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BRIEF REPORT

I Like to Get Nothing: Implicit and Explicit Evaluation of Avoided Negative Outcomes

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This study examined affective consequences of an active avoidance response. Catching a fleeting stimulus with a rapid key press secured a monetary reward in a reward condition or avoided a monetary loss in an avoidance condition. Outcomes of wins, missed wins, losses, and avoided losses were signaled with color patches that were evaluated explicitly (via evaluative rating) and implicitly (via an affective priming task). Liking scores in each condition were compared with those in yoked-control conditions in which wins and avoided losses were presented without the requirement of an active response. In the explicit measure, colors associated with an avoided loss were rated positively and colors associated with a missed win were judged negatively, irrespective of whether the outcome was self-generated. In the implicit measure, outcomes of missed wins and avoided losses were evaluated differently only when they were self-generated. The results confirm a qualitative affective equivalence between an avoided loss and an achieved win. Implications for avoidance theories are discussed.

Keywords: avoidance, implicit and explicit liking, affective priming, agency

In many everyday situations, a person can avoid unfavorable outcomes through direct action. The motivational processes driving an avoidance response, however, have puzzled researchers for decades, because once an aversive outcome or punishment is avoided successfully, the person does not experience an explicit reinforcement of the behavior. Thus, the theoretical puzzle that avoidance behavior poses is that it is not clear what consequence of avoidance maintains the behavior.

To account for this apparent paradox, theorists have proposed that active avoidance is reinforced by affective consequences of the behavior. Classic theories are two-factor theories that advocate an interaction between Pavlovian and instrumental learning processes (Mowrer, 1939) or theories that invoke cognitive expectancies (Seligman & Johnston, 1973). According to these accounts, the conditioned or cognitive expectancy of an aversive outcome causes fear, and the avoidance response reduces fear. An avoidance response is hence maintained by a reduction of negative emotional tension (i.e., fear), which reinforces the response (Rescorla & Lolordo, 1965). An alternative account is opponent-process theory (Solomon & Corbit, 1974). This theory proposes that the termination or offset of an affective process of one valence (induced by a hypothetical process A) is associated with the onset of a complementary affective response of the opposite valence (induced by a hypothetical process B). Accordingly, the termination of a negative affective state resulting from anticipation of an aversive outcome should be followed, in opponent process terms, by the onset of an opposing positively valenced hedonic response. Opponent process theory consequently proposes that an avoidance response is reinforced by an increase in positive affect that follows successful avoidance.

To summarize, there is a general agreement among avoidance theories that an avoidance response is reinforced by the affective consequences of successful avoidance. This hypothesis has received much empirical support (Dinsmoor, 2001; Mineka, 1979). For example, Morris (1975) showed that a stimulus that signals successful avoidance after the production of an avoidance response subsequently can be used as a positive reinforcer in its own right. Furthermore, neuropsychological studies observed that successful avoidance of an aversive outcome activates reward circuits in the human brain (Ilango, Shumake, Wetzel, Scheich, & Ohl, 2012; Kim, Shimojo, & O'Doherty, 2006). However, although these studies confirm reinforcing consequences of successful avoidance, they are not conclusive in respect to the affective properties of these consequences. In fact, some researchers have argued that behavior reinforcement, and the underlying neural system, is dissociable from the affective experience of a reinforcing event (Berridge, 2007; Berridge & Robinson, 2003). Furthermore, showing that successful avoidance is correlated with increased activity in mesolimbic brain structures does not indicate that these brain regions (and the motivational-affective processes associated with these regions) are also causally involved in the affective experience that is generated by successful avoidance (Sarter, Berntson, & Cacioppo, 1996). By using affective measurement procedures, the present research therefore attempted to provide more direct

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evidence for affective changes that are elicited by successful avoidance.

