans, & Eelen, 2007; Spruyt, De Houwer, & Hermans, 2009). Independent from the task in the current trial, affective priming effects only occurred if targets had to be evaluated in the majority of the trials. This shows that it is relevant for the processing of evaluative information whether people are in a general valence focus.

That conditioning can be influenced by modulating attention to the to be conditioned feature was recently shown by Olson and colleagues – albeit not for *evaluative* conditioning (Olson, Kendrick, & Fazio, 2009; see Eitam, Schul, & Hassin, 2009, for a similar result in the domain of implicit grammar learning). The authors showed that non-valent stimulus characteristics of a US (e.g., size) can be conditioned on a CS if (and only if) the relevant

stimulus dimension (size) is primed. The authors did not investigate whether *evaluative* conditioning (EC) effects are influenced by priming of valence. In their study, EC effects occurred without priming, which is in line with most of previous EC research. Nevertheless, it is possible that EC effects are *increased* by increasing the focus on valence. It is also possible that EC effects are *decreased* if the focus is directed to another stimulus dimension.

An indication that attentional modulation of the evaluative dimension could affect also *evaluative* conditioning effects comes from studies investigating the influence of cognitive or attentional load. Recent studies showed that executing a secondary task decreases EC effects (Field & Moore, 2005; Pleyers, Corneille, Yzerbyt, & Luminet, 2009; but see also Fulcher & Hammerl, 2001; Walther, 2002, for opposite results<sup>2</sup>). Pleyers and colleagues showed that this result is due to a reduction of contingency awareness in the condition with cognitive load, which in turn leads to decreased EC effects. Field and Moore also showed a disruptive influence of distraction on EC effects. In their study, however, the disruptive effect seemed not to be due to a reduction of contingency awareness. The authors discuss the possibility that the distraction task instead specifically undermined valence processing. Following these two lines of explaining the disruptive effect of attentional load, we think that distraction can forestall EC effects via two routes: By preventing contingency learning (Pleyers et al., 2009), and by preventing attention to valence (Field & Moore, 2005). It is this latter influence of attention to valence on EC effects that we focus on in the current research.

If evidence for a valence focus effect is found, it possibly has a moderating influence in many examples of EC effects. The way we regularly speak about what we like and what we don't like shows how casually valence is hinted at in everyday life – and in experiments, for example, by introducing the experiment in a certain manner or by asking participants to pre-rate the stimuli<sup>3</sup>. If a factor that can be installed so inconspicuously actually moderates EC effects it might be a candidate for explaining unresolved contradictions in EC research.

To address the question whether a valence focus influences evaluative conditioning, we manipulated the task participants were given during the conditioning phase. We will now report the results of three experiments in which participants either had the task to judge stimuli concerning valence or concerning a non-valent dimension.

### Experiment 1

The task focus in this experiment was operationalized by asking participants to judge the portraits presented as CSs and USs during the conditioning phase either with regard to their valence (likeability) or to a non-valent-dimension (geographic origin).

Each participant saw a number of positive and negative conditioning trials, in which a neutral picture (CS) was combined with a positive or negative picture (US). During each conditioning trial participants had to make a decision on the CS-US-pair. While participants in the valence task group had to judge whether the two people are rather likeable or rather dislikeable, participants in the non-valent task group had to judge whether the two persons depicted came more likely from the north or the south of Germany (north-south task).

### *Method*

#### *Participants and Design*

Fifty-six students from different faculties of the University of Jena participated in the experiment and were compensated with a bar of chocolate and a piece of fruit. Data from seven participants were excluded from analysis either due to technical problems during the experiment (two participants) or because individual stimulus ratings made the conditioning phase impossible, see below (five participants).<sup>4</sup> Thirty-six of the remaining participants were women. Ages ranged from 18 to 30 years ( $M = 23.10$ ,  $SD = 2.84$ ). Participants were randomly assigned to one of two groups of a 2 (conditioning task: valence task, north-south task) by 2 (US-valence in pairing: positive, negative) mixed design with the first factor varying between participants and the second within participants.

### *Material*

Pictures used as CSs and USs were color portraits taken from the database of Minear and Park (2004), cut to depict the face and neck of a person. The set from which CSs and USs were selected individually (see pre-conditioning rating below) consisted of 50 pictures, about half of them depicting women. The pictures were preselected so that the set contained portraits that were likeable, neutral, and dislikeable for most participants. The program for this and the following experiments was developed with the software E-prime.

### *Procedure*

Participants were tested in a laboratory at the campus of the University of Jena. They were seated in front of a computer screen from which they received all instructions. They were informed that they were about to participate in a study on person perception. The experiment consisted of three main phases, the pre-conditioning rating, the conditioning phase, and the post-conditioning rating. It lasted about 15 minutes.

*Pre-conditioning rating.* All participants were informed that they would see some portraits and that their task would be to indicate their likeability. They were encouraged to give their subjective impression but at the same time to be as precise as possible. The 50 portraits were shown in random order one by one on the screen with a scale consisting of 19 green squares below them. The endpoints were labelled “positive” and “negative” (ratings were scored from -9 to +9). The middle square was marked “neutral”. Participants could indicate their judgment by clicking on one of the squares. As this pre-rating might have brought all participants already into an evaluative focus before entering the conditioning phase, we asked them to complete a filler task after the pre-conditioning rating. In this filler task, participants saw 50 different portraits and had to indicate on a 19-point scale whether they think it is more likely that the person depicted comes from the north or the south of Germany.

*Conditioning phase.* The pre-conditioning ratings were used to select pictures for the conditioning phase individually. The four pictures evaluated most neutrally by a participant were selected as CSs. In the first step pictures with ratings of 0 were selected, if not enough, also pictures with ratings of -1 and +1, and if still not enough, also ratings of -2 and +2. If more pictures than necessary were available in one step the choice was randomized. Following the same principle, the two most positively rated pictures and the two most negatively rated pictures were selected as positive USs ( $US_{pos}$ ) and negative USs ( $US_{neg}$ ), respectively. Only pictures with ratings between +3 and +9 and between -9 and -3 were considered as USs. If not enough pictures were available for one of the stimulus types the experiment stopped at this point. As mentioned before, this was the case for five participants. Two positive and two negative CS-US-pairs were constructed by randomly assigning one of the neutral pictures to one of the positive or negative pictures. At the beginning of the conditioning phase, participants were instructed to form an impression of the upcoming picture pairs and to make one judgment on each pair. Depending on task condition, they were either asked to indicate whether their impression of the pair of the two people is rather “positive” or rather “negative” (valence task condition) or to indicate whether they can rather imagine that the pair of the two people comes from the north or the south of Germany (north-south task condition), and press one of two marked keys (‘X’ and ‘M’) accordingly. In each conditioning trial, CS and US appeared on the screen simultaneously; the CS always appeared on the left side, the US always on the right side of the screen. Both stimuli stayed on the screen for 2500 ms while the participant had to respond. When the response was entered two small lines appeared below the stimuli, indicating that the response was recorded. Only after the 2500 ms, the participant’s decision was indicated below the stimuli and stayed there with the stimuli for 1000 ms. The next trial was initiated after an inter-trial interval of 4000 ms. In one conditioning cycle all four CS-US pairs were shown once in random order. The



conditioning phase consisted of six conditioning cycles. Altogether there were thus 24 conditioning trials. The conditioning phase lasted three minutes.

*Post-conditioning rating.* After a break of 40 seconds, participants were instructed to rate the likeability of the depicted persons again. First the four CSs and then the four USs were rated in random order on the same scale as for the pre-conditioning rating.

*Contingency awareness measure.* Contingency awareness was assessed with a forced choice procedure. Participants were asked to indicate for each CS one by one with which US they thought it was shown. For this, the CS was presented in the middle of the screen surrounded by all four USs in the corners of the screen. The location of the correct and incorrect USs was randomized. Next to each US a number from 1 to 4 was shown. Participants had to type in the number of the US, which they thought was paired with the CS.

## Results

### *US Ratings*

We calculated mean evaluations for US<sub>pos</sub> and US<sub>neg</sub> separately for the ratings before and after the conditioning phase. US<sub>pos</sub> were clearly positive and US<sub>neg</sub> were clearly negative both before and after the conditioning phase (preconditioning US<sub>pos</sub>:  $M = 6.46$ ,  $SD = 1.39$ ; preconditioning US<sub>neg</sub>:  $M = -6.56$ ,  $SD = 1.75$ ; postconditioning US<sub>pos</sub>:  $M = 5.17$ ,  $SD = 2.25$ ; postconditioning US<sub>neg</sub>:  $M = -4.22$ ,  $SD = 2.72$ ). Not surprisingly, US<sub>pos</sub> were more positive than US<sub>neg</sub>,  $F(1,46) = 727.98$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = .94$ . This valence difference interacts with time of rating,  $F(1,46) = 38.61$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = .46$ , indicating that the USs were less extreme after conditioning. US valence in no way interacted with task condition, all  $F$ 's  $< 1$ .

