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FlashReport

Processing fluency: An inevitable side effect of evaluative conditioning☆

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HIGHLIGHTS

- The procedure of evaluative conditioning increases processing fluency of stimuli.
- The conditioned valence and the affectively positive fluency shape overall liking.
- The positive fluency experience amplifies the effect of positive conditioning.
- The positive fluency experience mitigates the effect of negative conditioning.
- Finding explains observed valence asymmetries and has implications for extinction.

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ABSTRACT

Human preferences can be shaped by evaluative conditioning (EC), which describes observed changes in liking of an initially neutral stimulus (conditioned stimulus) due to repeated paired presentations with an inherently positive or negative stimulus (unconditioned stimulus). The experimental procedure of EC implies that participants are repeatedly exposed to the conditioned stimulus. Prior research suggests that repeated exposure to stimuli facilitates their processing. Furthermore, the resulting experience of processing fluency is known to shape human preferences through its inherent positive valence. Surprisingly, however, the role of processing fluency due to repeated stimulus exposure has never been directly investigated within the context of EC. The present research extends current conceptualizations of EC by incorporating processing fluency. In particular, it presents the first study that differentiates between a direct effect of stimulus pairing and a fluency-mediated effect of stimulus repetition on liking in a standard EC procedure. This approach helps to answer the open theoretical questions of why negative EC (i.e., EC applying negative unconditioned stimuli) tends to produce smaller effects than positive EC (i.e., EC applying positive unconditioned stimuli), and why positive EC is less susceptible to extinction than negative EC. On this basis, we strongly recommend considering processing fluency in theoretical models and empirical studies on EC and other forms of evaluative learning.

Evaluative conditioning (EC) refers to "an observed change in liking that is due to the pairing of stimuli" (De Houwer, 2007, p. 233). Usually, EC is examined using a procedure in which an initially neutral conditioned stimulus (CS) acquires affective valence through repeated pairing with an affectively positive or negative unconditioned stimulus (US). A common example for the use of EC in practice is advertising (e.g., Gorn, 1982; Stuart, Shimp, & Engle, 1987). Advertisers have the choice between making consumers like their own product more by repeatedly associating it with positive USs (i.e., positive EC), or making consumers like the product of their competitor less by repeatedly associating it with negative USs (i.e., negative EC). The current research aims at examining whether the processes underlying EC imply that the valence of the US moderates the magnitude of EC such that one type of EC (positive vs. negative) is systematically more efficient than the other.

The experimental procedure of EC provides a starting point for this endeavor because the EC procedure not only repeatedly pairs the CS with the US, but necessarily repeatedly exposes participants to the CS, which suggests an underlying mechanism not yet considered in the context of EC: processing fluency (i.e., the subjective ease with which a stimulus is processed; Reber, Schwarz, & Winkielman, 2004). In particular, repeated exposure to a stimulus triggers a hedonically positive experience of fluent processing (Bornstein & D'Agostino, 1994; Reber, Winkielman, & Schwarz, 1998), which is sufficient to enhance affective stimulus evaluations (Harmon-Jones & Allen, 2001; Zajonc, 1968). Accordingly, we expect that EC not only reflects the positive or negative affect acquired through pairing with the US, but also includes a positive affective component due to the fluency induced by repeated exposure. This positive exposure effect

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would amplify the effect of pairing CSs with positive USs because both effects work in the same direction, but it would mitigate the effect of pairing CSs with negative USs, because these two effects work in opposite directions. Indeed, this preference asymmetry has repeatedly been noted in the EC literature (e.g., Baeyens, Crombez, Van den Bergh, & Eelen, 1988; De Houwer, Baeyens, Vansteenwegen, & Eelen, 2000), but its underlying mechanism has not been explicitly explored.

To put our idea to an empirical test, we extend a standard EC paradigm by adding a no-exposure control condition and by measuring the fluency of the CSs after conditioning. The no-exposure control condition allows us to quantify the amount of fluency induced by exposure. On this basis, we are able to statistically disentangle the direct effect of stimulus pairing from the effect of repeated exposure, as mediated by processing fluency, in the overall liking judgment. We expect that compared to negative conditioning, positive conditioning will result in a greater absolute shift from the liking baseline, due to the presumed additive combination of the positive exposure effect and an either positive or negative pairing effect. Furthermore, we predict that the asymmetry will disappear when we adjust the conditioning effect by removing the contribution of fluency.

1. Method

The empirical study consists of two parts. The first part is a supplementary study that replicated the well-known mere exposure effect (e.g., Zajonc, 1968) and served the purpose of validating that repeated exposure to our stimulus material induces processing fluency. We report details on this supplementary study in the Web-Appendix. The main study reported here employed a standard EC procedure (e.g., Sweldens, van Osselaer, & Janiszewski, 2010) extended by a no-exposure control condition and the measurement of fluency. 150 participants were recruited on Amazon MTurk. N = 127 finished all parts of the study and constitute our final sample that was randomly assigned to one of the two studies.[1] The median completion time was approximately 9 min and participants received a compensation of $0.40.