A straightforward way to examine these changes is to ask people how they feel after successful avoidance or how they evaluate the outcome of a successful avoidance response. This research approach, however, is not without problems. One difficulty is that judgments of pleasant and unpleasant outcomes or feeling states are inherently contrastive. That means that people judge neutral events as (more) pleasant when compared with clearly unpleasant events, whereas people judge them as (more) unpleasant when compared against pleasant events (e.g., Larsen & Norris, 2009; Parducci, 1984). It should be noted that affective contrast is not problematic per se for a study of avoidance behavior if these effects would describe true changes of affective perceptions. At least with self-report measures, however, there exist more mundane explanations involving strategic response biases that do not reflect a change of the underlying affective representation (Strack, 1994). For instance, participants may feel compelled to use the entire response scale (e.g., extremely unpleasant to extremely pleasant) to satisfy the conversational norm to provide informative answers (Schwarz, 1996). Consider an individual presented with a series of exceptionally unpleasant stimuli. Rating all of these stimuli as extremely unpleasant would convey no information about how unpleasant they are relative to one another, so the individual may choose to rate the least unpleasant of these exceptionally unpleasant stimuli as only mildly unpleasant. As a consequence, an outcome of successful avoidance is perhaps judged less unpleasant (or more pleasant depending on the rating scale) in the context of clearly aversive outcomes even though avoidance behavior has elicited no affective response.

One solution to this problem is a use of indirect attitude measures. In indirect attitude measures, object liking is not assessed directly but, rather, inferred indirectly from behavioral performance measures such as reaction time (RT) and/or error rates (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009). In the so-called affective priming task, for instance, the liking of prime stimuli is inferred from the reaction speed to positive and negative target stimuli that are presented briefly after or simultaneously with the prime stimuli (see Klauer & Musch, 2003, for a review). Responses to the target stimuli are typically faster and more accurate when the valence of the prime stimulus is congruent with the valence of the target stimulus (i.e., positive-positive, negative-negative) compared to when they are incongruent (i.e., positive-negative, negative-positive). Given that the participants are instructed to ignore the prime stimuli and to respond only to the target stimuli, this task procedure rules out judgmental response biases like conversational norms (Scherer & Lambert, 2009). Furthermore, evaluations of the prime stimuli must be spontaneous and unintended in order to affect behavioral performance (Moors & De Houwer, 2001). The indirect measurement technique consequently allows for an assessment of spontaneous motivational evaluations without intrusion of explicit judgmental biases (Fazio & Olson, 2003).

The Present Study

The present study used implicit and explicit liking measures for an examination of approach- and avoidance-related action outcomes. Participants were randomly assigned to one of two "active-response conditions" in which they were to "catch" a fleeting stimulus (i.e., a box) with a rapid key press during stimulus presentation. In a "reward condition," participants earned points when they caught the box; however, they received no points when they missed the box. In an "avoidance condition," participants lost points when they missed the box, while they lost no points when they caught the box. The achieved outcome was signaled by a color cue that was evaluated implicitly (with an affective priming measure) and explicitly (with rating scales) in separate blocks. These evaluations were then compared with evaluations of the same color cues in yoked-control conditions in which wins and losses (and their absence) were determined by the computer and not by an active response of the participant (in a "passive-observation condition").

We expected that colors associated with an avoided loss act like positive primes in the affective priming task, while colors associated with a missed win operate like negative primes in this task. An interesting research question is whether an avoided loss is evaluated differently depending on whether the outcome was self-produced. Several research findings suggest that outcomes of one's own actions are appraised in a different way than outcomes produced by circumstances (Averill, 1973; McFarland & Ross, 1982). Liking scores in the active-response conditions therefore were compared with those in the yoked-control conditions in which the outcome was delivered in the absence of an active response.

Method

Participants

Sixty-four students (31 women) were randomly assigned to the reward or avoidance conditions. One participant in the avoidance condition responded erroneously in 35% of the priming trials (rest of the sample: $M = 11\%$, $SD = 6.5$). This participant was replaced with another person. An additional 64 students (37 women) were assigned to the yoked-control conditions. Thus, each condition comprised 32 participants.