### *CS Ratings (EC Effect)*

We calculated mean evaluations for CSs paired with a positive US (CS<sub>pos</sub>) and CSs paired with a negative US (CS<sub>neg</sub>) separately for the ratings before and after conditioning. To simplify and because the CS evaluations before the conditioning phase were very close to 0

( $CS_{\text{pos}}$ :  $M = -0.02$ ,  $SD = 0.31$ ;  $CS_{\text{neg}}$ :  $M = 0.02$ ,  $SD = 0.31$ ), statistical tests and reports are based on evaluative change scores (postrating - prerating). Means of these change scores for all conditions are shown in Figure 1. Based on these change scores a 2 (US-valence in pairing:  $CS_{\text{pos}}$ ,  $CS_{\text{neg}}$ , within)  $\times$  2 (conditioning task: valence task, north-south task, between) ANOVA was calculated. There was a main effect of US-valence in pairing (EC effect),  $F(1,47) = 15.07$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = .24$ .  $CS_{\text{pos}}$  ( $M = 1.36$ ,  $SD = 2.28$ ) changed into a more positive direction than  $CS_{\text{neg}}$  ( $M = -0.28$ ,  $SD = 2.05$ ). This main effect interacted with task condition,  $F(1,47) = 10.42$ ,  $p < .01$ ,  $\eta^2_{\text{partial}} = .18$ . In the valence task condition the difference between  $CS_{\text{pos}}$  ( $M = 2.02$ ,  $SD = 1.89$ ) and  $CS_{\text{neg}}$  ( $M = -0.92$ ,  $SD = 2.02$ ) was more pronounced than the difference between  $CS_{\text{pos}}$  ( $M = 0.67$ ,  $SD = 2.47$ ) and  $CS_{\text{neg}}$  ( $M = 0.40$ ,  $SD = 1.91$ ) in the north-south task condition. The simple EC effect was only significant in the valence task condition,  $t(24) = 5.40$ ,  $p < .001$ ,  $d = 1.08$ , but not in the north-south task condition  $t(23) = 0.43$ ,  $ns$ ,  $d = -0.09$ .

(Figure 1 about here)

#### *Contingency Awareness*

Memory for CS-US-pairings was generally relatively good. On average, participants selected the correct US for 3.33 ( $SD = 1.09$ ) out of 4 CSs. A CS-US contingency awareness score (number of CSs for which the participant selected the right US) was not related to the strength of the EC effect,  $\beta = -0.11$ ,  $t(47) = -0.74$ ,  $ns$ . To test the possible mediating role of contingency awareness on the influence of task condition on the EC effect, we performed a mediation analysis (Baron & Kenny, 1986) with conditioning task as independent variable, contingency awareness score as mediator, and EC effect as dependent variable. Conditioning task significantly predicted the size of the EC effect,  $\beta = 0.43$ ,  $t(47) = 3.23$ ,  $p < .01$ , and it also had an influence on the level of contingency awareness,  $\beta = 0.34$ ,  $t(47) = 2.44$ ,  $p < .05$ , with contingency awareness being somewhat higher in the evaluative task condition ( $M = 3.68$ ,  $SD$

= 0.69) than in the north-south task condition ( $M = 2.96$ ,  $SD = 1.30$ ). Level of contingency awareness did influence the EC effect over and above task, but in the opposite direction, i.e. higher contingency awareness was related to smaller EC effects,  $\beta = -0.28$ ,  $t(46) = -2.08$ ,  $p < .05$ . It did also not decrease (but descriptively increase) the regression coefficient of conditioning task ( $\beta = 0.52$ ,  $t(46) = 3.84$ ,  $p < .001$ ). Accordingly, contingency awareness does not mediate but in tendency suppresses the influence of task focus on evaluative conditioning effects, Sobel's  $Z = -1.58$ ,  $p = .11$ .<sup>5,6</sup>

### *Discussion*

The results revealed an EC effect. Formerly neutral faces were evaluated more positively if they had been paired with positive faces in the conditioning phase than if they had been paired with negative faces. This effect interacted with the type of task participants performed during the conditioning phase. An EC effect was found only in the valence task condition but not in the north-south task condition. This is first evidence that EC effects depend on whether participants are in a valence focus or rather focus on other stimulus properties during the learning phase. The EC effect did not interact with CS-US contingency awareness.<sup>7</sup> CS-US contingency awareness did also not mediate the valence focus effect.

What are the cognitive processes behind this modulating influence of task condition? It seems possible that the non-valent task induces a higher level of mental load than the valence task and therefore decreases the capacities for learning. In this case the valence focus effect would be due to a general difference in the learning capacities in the different task conditions. This could explain the valence focus effect, as it has been shown before that mental load reduces EC effects (Field & Moore, 2005; Pleyers et al., 2009). In the study of Pleyers and colleagues this effect was due to decreased CS-US contingency awareness in the mental load condition, which speaks for a reduction of general learning capacities. If our results were based on a similar mechanism this would mean that our valence focus

manipulation does not specifically influence evaluative processing but cognitive processing or learning more generally. In this case, however, the valence focus effect should be mediated by CS-US contingency awareness, which was clearly not the case in this experiment (although the level of CS-US contingency awareness was indeed influenced by the conditioning task). This indicates that the valence focus effect in our experiment was not due to a similar process that influenced EC effects in the study by Pleyers and colleagues.

We showed with this experiment that EC effects can depend on a valence focus. However, there are some limitations to this study: We chose the north-south task because it is valence-free. This is an unusual task and some participants might have felt that they are asked to judge something that they cannot judge. Although we do not think that this can explain the absence of an EC effect we think that a replication with another non-valent dimension might be advisable.

## Experiment 2

The first goal of the study was to replicate the findings of Experiment 1 with another non-valent task. Participants had to judge the age of CS-US pairs. Age is more comparable to valence than geographic origin, because it is more relevant and it can be judged with some certainty<sup>8</sup>.

A second important objective of this experiment was to test whether the valence task's influence on EC effects is also found if CS evaluation is assessed with an implicit measure. We chose the affective priming paradigm. Assessing EC effects with an implicit measure helps to rule out alternative explanations in terms of demand effects.

The CSs used in this experiment were portraits similar to those used in Experiment 1. Different to Experiment 1, USs were adjectives. Another difference is that the material was rated and selected in a preliminary study to avoid that participants were brought into an evaluative focus by pre-rating the stimuli.

## *Method*

### *Participants and Design*

Sixty-four students from different faculties of the University of Jena participated in the experiment and were paid 2 Euro. Depending on their performance in the affective priming task, participants were given an additional bar of chocolate. Ages ranged between 19 and 32 years ( $M = 23.86$ ,  $SD = 3.01$ ). Thirty-nine of the participants were women. Participants were randomly assigned to one of the two groups of a 2 (conditioning task: valence task, age task) by 2 (US-valence in pairing: positive, negative) mixed design with the first factor varying between participants and the second within participants.

### *Material*

Both the portraits used as neutral CSs and the adjectives used as USs were selected in pre-studies.

*CSs.* The CSs were eight color portraits taken from the database of Minear and Park (2004), cut to depict the face and neck of a person. The portraits were selected in a pre-study ( $N = 38$ ), in which they were rated on 19-point scales on the dimensions valence and age. They were neutral in valence (range: -0.87 to 1.55,  $M = 0.01$ ,  $SD = 1.92$ ), and the persons depicted were estimated to be of middle age (range: -0.84 to 1.29,  $M = 0.42$ ,  $SD = 1.57$ ). Half of the pictures depicted women.

*USs.* The USs were 8 German adjectives. These were pre-tested for an unrelated set of experiments ( $N = 15$ , Gast & Rothermund, in press) to be either positive and stereotypically young (“spontaneous”, “easygoing”), (2) positive and stereotypically old (“dignified”, “considerate”), (3) negative and stereotypically young (“careless”, “spoilt”), or (4) negative and stereotypically old (“confused”, “frail”). Valence extremity was similar across conditions of valence and age.

*Affective priming targets.* The targets in the affective priming procedure were positive and negative nouns taken from Gawronski, Walther, & Blank (2005; positive words: love, laughter, fun, joy, happiness, kiss, freedom, friend, humour, present; negative words: enemy, violence, hate, war, misery, terror, brutality, murder, anxiety, poison).

#### *Procedure*

Participants were tested in a laboratory at the campus of the University of Jena. They were seated in front of a computer screen from which they received all instructions. They were informed that they were about to participate in a study on word and picture perception. The experiment consisted of three phases, the conditioning phase, the post-conditioning rating, and the affective priming procedure. It lasted approximately 20 minutes.