N = 57 ($M_{age} = 39.1$; 38.6% female) participants were assigned to the main study on EC, which used a one-factorial within-subjects design with four levels: no-exposure, positive EC, neutral EC, and negative EC. As CSs, we used a pool of 18 Kanji characters (cf. Dechêne, Stahl, Hansen, & Wänke, 2009). To account for any stimulus effects, for each participant we randomly sampled 6 Kanji characters to serve as CSs. Of these six characters, two each were paired with positive, neutral, and negative USs. We sampled an additional 6 Kanji characters to serve as no-exposure baseline comparisons. The remaining 6 Kanji characters served as distractor stimuli for a memory task. We used ten positive (1 *SD* above the database mean, i.e., $M \approx 6.81$), ten neutral (close to the database mean, i.e., $M \approx 5.03$), and ten negative (1 *SD* below the database mean, i.e., $M \approx 3.25$) IAPS pictures[2] as USs (Lang, Bradley, & Cuthbert, 2008).

Participants went through three consecutive experimental phases: a conditioning phase, a rating phase, and a memory test. During the conditioning phase, the participants saw a stream of pictures where the CSs and USs were shown side-by-side for 3 s with a 2 s inter-trial interval (the conditioning procedure follows Sweldens et al., 2010). Each CS was shown five times and paired once with each of five USs of one of the three valence categories.[3] The order of presentation was randomized and the total duration of the EC phase was 6 (total number of CSs per participant) × 5 (frequency of showing each CS during conditioning) × 5 (duration of each conditioning trial in seconds) = 150 s. In addition to instructing the participants to watch the stream of pictures, we announced that there would be a memory task at the end of the study. After the conditioning phase, the 6 CSs and the 6 no-exposure stimuli were presented in random order, and participants rated their liking of the Kanji characters ("How much do you like this character?"; end points "not at all" and "very much") on a visual analog scale (101 continuous increments), followed by a further round in which participants rated the characters on subjective fluency ("How easy or difficult was it to study this character?"; end points "not at all" and "very much"). Finally, the participants saw the six CSs and the six distractor characters at once and had to indicate which of the stimuli they had seen during the course of the experiment. As the purpose of the memory task was merely to ensure attention during the conditioning phase, it will not be discussed further. At the end, we collected information on general familiarity with Kanji characters, study involvement, and sociodemographic data. We did not employ any further measures or manipulations. All statistical analyses are based on the full sample size of participants who completed all parts of the study.

2. Results

Table 1 provides the descriptive statistics for the two dependent variables (i.e., liking and fluency). Fig. 1 provides an overview of the conceptual model underlying our statistical analyses and the model estimates.

To disentangle the exposure effect from the pairing effect in the liking judgments, we estimated the three standard equations of statistical mediation analysis (Muller, Judd, & Yzerbyt, 2005) with liking as the dependent variable, fluency as the mediator, and the valence of the USs as the independent variable. To adequately model the data, we follow the recommendations of Westfall, Kenny, and Judd (2014) and account for the random variance induced by sampling participants *i* and stimuli *j* by estimating the following three Linear Mixed Models:

$$\text{liking}_{ij} = b_0 + b_1 * \text{negative}_{ij} + b_2 * \text{neutral}_{ij} + b_3 * \text{positive}_{ij} + u_{0i} + u_{0j} + e_{ij} \tag{1}$$

$$\text{fluency}_{ij} = b_0 + b_1 * \text{negative}_{ij} + b_2 * \text{neutral}_{ij} + b_3 * \text{positive}_{ij} + u_{0i} + u_{0j} + e_{ij} \tag{2}$$

$$\text{liking}_{ij} = b_0 + b_1 * \text{negative}_{ij} + b_2 * \text{neutral}_{ij} + b_3 * \text{positive}_{ij} + b_4 * \text{fluency}_{ij} + u_{0i} + u_{0j} + e_{ij} \tag{3}$$

where *b* indicates the fixed effects, *u* indicates the random effects, and *e* indicates the residuals. The three valence categories of the USs are coded as follows: Negative [0 = no-exposure; 1 = negative], neutral [0 = no-exposure; 1 = neutral], and positive [0 = no-exposure; 1 = positive]. We used the "lmer"-function of the "lme4" library of the statistical software R to estimate the models (Bates, Maechler, Bolker, & Walker, 2015).[4]

Model 1 tests the total effects of the EC valence conditions on liking (depicted in square brackets in Fig. 1) and shows positive effects of neutral EC ($b_2 = 5.13$ [0.06, 10.20]) and positive EC ($b_3 = 17.85$ [12.13, 23.48]) but no effect of negative EC ($b_1 = -4.82$ [−10.89, 1.47]). This analysis replicates the asymmetric valence effect already observed in

[1] The required minimum sample size for the supplementary study and the main study (N = 120 in total) was determined according to Westfall et al. (2014) to achieve a power of 0.80. Effect sizes were obtained from Bornstein (1989) for mere exposure and Hofmann et al. (2010) for EC. Because we selected a homogenous set of stimuli, we restricted the VPC stimulus-slope to zero.

[2] We used the following IAPS pictures: Positive [1603, 1812, 4612, 4700, 5626, 5870, 5994, 7501, 8033, 8041], neutral [1645, 2102, 2397, 2411, 2880, 7002, 7009, 7045, 7255, 7640], and negative [1304, 2120, 2457, 2700, 2753, 7135, 9341, 9373, 9417, 9584]. Please note that the positive and negative pictures do not differ in terms of arousal ($p = 0.323$).

[3] Importantly, since each US was only used once during conditioning, the USs are not affected by any repeated exposure effects. Moreover, pairing each CS with five different USs in a simultaneous presentation mode enables the creation of direct affective responses towards the CSs (Sweldens et al., 2010).

[4] For all analyses, we report the REML estimates and [95%] bootstrapped confidence intervals based on 5000 random draws.