Apparatus and Stimuli

Participants were seated at a distance of about 60 cm from a 17″ VGA color monitor. Stimulus presentation and measurement of response latencies were controlled by a software timer with video synchronization (E-Prime2; Schneider, Eschmann, & Zuccolotto, 2002).

For the "catch-the-box task," a white box (300 pixels wide and 150 pixels high) was presented at the center of the computer screen. A turquoise box and a yellow box served as feedback stimuli. Targets for the affective priming task were 24 clearly positive and 24 clearly negative adjectives that were selected from a standardized word pool according to their valence norms (Schwibbe, Röder, Schwibbe, Borchardt, & Geiken-Pophanken, 1981). The subsets of positive and negative words were matched in number of letters (range: 4–9) and frequency of usage (with both Fs < 1). An additional 6 positive and 6 negative adjectives were used for task practice. The words were presented in lower case letters at the screen center.

Design

Participants were assigned to one of four conditions. (1) In the reward condition, participants earned points when they pressed a button during the presentation of a stimulus (white box), and they earned no points when they missed the stimulus. (2) In the yoked-reward condition, yoked participants received the same number and sequence of rewards as the participants in the reward condition, but this time without pressing a key. (3) In the avoidance condition, participants lost points when their key press missed the box. A timely key press, however, avoided a point loss. (4) In the yoked-avoidance condition, the outcome was controlled by the computer, and points were lost with the same frequency and in the same sequence as in the avoidance condition.

Procedure

Participants completed two tasks: a "catch-the-box task" and an "evaluate-the-word task" (affective priming task). Both tasks alternated in blocks of trials in a strict sequence.

A white box was presented as the target for the catch-the-box task. Participants in the active-response conditions were instructed to "catch" the box with a press of the spacebar during the presentation of the box. When the spacebar was pressed in time, the color of the box turned into turquoise or yellow, indicating that the participant had earned 10 points (reward condition) or had not lost points (avoidance condition) in this trial. If the key was not pressed in time, or"missed" the box, the box changed into the other color, signaling no reward (reward condition) or a loss of 10 points (avoidance condition). The assignment of the colors to the response feedback was counterbalanced across participants. In the yoked-control conditions, participants were instructed to observe the box that signaled a point win or loss (and their absence) without a response requirement.

Before the experimental blocks, the presentation duration of the white box was individually adjusted for the catch-the-box task to avoid ceiling and floor effects of the hit rates. Participants completed eight blocks with 10 trials each. The presentation time of the white box was set to 320 ms in the first block. After each trial block of the adjustment phase, the presentation time was adjusted using a staircase procedure to achieve a "hit" (i.e., a key press made during the box presentation) rate between 60% and 80%. The presentation time was increased by 20 ms when the hit rate was lower than 60% and decreased by 20 ms when it was above 80%. During the adjustment phase, the box was not colored for a response feedback. Instead, the word "TREFFER!" (HIT!) was presented at the center of the screen for 1000 ms if the spacebar was pressed during the box presentation. If the spacebar was pressed too early (i.e., before the onset of the box) or too late (i.e., after the offset of the box), the words "ZU SCHNELL!" (TOO FAST!) and "ZU LANGSAM!" (TOO SLOW!) informed the participant about an anticipatory or delayed response, respectively. The next trial was initiated after a random time interval between 600 and 1200 ms. Only participants in the active-reward conditions worked through an adjustment phase.

In the affective priming task, participants categorized the evaluative meaning of a word as quickly and as accurately as possibly by pressing the keys "*d*"" and "k" of the keyboard. The assignment of the response keys to a positive or negative word meaning was counterbalanced across participants. Half of the positive and negative words had a turquoise color, the other half were presented in a yellow color. After a fixation cross (300 ms) and a blank time period (100 ms), the target word was presented until the press of response key or for 2000 ms. The next trial was initiated after 300 ms.