*Conditioning phase.* Participants were instructed to form an impression of the upcoming combinations of picture and word. In the valence task condition they were asked to indicate whether their impression of the combination is rather “positive” or rather “negative”. In the age judgment condition they were asked to indicate whether their impression is rather “typical old” or “typical young”. All participants responded by pressing the left or right marked key (“X” or “M”). The allocation of judgment to key was counterbalanced across participants. The labels “positive” and “negative” or “young” and “old” were shown on the respective side of the screen during the whole conditioning phase. In each conditioning trial first the CS (the portrait) appeared. After 500 ms the US (the adjective) was superimposed in green letters over the lower half of the pictures. Both stimuli stayed on the screen for 3200 ms. Participants had to make their decision during the first 2200 ms of the joint presentation. When the participant responded, two small lines appeared below the stimuli, indicating that the response was recorded. If the participant did not respond in time, the message “no response” was displayed. After an inter-trial interval of 4000 ms, the next trial was initiated. For each participant two CSs were combined with adjectives that were positive and typically

young, two CSs were combined with adjectives that were positive and typically old, two CSs were combined with adjectives that were negative and typically young, and two CSs were combined with adjectives that were negative and typically old. The assignment of pictures to the age and valence conditions was counterbalanced across participants. Each participant saw all eight CS-US pairs eight times each. The order of the 64 conditioning trials was randomized. The conditioning phase lasted approximately 8 minutes.

*Post-conditioning rating.* Participants were informed that they would see some portraits without adjectives and that their task would be to indicate their likeability. They were encouraged to give their subjective impression but at the same time to be as precise as possible. The eight CSs were shown on the screen one by one with a scale consisting of 19 green squares below them. The endpoints were labelled “positive” and “negative”. The middle square was marked “neutral”. Participants rated the pictures by clicking on one of the squares.

*Affective priming.* In the affective priming phase, the CSs were used as primes; positive and negative words served as targets. Participants were told that they would see pictures and words. They were instructed to decide as fast as possible whether the word is positive or negative, and press the right key (“M”) for positive and the left key (“X”) for negative words. Each trial started with the presentation of a CS as prime for 200 ms. Immediately after the offset of the prime, the target appeared on the screen (SOA 200 ms) where it remained until the participant responded. To emphasize speed, the target changed its color from black to red after 750 ms of presentation. If a participant responded after the color change, a message was displayed for 1000 ms prompting him/her to respond faster. The next trial started after an inter-trial interval of 1000 ms. The affective priming procedure started with a practice block of twelve trials. Twelve neutral portraits not used in the conditioning phase were used as primes and were combined with 6 positive and 6 negative adjectives

randomly drawn from the target set. Only in this practice phase, participants received feedback on erroneous responses. To increase motivation to work at their performance limit, participants were reminded again to respond fast after the practice block and were told that if they responded very fast and correct on many trials, they would receive an additional gift. The main affective priming block started with four randomly ordered warm-up trials in which four of the practice primes were combined with two positive and two negative targets. In the core part of the affective priming procedure, each of the CSs was used as a prime with two randomly selected positive and two randomly selected negative targets. The procedure was divided into two blocks each of which consisted of 16 trials in which each of the CSs was once paired with a positive and once with a negative target. Within each block the order of trials was randomized.

### *Results*

#### *CS Ratings (EC Effect on Explicit Measure)*

For each participant, we calculated the mean rating of the four CS<sub>pos</sub> and of the four CS<sub>neg</sub>. Average CS ratings for each condition are shown in Figure 2. Based on these valence scores a 2 (US-valence in pairing: CS<sub>pos</sub>, CS<sub>neg</sub>, within) x 2 (conditioning task: valence task, age task, between) ANOVA was calculated. We did not find a significant main effect of US-valence in pairing (EC effect),  $F(1,62) = 2.28, p = .14, \eta^2_{\text{partial}} = 0.04$ , indicating that across both task conditions CS<sub>pos</sub> ( $M = 0.60, SD = 2.30$ ) were not reliably more positive than CS<sub>neg</sub> ( $M = 0.15, SD = 2.36$ ). We did, however, find an interaction of valence in pairing and task,  $F(1,62) = 4.80, p < .05, \eta^2_{\text{partial}} = 0.07$ . In the valence task condition the difference between CS<sub>pos</sub> ( $M = 0.90, SD = 2.23$ ) and CS<sub>neg</sub> ( $M = -0.20, SD = 2.18$ ) was more positive than the difference between CS<sub>pos</sub> ( $M = 0.30, SD = 2.36$ ) and CS<sub>neg</sub> ( $M = 0.50, SD = 2.52$ ) in the age task condition. Planned comparisons revealed an EC effect in the valence task condition,  $t(31) = 2.53, p < .05, d = 0.45$ , but not in the age task condition,  $t(31) = -0.50, ns., d = -0.09$ .



(Figure 2 about here)

*Affective Priming (EC Effect on Implicit Measure)*

For the analysis of the affective priming data, erroneous responses (10.84 %) as well as response time outliers (RT < 300 ms, or RT > 896 ms, 0.82 % of the correct responses)<sup>9</sup> were discarded. We calculated an evaluative score for positive and negative CSs separately by subtracting the mean RT for positive target words from the mean RT for negative target words (Gawronski et al., 2005). Thus, higher values indicate more positive evaluations. Average evaluative scores for the conditions are shown in Figure 3. Based on the evaluative scores, we calculated a 2 (US-valence in pairing, within) x 2 (conditioning task, between) ANOVA. We did not find a main effect of valence in pairing (EC effect),  $F < 1$ ,  $\eta^2_{\text{partial}} = 0.01$ . This indicates that across both task conditions, CS<sub>pos</sub> did not lead to a significantly more positive evaluative score in the affective priming procedure ( $M = 18.44$ ,  $SD = 60.95$ ) than CS<sub>neg</sub> ( $M = 11.41$ ,  $SD = 42.65$ ). Similar as with the explicit ratings, we did find an interaction of valence in pairing and conditioning task,  $F(1,61) = 6.90$ ,  $p < .05$ ,  $\eta^2_{\text{partial}} = 0.10$ , indicating that in the valence task condition the difference between CS<sub>pos</sub> ( $M = 37.44$ ,  $SD = 63.67$ ) and CS<sub>neg</sub> ( $M = 5.43$ ,  $SD = 38.59$ ) is more positive than the difference between CS<sub>pos</sub> ( $M = 0.03$ ,  $SD = 52.88$ ) and CS<sub>neg</sub> ( $M = 17.20$ ,  $SD = 46.12$ ) in the age task condition. Planned comparisons revealed an EC effect in the valence task condition,  $t(30) = 2.15$ ,  $p < .05$ ,  $d = 0.39$ , but not in the age task condition,  $t(31) = -1.50$ ,  $p = .15$ ,  $d = -0.26$ .

(Figure 3 about here)

*Correlation of Explicit and Implicit EC Effects*

We calculated an EC effect variable on the difference of CS<sub>pos</sub> and CS<sub>neg</sub> both for the explicit and for the implicit measure by subtracting the respective evaluative score of CS<sub>neg</sub> from the evaluative score of CS<sub>pos</sub>. There was no correlation of the explicit and the implicit effect variable, neither across all participants,  $r = .12$ ,  $t(61) = 0.97$ , *ns*, nor within the valence

task condition,  $r = .00$ ,  $t(29) = 0.01$ , *ns*, nor within the age task condition,  $r = .11$ ,  $t(30) = 0.59$ , *ns*.

### *Discussion*

Experiment 2 replicated the influence of the conditioning task on EC effects. As in Experiment 1, an EC effect was found only if participants judged the valence of CS-US pairs during the conditioning task but not if they judged the stimuli according to another dimension, in this case according to age. This replicates and generalizes the valence focus effect found in Experiment 1.

Importantly, we find the same moderating influence of conditioning task on EC effects with an implicit measure of evaluations, namely the affective priming task. The results on this measure closely mirrored the results on the explicit ratings: An EC effect was found only if participants judged the CS-US-pairs according to valence and not if they judged them according to age. Replicating the valence focus effect with an implicit measure of evaluations makes it very unlikely that the results are demand effects. Interestingly, although the pattern of the implicitly assessed EC effect closely mirrored the pattern of the EC effect for explicit evaluations, correlation analyses showed that both effects were unrelated in our study.

So far, the conditioning task was always performed on the conditioning pairs. For this reason, we cannot be sure whether such a direct manipulation is necessary. Furthermore, performing the task always on the pairs might induce a similarity focus, because the task presupposes that a common judgment on the two stimuli is possible. Although this cannot explain the valence focus effect (because it applies to both task conditions), it might generally increase the EC effect (Corneille, Yzerbyt, Pleyers, & Mussweiler, 2009). For these reasons, the conditioning task will not be performed on the conditioning pairs in Experiment 3.

### Experiment 3

The goal of this experiment was to test whether a valence focus also influences EC effects if it is operationalized in a more general manner, and not by a task that pertains directly to the conditioning stimuli. Thus, the main difference in this study is that participants did not perform a task on the CS-US pairs but on different stimuli that were interspersed in the conditioning trials. To further generalize the effect for different classes of materials we used pictures of non-living objects (pieces of clothing) as CSs and USs.

### *Method*

#### *Participants and Design*

Forty-four students of different faculties of the University of Jena participated in the experiment and were compensated with a bar of chocolate and a fruit. Participants were randomly assigned to one of the two groups of a 2 (conditioning task) by 2 (US-valence in pairing: positive, negative) mixed design with the first factor varying between participants and the second within participants.

#### *Material*

CSs and USs were color photographs of pieces of clothing taken in local clothing stores while worn by a female student. The pictures were edited to show only the garment. A set of 78 pictures (39 tops, 39 trousers/skirts) were used in the experiment, which cover a range of different styles and lead to a range of different evaluations by most people. From this set of pictures those used as CSs and USs were selected individually (see procedure).

#### *Procedure*

Participants were seated in front of a computer screen from which they received all instructions. They were informed that they were about to participate in a study on the psychology of fashion. The experiment consisted of three main phases: the pre-conditioning rating, the conditioning phase, and the post-conditioning rating. The experiment lasted about 18 minutes.

*Pre-conditioning rating.* Participants were informed that they would see pieces of clothing and that their task would be to indicate how much they like them. Because clothing pictures are a set of material not typically encountered in psychological labs, participants saw a short overview over the pictures before the rating-phase (all pictures were presented in random order for 500 ms each). This procedure avoids biased ratings due to premature anchoring of the evaluative range of the pictures (De Houwer, Baeyens, Vansteenwegen, & Eelen, 2000). Following this, the 78 pictures were shown in random order one by one on the screen. Participants could indicate their judgment on a scale from -9 to +9 by pressing one of the keys, which were marked with the according numbers.

*Conditioning.* CSs and USs were selected according to the rules described for Experiment 1. In this experiment, four positive and four negative stimuli were chosen as USs, and eight neutral stimuli as CS<sub>pos</sub> and CS<sub>neg</sub>. The neutral stimuli were randomly assigned to conditions. Four additional neutral stimuli were selected as filler stimuli for the procedure to assess contingency awareness (see below). These were also shown in pairs during the conditioning phase. For each stimulus category, half of the selected pictures depicted a top and half a trouser or skirt. A conditioning pair always consisted of a top and a trouser/skirt. If not enough pictures were available for one of the stimulus types, the experiment stopped at this point. From the remaining 58 pictures in the set, 40 were chosen randomly as single stimuli for the focus task.

At the beginning of the conditioning procedure, participants were told that they would see some of the garments again, some of them alone, others in pairs. They were asked to make judgments on the single garments. In the valence task condition they were asked to decide within 1.5 seconds whether they rather liked or disliked the single piece of garment. In the style task condition they were asked to categorize the single pieces of garment as either suitable for casual or for festive occasions. In order to keep the focus present throughout the

conditioning phase, participants were asked to count the number of pieces they judged to be positive and negative or casual and festive. Regarding the clothes presented in pairs (the actual conditioning stimuli), participants were asked to simply watch them attentively.

During a conditioning trial, CSs and USs were presented simultaneously for two seconds, with the shirt always on the left side of the screen and the skirt/trouser always on the right side of the screen. Each of the conditioning pairs was shown four times for two seconds each. The single pieces of clothing for the categorization task were also shown for two seconds. Participants could respond during the first 1.5 seconds. If they responded in time, the label of the chosen category was presented below the picture for the remaining 500 ms. The conditioning trials and the judgment trials were presented in random succession with the constraint that not more than either four conditioning pairs or single categorization pictures were presented in direct succession. The inter-trial interval was 2.5 seconds. Altogether the conditioning phase including filler and judgment trials consisted of 80 trials and lasted 6 minutes. At the end of the conditioning phase, participants typed in the numbers of their counted judgments.

*Post-conditioning rating.* Participants were asked to rate the presented pictures once more. The pictures used in the conditioning trials were shown in random order with the same evaluation scale as in the pre-conditioning phase.

*Contingency awareness.* Contingency awareness was assessed with a forced choice procedure similar to Experiment 1. Participants were asked to indicate for each CS one by one with which US they thought it was shown. For this, the CS was presented on the left side of the screen and four possible USs were shown on the right side. One of these was the correct US, one an incorrect US of the same valence as the correct US, one an incorrect US of opposite valence, and one an incorrect stimulus which had been part of a neutral filler pair (Walther & Nagengast, 2006). The position of the USs was randomized. Next to each US a

number from 1 to 4 was shown. Participants had to type in the number of the US which they thought had been paired with the CS.

### *Results*

Four participants in the valence task condition and four participants in the style task condition gave no or only very few responses in the judgment task during the conditioning phase (less than two left or right key-presses). Data from these participants were excluded from the reported analyses, although this did not affect the pattern of results.

#### *US Ratings*

We calculated mean evaluations for positive and negative USs separately for the ratings before and after the conditioning phase. Positive USs were clearly positive and negative USs were clearly negative both before and after the conditioning phase (preconditioning  $US_{\text{pos}}$ :  $M = 7.41$ ,  $SD = 1.22$ ; preconditioning  $US_{\text{neg}}$ :  $M = -7.85$ ,  $SD = 1.20$ ; postconditioning  $US_{\text{pos}}$ :  $M = 5.41$ ,  $SD = 2.03$ ; postconditioning  $US_{\text{neg}}$ :  $M = -6.06$ ,  $SD = 2.18$ ). Not surprisingly,  $US_{\text{pos}}$  were more positive than  $US_{\text{neg}}$  ( $F(1,34) = 1050.95$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = 0.97$ ). The difference between  $US_{\text{pos}}$  and  $US_{\text{neg}}$  interacted with time of rating,  $F(1,34) = 52.28$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = 0.61$ . The difference between  $US_{\text{pos}}$  and  $US_{\text{neg}}$  also interacted with task condition,  $F(1,34) = 4.91$ ,  $p < .05$ ,  $\eta^2_{\text{partial}} = 0.13$ . This difference already existed before the conditioning phase,  $F(1,34) = 9.14$ ,  $p < .01$ ,  $\eta^2_{\text{partial}} = 0.21$ . The difference between  $US_{\text{pos}}$  and  $US_{\text{neg}}$  before conditioning was more pronounced in the valence focus group ( $US_{\text{pos}}$ :  $M = 7.86$ ,  $SD = 0.96$ ;  $US_{\text{neg}}$ :  $M = -8.36$ ,  $SD = 0.79$ ) than in the style task group ( $US_{\text{pos}}$ :  $M = 6.96$ ,  $SD = 1.31$ ;  $US_{\text{neg}}$ :  $M = -7.34$ ,  $SD = 1.35$ ).<sup>10</sup>

#### *CS Ratings (EC Effect)*

We calculated mean evaluations for  $CS_{\text{pos}}$  and  $CS_{\text{neg}}$  separately for the ratings before and after conditioning. To simplify the description, and because the CS evaluations before the conditioning phase were very close to 0 ( $CS_{\text{pos}}$ :  $M = 0.06$ ,  $SD = 0.36$ ;  $CS_{\text{neg}}$ :  $M = 0.03$ ,  $SD =$

0.41) statistical tests and reports are based on evaluative change scores (postrating-prerating). Average CS evaluations for the different conditions are shown in Figure 4. Based on these change scores, a 2 (US-valence in pairing: CS<sub>pos</sub>, CS<sub>neg</sub>, within) x 2 (conditioning task: valence task, style task, between) ANOVA was calculated. Valence in pairing had a significant influence on the evaluative change score,  $F(1,34) = 6.96, p < .05, \eta^2_{\text{partial}} = 0.17$ . As in the previous experiments, this EC effect was qualified by a significant interaction with task,  $F(1,34) = 5.70, p < .05, \eta^2_{\text{partial}} = 0.14$ . In the valence task condition, the difference between CS<sub>pos</sub> ( $M = 0.17, SD = 2.14$ ) and CS<sub>neg</sub> ( $M = -1.78, SD = 2.44$ ) was more pronounced than the difference between CS<sub>pos</sub> ( $M = -0.33, SD = 1.79$ ) and CS<sub>neg</sub> ( $M = -0.43, SD = 1.86$ ) in the style task condition. The EC effect was only significant in the valence task condition,  $t(17) = 2.79, p < .05, d = 0.66$ , but not in the style task condition,  $t < 1, d = 0.07$ .

(Figure 4 about here)

#### *Contingency Awareness*

Contingency awareness can both be understood as being aware of the specific US a CS was paired with or as being aware of the valence of the US a CS was paired with (Stahl & Unkelbach, 2009; Stahl, et al., 2009). We will report both results for selecting the correct US (CS-US contingency awareness), and for selecting an US of the correct valence (CS-valence contingency awareness). On average, participants selected the correct US for 4.31 ( $SD = 1.79$ ) out of 8 CSs. The respective CS-US contingency awareness score (number of CSs for which the participant selected the right US) tended to be related to the EC effect ( $\beta = .29, t(35) = 1.78, p = .085$ ). On average, participants selected a US of the correct valence for 5.53 ( $SD = 1.52$ ) out of 8 CSs. The CS-valence contingency awareness score was related to the EC effect ( $\beta = .48, t(35) = 3.22, p < .01$ ).