The experiment started with a practice block of the evaluate-the-word task. Participants evaluated 4 positive words and 4 negative words in random order. For task practice, all words were presented in white color. The word "RICHTIG!" (CORRECT!) appeared for 500 ms on the screen after a correct response; after an incorrect or omitted response, the word "FALSCH!" (INCORRECT!) appeared for 1000 ms as a reminder of the task rules. After the practice block, the adjustment phase followed, which familiarized the participants with the catch-the-box task.

At the start of the experimental phase, participants were informed that they could earn real money by collecting points in both tasks. The total score of points was displayed at the upper right corner of the screen. Participants, however, were not informed about the conversion rate of the points in Eurocents (which was 4:1). In the reward condition, participants started with zero points. Catching the box was rewarded with 10 points and missing the box (i.e., an anticipatory or delayed response) earned no points. In the avoidance-condition, participants started with a credit of 800 points. Catching the box saved 10 points, which were otherwise subtracted. For the yoked-conditions, participants received the same instructions but it was stated that a computer program determined whether points were lost or earned, respectively. The participants in the yoked-conditions viewed the white box and the colored box for the same time periods as their associates in the experimental groups. Furthermore, task instructions explicitly described which box color signals which outcome.

In the affective priming task, participants earned 50 extra points with a high number of fast and correct responses in a block. Response accuracy was high when responses were correct in more than 75% of the block trials. Response speed was high when the mean latency of correct responses in a block was below 1000 ms. After each block, a performance summary appeared whether accuracy and response speed in that block had been sufficient to gain the bonus.

The experimental phase consisted of eight blocks of the catch-the-box task with 10 trials each and eight blocks of the evaluate-the-word task with 12 trials each. Participants knew that the tasks will alternate from one block to the next one, and a screen informed at the start of each block about the upcoming task. After each block of the catch-the-box task, the presentation time of the white box was still adjusted (if necessary) using the staircase procedure of the adjustment phase.

After the experimental phase, participants were asked to rate the box colors on unipolar and bipolar rating scales. In a first set of questions, turquoise and yellow color patches were rated on unipolar scales that ranged from neutral (0) to very positive (9) (positive scale) and from neutral (0) to very negative (9) (negative scale). The order of the four questions was random. After that, the two color patches were rated on bipolar scales that ranged from 0 (very negative) to 9 (very positive). Finally, participants were paid, debriefed, thanked, and dismissed.

Results

Catch-the-Box Task

Participants caught the box in 70% of the trials in the reward condition and in 69% of the trials in the avoidance condition. Thus, participants earned a similar amount of money in the reward condition (M = 222 Eurocents, SD = 22) and in the avoidance condition (M = 218 Eurocents, SD = 24), $t < 1$.

Implicit Priming Measure

Trials with incorrect responses were removed from RT analyses. In addition, individual Tukey (1977) outlier thresholds were computed for each condition to identify response latency outliers; this truncation removed 4.3% of the RTs. Figure 1 shows the mean RTs (left side) and the percentage of incorrect responses (right side) to positive and negative words as a function of whether the word color was associated with a loss and no loss (upper panel) or with a win and no win (lower panel). Analyses of error rates lead to roughly the same conclusions as the analyses of the RTs. Confidence intervals of standardized effect sizes (Cohen's d, partial eta-square) were computed with the R package "MBESS" (Kelley, 2007).

A mixed analysis of variance (ANOVA) of the RTs with word valence (positive vs. negative) and color association (no change in points vs. change in points) as within-subjects factors and outcome (win vs. loss) and agency (person vs. computer) as between-subjects factors yielded a main effect of word valence and a main effect of agency, $F(1, 124) = 5.57$, $p < .05$, $\eta_p^2 = .043$, 95% CI [.001, .128], and $F(1, 124) = 10.99$, $p < .05$, $\eta_p^2 = .081$, 95% CI [.013, .181]. Participants responded faster to positive words and slower in the yoked-control conditions. The expected three-way interaction between word valence, color association, and outcome was significant, $F(1, 124) = 5.67$, $p < .05$, $\eta_p^2 = .044$, 95% CI [.001, .129]. Furthermore, the four-way interaction reached significance, $F(1, 124) = 4.73$, $p < .05$, $\eta_p^2 = .037$, 95% CI [0, .114], indicating an additional influence of agency on the affective priming effects. Further planned comparisons were performed to reveal the nature of the four-way interaction.