It has been shown that the influence of contingency awareness on EC effects is best analysed on a within participant basis by comparing EC effects for remembered pairs with EC

effects for non-remembered pairs (Pleyers et al., 2007). Both CS-US and CS-valence contingency awareness were therefore also analysed on the basis of the single pairs. For these analyses, we first performed for each participant two within subject regression analyses (one for CS-US contingency awareness and one for CS-valence contingency awareness) with CS evaluation score as criterion (Lorch & Myers, 1990). As predictors, US valence and contingency awareness (CS-US awareness or CS-valence awareness) were entered in the first step; in the second step, the interaction of US valence and awareness was entered into the regression equation as additional predictor. The unstandardized B-weights derived for these interaction terms indicate the influence of contingency awareness (CS-US awareness or CS-valence awareness) on EC and were tested against 0. CS-US contingency awareness was not significantly related to stronger EC effects,  $t(27) = 1.63, p = .12, d = 0.31$ . However, valence contingency awareness was,  $t(20) = 2.23, p < .05, d = 0.49$ . Conditioning task did not moderate the influence of contingency awareness on EC, neither for stimulus awareness,  $t(26) = -0.38, ns, d = -0.07$ , nor for valence awareness  $t(19) = -1.33, ns, d = -0.29$ .

To test the possible mediating role of contingency awareness on the influence of task condition on the EC effect, we performed mediation analyses with conditioning task as independent variable, one of the contingency awareness scores as mediator, and EC effect as dependent variable. Conditioning task significantly predicted the size of the EC effect,  $\beta = .38, t(35) = 2.39, p < .05$ , and it also had an influence on the level of CS-US contingency awareness,  $\beta = 0.36, t(35) = 2.27, p < .05$ , with CS-US contingency awareness being somewhat higher in the evaluative task condition ( $M = 4.94, SD = 1.76$ ) than in the style task condition ( $M = 3.67, SD = 1.61$ ). Level of CS-US contingency awareness, however, did not influence the EC effect over and above task,  $\beta = 0.18, t(35) = 1.04, ns$ . It did also not significantly decrease the regression coefficient of conditioning task ( $\beta = .32, t(35) = 1.85, p =$



.07, Sobel's  $Z < 1$ , ns). This shows that the influence of valence focus on the EC effect was not mediated by CS-US contingency awareness.

Conditioning task also influenced the level of CS-valence awareness,  $\beta = 0.43$ ,  $t(35) = 2.75$ ,  $p < .01$ . CS-valence awareness was higher in the evaluative task condition ( $M = 6.17$ ,  $SD = 1.54$ ) than in the style task condition ( $M = 4.89$ ,  $SD = 1.23$ ). Level of valence awareness did influence the EC effect over and above task,  $\beta = .39$ ,  $t(35) < .05$ , and tended to reduce the regression coefficient of conditioning task, but not significantly so ( $\beta = .21$ ,  $t(35) = 1.29$ ,  $p = .21$ , Sobel's  $Z = 1.80$ ,  $p = .07$ ). This indicates that valence awareness tended to mediate the effect of our experimental manipulation on EC effects. Analysing the mediating influence of CS-US awareness and CS-valence awareness in a multiple mediation analysis (Preacher & Hayes, 2008) generally confirms these results: CS-US awareness does not mediate the valence focus effect ( $Z = -1.00$ ,  $p = .32$ ), while CS valence awareness tends to do ( $Z = 1.85$ ,  $p = .06$ ). The contrast between these mediating variables is not significant ( $Z = -1.60$ ,  $p = .11$ ).<sup>11</sup>

### *Discussion*

In Experiment 3 we operationalized the valence vs. non-valence focus with additional stimuli interspersed between the conditioning trials on which participants had to perform either a valence judgment or a style judgment. Again, we found stronger EC effects in the valence task condition than in the non-valence task condition. This shows that it is not necessary to implement the focus directly on the conditioning pairs. A more generally activated task focus also influences EC effects. At this point, however, we cannot conclude on how far the valence focus generalizes. The stimuli that had to be judged and the conditioning stimuli were very similar. It would be a further step to investigate whether the valence focus generalizes to clearly different stimuli.

Contingency awareness analyses revealed that the EC effect is related with CS-valence contingency awareness but not significantly with CS-US contingency awareness (Stahl et al.,

2009). Similar as in study 1, a mediation analyses with CS-US contingency awareness as a mediator revealed that the influence of the valence focus manipulation on EC effects was not due to better CS-US contingency learning in the valence focus condition. There was, however, a tendency for valence contingency awareness to mediate the relation between conditioning task and the EC effect. This might suggest that a critical factor in the valence focus effect is not cognitive processing per se, but rather valence processing specifically.

### General Discussion

We reported three experiments in which EC effects depended on whether participants focused on valence during the conditioning phase. Consistently for a range of stimulus types and for both a directly and an indirectly implemented task focus, we only found EC effects if participants judged valence and not if they judged stimuli according to another dimension during the conditioning phase. While all experiments included explicit ratings as measures, Experiment 2 additionally contained an implicit measure of valence (affective priming). With both the explicit and the implicit measure, exactly the same pattern of results appeared: Irrespective of measure, EC effects were only found in the valence focus conditions. The results on the implicit measure indicate that the valence focus effect is very likely not due to demand effects. Additional analyses in Experiments 1 and 3 showed that CS-US contingency awareness did not mediate the influence of the valence focus on the EC effect. This shows that the valence focus effect is different from a cognitive load effect that forestalls CS-US contingency learning (Pleyers et al., 2009). In Experiment 3, however, there was a tendency for the valence focus effect to be mediated by valence awareness. Taken together, these results suggest that the valence focus effect is not based on differences in general learning, but rather specifically on differences in valence processing. We will come back to this point in the following section on underlying mechanisms.

The valence focus effect is interesting for practical reasons. Our findings suggest that a stimulus only gains a new valence through EC-like mechanisms if a person (a consumer watching an advertisement, a phobic patient, or anyone learning about social relations and circumstances) is in an evaluative mindset. Considering how we are surrounded by tasks that are evaluative to largely different degrees (grading students vs. returning empty bottles) and how we can concentrate on a non-evaluative task but then casually evaluate a thing or a person if asked, it is likely that we are quite efficient in switching on (and off) such a mindset, not just in experiments but also in everyday life.

#### *The Valence Focus Effect – Underlying Mechanisms*

First, we will outline (and as far as possible evaluate) three hypotheses on mechanisms that can explain the valence focus effect. We call them the *CS-US-processing hypothesis*, the *CS-ER hypothesis*, and the *US-valence hypothesis*. After this, we will turn towards the question what we can conclude from our results on the *goal dependence* of EC effects.

#### *The CS-US Processing Hypothesis*

This hypothesis states that the focus on the valence dimension leads to stronger or qualitatively different cognitive processing of the CS-US pairs, which leads to a stronger link between the CS and the US in memory, more reliable knowledge on the CS-US contingency, and therefore to stronger EC effects. Previous research has shown that attention can lead to increased CS-US contingency awareness that leads to larger EC effects (Pleyers et al., 2009). We do not think, however, that the valence focus effect is due to this mechanism. Mediation analyses in Experiments 1 and 3 showed that although the valence focus did in fact foster learning of the CS-US contingency, this was not the cause of the stronger EC effect in the valence focus condition. Nevertheless, it is quite interesting to note that the valence focus seems to have a positive effect on contingency learning. For this reason, and because other research has shown that contingency awareness fosters EC effects (e.g., Pleyers et al., 2007),

it seems that the causal link from valence focus to contingency awareness to an increased EC effect could be possible. The valence focus effect reported in our studies, however, must be due to other processes.

#### *The CS-ER Hypothesis*

The CS-ER hypothesis states that the evaluative task induces participants to give more evaluative responses (ERs) during the conditioning phase than a non-valent task. Therefore participants in the valence focus condition are more likely to directly learn a link between a CS and an ER. This direct CS-ER link can lead to an immediate activation of the ER by the CS, which contributes to the EC effect.