Avoidance-related conditions. Among the participants assigned to the avoidance condition, the expected word valence (positive vs. negative) × color-association (no loss vs. loss) interaction emerged, $F(1, 31) = 11.74$, $p < .05$, $d = .60$, 95% CI [0.22, 0.97]. As shown in Figure 1, colors associated with a loss facilitated negative word judgments relative to positive word judgments (ΔM = 8 ms), whereas colors associated with no loss facilitated positive word judgments relative to negative word judgments (ΔM = 25 ms). An analogous effect, however, was not observed in the yoked-control condition. In this condition, word colors associated with loss (ΔM = 1 ms) and no loss (ΔM = 6 ms) had no reliable effects on the evaluation speed of positive words

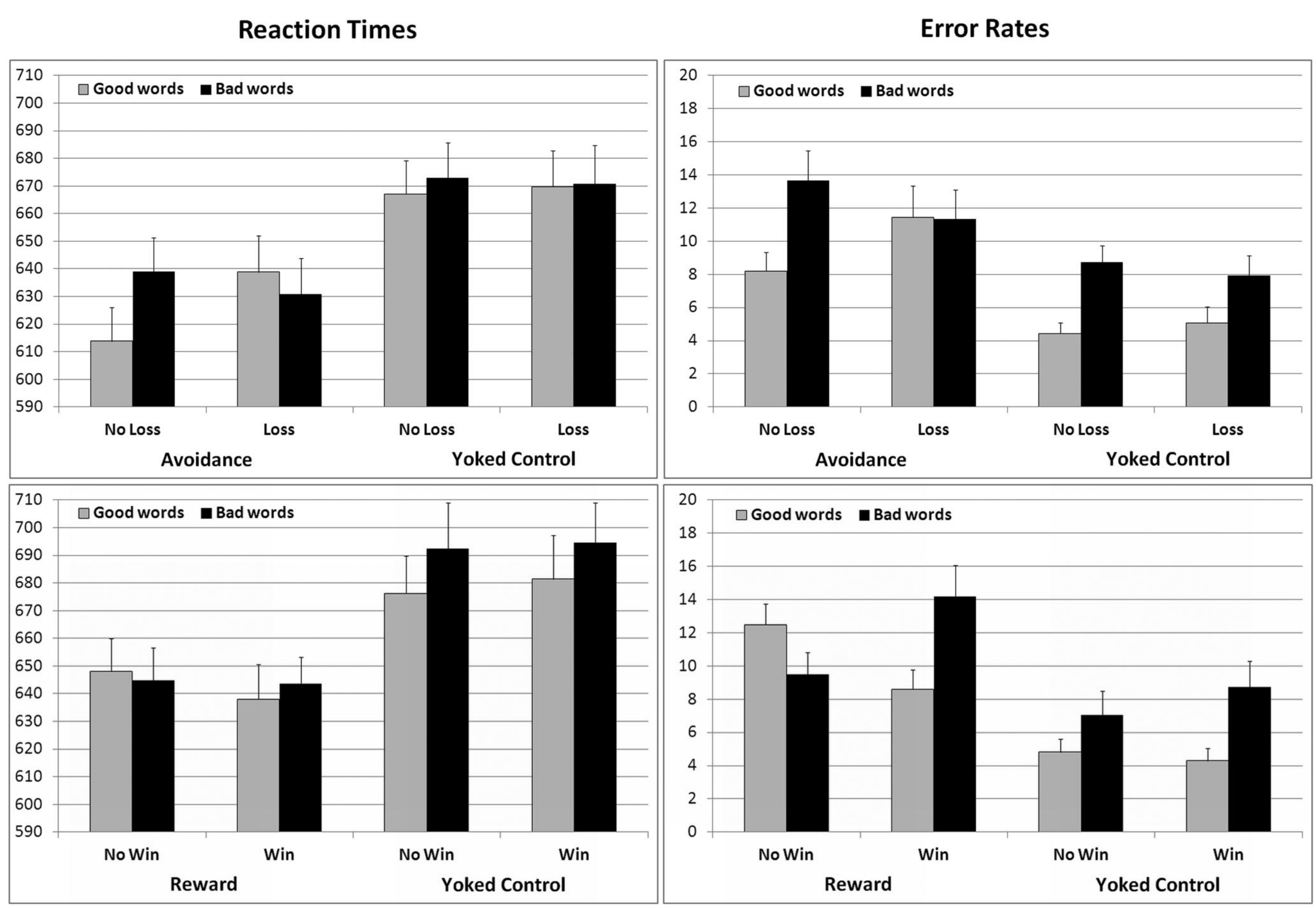

Figure 1. Mean reaction times (RTs) in ms (left side) and error rates in percent (right side) in the affective priming task as a function of word valence, color-association, and experiment condition. Error bars show the standard error.

relative to negative words, $F(1, 31) = 0.32$, $p = .58$. A priming effect was consequently only observed in the avoidance condition but not in the yoked-control condition, which is confirmed by a significant three-way interaction between word valence, color-association, and agency (person vs. computer), $F(1, 62) = 4.77$, $p < .05$, $\eta_p^2 = .071$, 95% CI [0, .214].

The affective priming effect observed in the avoidance condition suggests that colors associated with no loss facilitated positive word judgments relative to negative word judgments. The interpretation of this effect, however, is complicated by the possibility of a general difference in the processing speed of positive and negative words. Therefore, an additional analysis was carried out that corrected priming scores for a positivity bias estimated from the yoked-control group. In a first step, the evaluation speed of positive words was subtracted from the evaluation speed of negative targets in the yoked-control group. These differences were then