The CS-ER hypothesis is reminiscent of the discussion on S-S models and S-R models of evaluative conditioning. S-S models state that EC effects are based on an association or mental link between the CS and the US (Baeyens, Eelen, Van den Bergh, & Crombez, 1992; Hammerl & Grabitz, 1996; Walther, Gawronski, Blank, & Langer, 2009). This means that the CS activates the cognitive representation of the US which in turn activates an evaluative response. S-R models on the other hand state that the basis of the EC effect is a direct link between the CS with an evaluative response. There is less evidence for S-R models than for S-S models of EC effects (but see Baeyens, Vanhouche, Crombez, & Eelen, 1998; and Jones, Fazio, & Olson, 2009, for more recent albeit indirect evidence for the S-R model). However the evidence on S-R learning in evaluative conditioning without additional tasks might be, there is evidence that S-R links can lead to evaluative conditioning effects, in cases where strong evaluative responses are given. In a different set of studies, we found evidence that EC effects can be based on S-R-learning if ERs are fostered by asking participants to evaluate the stimuli (Gast & Rothermund, 2010). Similar evidence comes from research on evaluative consequences of approach and avoidance movements, which shows that faces that were zoomed in with a pulling joystick-movement are later evaluated more positively than faces

that were zoomed out in a pushing joystick-movement (Woud, Becker, & Rinck, 2008). Similarly, ideographs that were shown during arm flexion before are evaluated more positively than ideographs that were shown during arm extension if participants had the task to evaluate the stimuli during flexion and tension (Cacioppo, Priester, & Berntson, 1993). These results suggest that especially when responses (push/extension vs. pull/flexion) are given an evaluative meaning they can lead to an evaluative change of the stimulus they were paired with. It seems therefore possible that the EC effect increased in the valence task condition because the CS acquired a direct mental link to the evaluative response that was given in the learning phase.

In Experiment 3, valence awareness – but not stimulus awareness – tended to mediate the valence focus effect. Also this tentative result is in favor of the CS-ER hypothesis if it is assumed that a CS-ER link is typically accompanied by knowledge with which valence (but not necessarily with which stimulus) a CS was paired. It also suggests that a CS-ER link might depend on such knowledge and is in this sense not an automatic association.

A way to test whether the valence focus effect depends on CS-ER learning might be to employ a US revaluation technique. In US revaluation studies the valence of the US is changed after the conditioning phase in which the CS was paired with the US. If the EC effect depends on the CS-US link rather than on a direct CS-ER link it should depend on whether the US is revaluated or not. If, on the other hand, the effect depends on a CS-ER link, it should not depend on US revaluation. Showing that the increased EC effect in the valence task condition is due to CS-ER learning would speak in favor of the CS-ER hypothesis.

#### *The US-Valence Hypothesis*

This third hypothesis on the valence focus effect assumes that due to attentional processes the salience of the US valence is influenced by the task focus. Humans can flexibly allocate attention to task relevant properties and away from task irrelevant properties; this

attentional focus influences even involuntary aspects of stimulus processing and task performance (e.g. Folk, Remington, & Johnston, 1992; Haider & Frensch, 1996; for the domain of valence, see Spruyt et al., 2007, 2009). Thus, participants who judge valence are more likely to pay attention to valence relevant features (e.g., facial expressions) than participants who judge for example age or geographic origin, and who pay more attention to other features (e.g., wrinkles, hair color). The latter group might even direct attention away from – possibly distracting – valence relevant features. Therefore, US valence could become temporarily activated for participants who focus on valence and temporarily deactivated for participants who focus on something else. The US-valence-hypothesis states that the EC effect is based on a CS-US link, but that this link can only lead to a valence change of the CS if the *valence* of the US is active. If the valence of the US is deactivated, the CS-US link can confer no valence from the US to the CS, regardless of how strong the CS-US-link might be.

As this hypothesis does not assume a difference in the strength of the CS-US link between the two conditions, but only a difference in how activated the valence of the US is, it could be tested by increasing US-valence activation independent from the learning phase. This could be done in an experiment in which all participants work on a non-valent task during conditioning; after conditioning participants in the valence task condition work on an evaluative task in which *only* the USs are evaluated. According to the US-valence hypothesis, a valence-focus effect should also be found in such an experiment.

#### *Goal Dependence of Evaluative Conditioning*

Does our research allow the conclusion that EC effects are goal dependent? By manipulating the judgmental task, we also manipulated the judgmental goal. The EC effect depended on this manipulation. Therefore, the obvious answer is, yes, EC effects are goal dependent.<sup>12</sup>

It is a different question whether the *learning processes underlying* EC effects are goal dependent (see De Houwer, 2007, for a distinction between effect and process). There is a growing body of evidence in favour of the idea that the learning processes underlying EC are at least often non-automatic or propositional (e.g. Field, 2000; Purkis & Lipp, 2001; Pleyers et al., 2007; see Hofmann et al., 2009, for a meta-analysis, and Lovibond & Shanks, 2002; Mitchell, De Houwer, & Lovibond, 2009, for reviews). Goal dependency is a non-automatic feature of a psychological process (Moors & De Houwer, 2006). Therefore the question whether the learning process underlying EC is goal dependent is relevant for research investigating whether the learning process underlying EC is non-automatic or propositional. If the learning process underlying EC is goal dependent it is at least non-automatic in the sense of goal dependent. Recent work suggests that this is the case (Corneille et al., 2009; Unkelbach & Fiedler, 2008).

Do our results (which suggest the goal dependence of EC effects) allow a similar conclusion regarding the goal dependency or non-automaticity of the learning process underlying EC? We do not think so.

Most importantly, it is likely that in our studies (different from other studies) the manipulation did not predominantly affect the learning process, but rather the *content* of this learning process. To make this clearer, consider the CS-US-processing hypothesis. This hypothesis assumes that the valence focus led to better memory for the CS-US pair. This hypothesis is actually a hypothesis on the learning process. However, the fact that CS-US contingency awareness did not mediate the valence focus effect led us to reject this hypothesis. The two other hypotheses that we proposed localize the critical mechanism rather in *what* is learned than in a certain learning process. The CS-ER mechanism assumes more evaluative responses in the learning phase that can be linked to the US; the US-valence hypothesis assumes that the US is seen differently. Therefore, in both cases, the conditioning

task influences *what* is connected to the CS rather than *how* (e.g. automatically or propositionally) it is connected. If any, or both, of these hypotheses can explain the valence focus effect – which we think is the case (Gast & Rothermund, 2010) – then the valence focus effect is no proof that the *learning process* underlying the EC effect is goal dependent. It does, however, show that the *EC effect* depends on the goal to evaluate – probably because EC effects depend on stimulus evaluation and stimulus evaluation depends on the goal to evaluate.<sup>13</sup>

#### *Goal Dependence of Evaluation*

Taken together, our results do not allow the conclusion that the learning process underlying EC effects are goal dependent. They do, however, strongly suggest that stimulus evaluation is goal dependent. Many researchers assume that stimulus evaluation is automatic, and specifically, independent from the goal to evaluate (e.g. Bargh et al., 1992; Bargh et al., 1996; Murphy & Zajonc, 1993; Zajonc, 1980). If this was the case, however, we see no way of explaining why evaluative conditioning effects should differ dependent on the conditioning task. We proposed two ways of explaining the evaluative focus effect, and there might be more. Any explanation that we could think of, however, needs to assume that stimulus evaluation is influenced by whether the participant is asked to evaluate stimuli. In line with research from other domains, our results therefore strongly suggest that stimulus evaluation depends on the goal to evaluate. Our results go beyond this earlier research in showing the relevance of this conclusion for evaluative conditioning.

#### *Directions for Further Research*

The first aim of further research might be to test hypotheses on the underlying mechanisms of the valence focus effect. We proposed three hypotheses, the *CS-US association hypothesis*, the *CS-ER hypothesis*, and the *US-valence hypothesis* that can explain a valence focus effect. We tested the first hypotheses with mediation analyses and concluded



that – although it might play a role in other research – it does not account for our results. It remains to be tested whether one or both of the other hypotheses can account for the valence focus effect.

Another question is whether it is necessary that the valence focus is manipulated by tasks. It seems possible that a valence focus effect shows when the evaluative vs. non-evaluative character of the context is manipulated without an explicit task. For example, strongly valenced stimuli – as compared to moderately valenced stimuli – might induce a valence focus. In a similar vein, it might also be tested whether priming the concept of valence, or previous evaluative tasks lead to stronger EC effects. Another possibility is that humans are by default in a valence focus (simply because valence is the most important stimulus dimension), and that this default focus can only be changed if another dimension becomes task relevant. This would mean that our manipulation would be due to destroying the default valence focus in the non-valent task conditions.

The third point is related. From the presented data, we cannot conclude whether the valence focus effect is due to increased EC effects in the valence focus condition, decreased EC effects in the non-valent task conditions, or both. As earlier research has shown, EC effects can emerge in the absence of explicit instructions to evaluate stimuli. This suggests that the non-valent tasks decrease the EC effect. However, we think that also an increase due to the valence task might contribute to the effect. Results from a recent meta-analysis showed that EC effects for ratings have an average effect size of  $d = 0.53$  (Hofmann et al., 2009). In our studies the effect sizes for ratings range between  $d = 0.45$  and  $d = 1.08$  in the valence focus condition, and between  $d = -0.09$  and  $d = 0.07$  in the non-valent task condition. Although speculative, this might suggest both an increasing and a decreasing mechanism.

Further research could investigate this question by including a neutral comparison condition. Some thought is necessary on what would be an appropriate comparison condition.

It is possible that all conditioning tasks, whether on valence or a non-valent stimulus dimension, might have a general effect on the EC effect because they force the participant to pay attention to the stimuli. It is also possible that both non-valent and valent tasks induce a similarity focus because both tasks are supposed to be performed on both stimuli. Such a similarity focus has been shown to increase the EC effect (Corneille et al., 2009). All of these mechanisms do not question the difference between the valent and the non-valent task conditions but they could lead to a general increase of EC effects due to any additional task and therefore overestimate the increasing effect of the valent task condition as compared to the decreasing effect of the non-valent task condition.

Finally, it would be interesting to systematically compare the focus-dependent conditioning of valence and non-valent properties. In combination with previous research by Olson and colleagues (2009), our results suggest that it is always the dimension focused on that is changing in co-occurring stimuli. It would be interesting to investigate whether both effects are actually due to the same cognitive processes.

### *Conclusion*

The aim of this research was to thoroughly investigate whether a focus on valence influences the strength of EC effects. This is the case. EC effects are stronger if people focus on valence. If participants focused on another stimulus dimension, EC effects in our studies were nonexistent. Concerning the mechanisms underlying the valence focus effect, we proposed an additional learning of a CS-ER link in the valence focus condition (CS-ER hypothesis), and a mechanism that increases activation of valent features of the USs (US-valence hypothesis). We could exclude a mechanism based on increased CS-US contingency awareness in the valence task condition. For this reason, it seems that we have identified an influence factor on EC that is different from the broadly discussed influence of contingency

awareness. The valence focus effect might therefore add to the understanding of the boundary conditions of EC effects and the cognitive processes on which EC effects are based.

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Figure Captions

Figure 1. CS' evaluative change scores (postrating - prerating) for conditions of valence of pairing and conditioning task in Experiment 1.

Figure 2. CS ratings for conditions of valence of pairing and conditioning task in Experiment 2.

Figure 3. CS' evaluative scores from the affective priming procedure for conditions of valence of pairing and conditioning task in Experiment 2.

Figure 4. CS' evaluative change scores (postrating - prerating) for conditions of valence of pairing and task in Experiment 3.

Figure 1

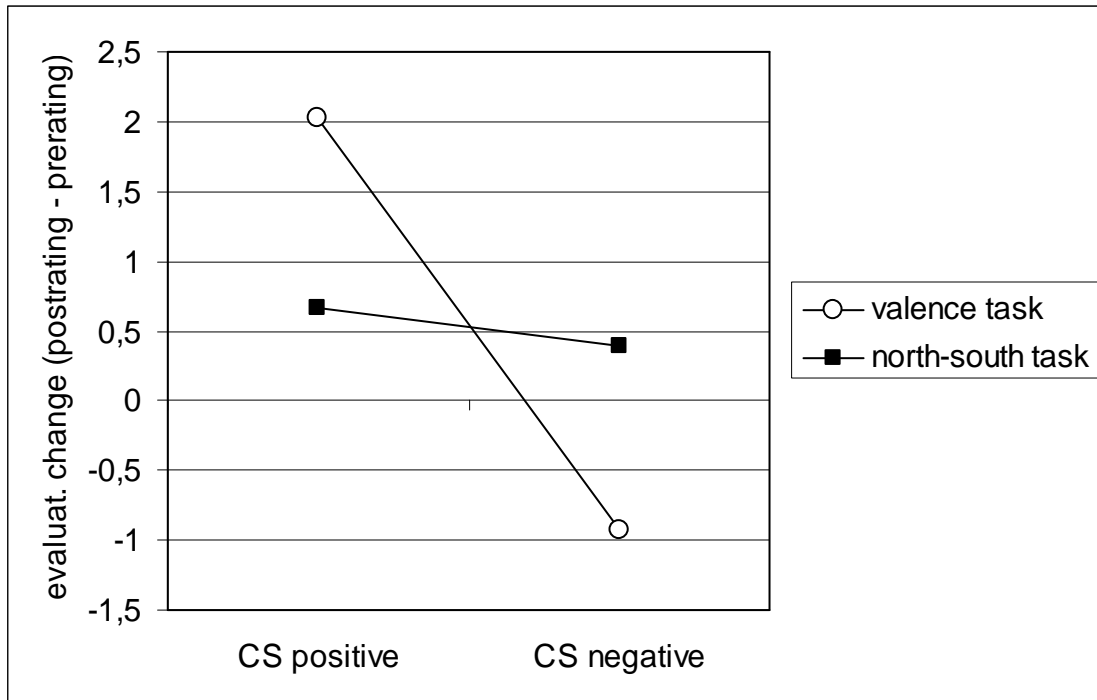


Figure 2

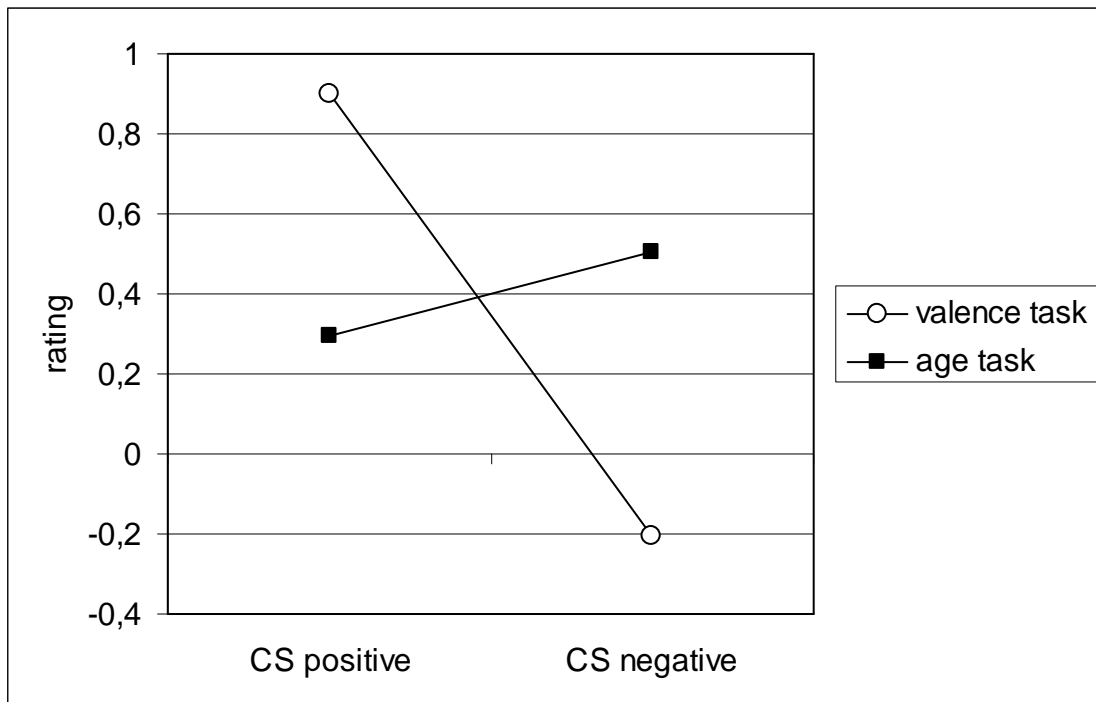


Figure 3

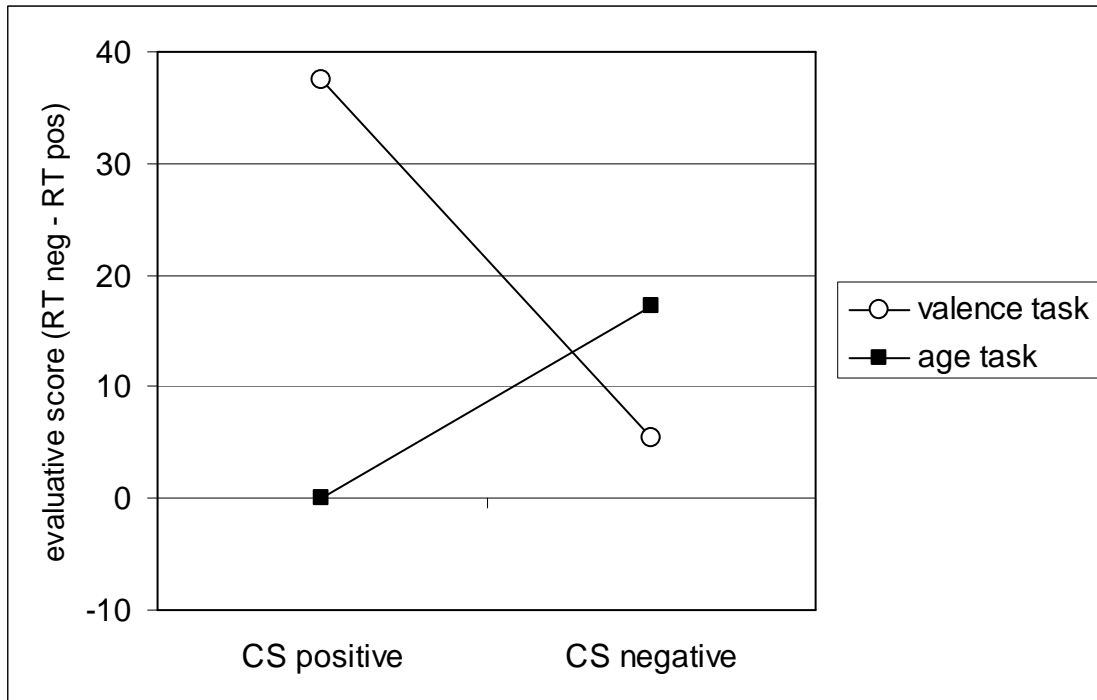
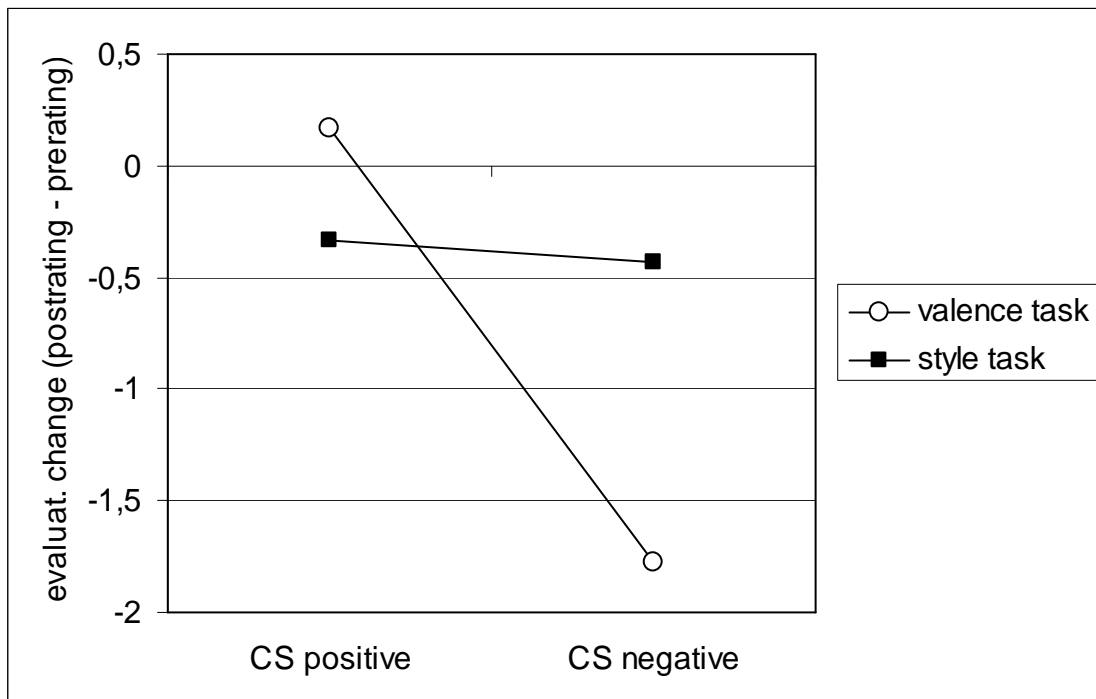


Figure 4



Author Note

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## Footnotes

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<sup>1</sup> Ferguson and Bargh (2004) could show that goal relevant stimuli are evaluated more positively than goal irrelevant stimuli. In this article, however, we are concerned with global differences regarding the readiness with which all kinds of stimuli are evaluated, rather than with differences regarding the valence of specific stimuli that are related to a particular goal.

<sup>2</sup> It is unclear how it can be explained that a secondary task sometimes lead to increased and sometimes to decreased EC effects. Similar to the diverging results on contingency awareness, these discrepant findings might suggest that EC effects can be due to different processes that respond differently to cognitive load.

<sup>3</sup> Both individual and non-individual stimulus selection procedures are common in evaluative conditioning research. As an individual preselection phase (that is usually accomplished right before the conditioning phase) might bring participants into a valence focus that remains during the conditioning phase, the valence focus hypothesis predicts stronger EC effects after individual stimulus selection. Effects in fact are stronger when USs are selected on an individual basis. This is not the case for individually preselected CSs (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2009). Effects of preselecting CSs, however, could be influenced by several variables (individual selection of CSs could lead to reduction of error variance on the one hand, but to a decrease of the effect due to participants' aim to remain consistent on the other hand) and are therefore difficult to interpret anyway. These explanations do not apply in the same manner to preselecting the USs. The valence focus mechanism, however, can explain the effect of US-pre-selection.

<sup>4</sup> Inclusion of those participants of whom data were available did not lead to different results.

<sup>5</sup> Contingency awareness can also be understood as awareness of the valence of the US the CS was paired with (Stahl & Unkelbach, 2009; Stahl, Unkelbach, & Corneille, 2009). Counting the trials in which the participant selects a US of the correct valence (not necessarily the



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correct US) gives an estimate of this valence awareness. In this experiment, however, only eight participants ever selected a wrong US that was of the right valence. Thus stimulus awareness and valence awareness are highly correlated. All contingency awareness analyses lead to very similar results. Importantly, valence awareness was also unrelated to the EC effect,  $\beta = 0.01$ ,  $t(48) = 0.04$ , *ns*. Accordingly, there was also no mediation of the valence focus effect by valence awareness.

<sup>6</sup> It has been shown that the influence of contingency awareness on EC effects is best analysed on a within participant basis by comparing EC effects for remembered pairs with EC effects for non-remembered pairs (Pleyers, Corneille, Luminet, & Yzerbyt, 2007). However, in Experiment 1, there were only four CS-US-pairs for each participant and most of them were remembered correctly. Thus only eight participants actually had both positive and negative non-remembered pairs. Only three participants had both remembered and non-remembered positive and negative CS-US pairs. Thus, the within participant awareness factor does not vary for the majority of the participants. Analysing only remembered pairs shows an EC effect,  $F(1,39) = 8.61$ ,  $p < .01$ ,  $\eta^2_{\text{partial}} = .18$ , and an interaction of valence focus and EC,  $F(1,39) = 14.18$ ,  $p < .001$ ,  $\eta^2_{\text{partial}} = .27$ . Analysing only non-remembered pairs shows no EC effect,  $F(1,6) = 1.64$ ,  $p = .25$ ,  $\eta^2_{\text{partial}} = .22$ , and no interaction of valence focus and EC,  $F(1,6) < 1$ ,  $p = .86$ ,  $\eta^2_{\text{partial}} = .005$ . Please note the small power for non-remembered pairs.

<sup>7</sup> The fact that no influence of contingency awareness on EC effects was found in our study should not be interpreted as showing that EC is not influenced by contingency awareness. The general level of contingency awareness was high in our study so that a ceiling of what is necessary for EC might have been reached.

<sup>8</sup> Although the age dimension is not completely valent-free, it is clearly less valent than the valence dimension.

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<sup>9</sup> Reaction times above 896 ms were more than three interquartile ranges above the third quartile of the response time distribution (“far out values”; Tukey, 1977). Analysing only those responses that were given before the target turned red ( $\leq 750$  ms) led to the same results.

<sup>10</sup> This difference is possibly relevant because it could bias the group differences in the EC-effect. It does not, however, significantly correlate with the EC effect, neither across all participants, nor in one of the groups (all  $r < .26$ , *ns*). Therefore, entering US ratings as covariates seemed not warranted. Nevertheless we performed additional analyses with US-ratings as covariates. These led to the same pattern of results.

<sup>11</sup> These mediation analyses could unfortunately not be performed on the stimulus-pair level because repeated measures regression analyses require to either calculate regression coefficients for each participant separately or to enter  $N-1$  subject-dummy variables for every predictor and their interactions (Lorch & Myers, 1990). This leads to two problems: 1. Between-subjects effects cannot be calculated because they do not vary within the subjects. 2. The complete analysis involves a very large number of predictors that almost reaches the number of data points.

<sup>12</sup> The fact that in our studies the EC effect only obtained when participants had the goal to evaluate does in a strict sense not proof that EC effects never appear without the goal to evaluate. They only show that within the constraints and conditions of our experiment we found such a dependency (see Moors & De Houwer, 2006, for a discussion of this issue).

<sup>13</sup> An additional point is that independent of the process mediating the valence focus effect, it is possible that this mechanism just adds up to a standard EC effect which by itself might be based on a different process. If, for example, the valence focus effect is based on a CS-ER link then this does not mean that all of the EC effect is based on a CS-ER link; it might be

partially based on a CS-US link. Of course, the nature of the process underlying the valence focus effect might be informative about the process underlying the EC effect.