averaged to provide an estimate of a positivity bias. In a second step, a priming score was computed for the no-loss color only by subtracting the reaction speed to positive words from the reaction speed to negative words. A positive priming score indicated a priming of positive words relative to negative words. Finally, the priming scores were corrected by the estimate of the positivity bias ($M = 3.38$ ms) and the corrected scores were tested against zero. The analysis yielded a significant priming score ($M = 22$ ms, $d = 0.46$, 95% CI [0.09, 0.82]), $t(31) = 2.59$, $p < .05$. This priming effect confirms that colors associated with no loss acquired a positive valence.

Reward-related conditions. A comparison of the reward condition with the yoked-control condition yielded a similar pattern of results that was, however, less clear. As shown in the lower panel of Figure 1 (left side), participants responded in the reward condition faster to negative words than to positive words when the word color was associated with no wins ($\Delta M = 3$ ms), whereas the pattern was reversed when the word color signaled a win in the previous task ($\Delta M = 5$ ms). This affective priming effect, however, did not reach statistical significance, $F(1, 31) = 0.99$, $p = .33$. In the yoked-control condition, participants responded generally faster to positive words than to negative words, $F(1, 31) = 4.63$, $p < .05$, $d = .38$, 95% CI [0.02, 0.74]. The color-association with wins ($\Delta M = 14$ ms) and no wins ($\Delta M = 16$ ms) had no effect on the speed of positive relative to negative word judgments, $F(1, 31) = 0.94$, $p = .76$. In short, a priming effect was observed in neither reward-related condition, suggesting that winning (no) points in the reward condition had less motivational significance than (not) losing points in the avoidance condition in the RT measure. It should be noted, however, that a clear priming effect ($M = 8.6\%$, $d = 0.59$, 95% CI [0.21, 0.96]) was observed in the error rates of the reward condition, $F(1, 31) = 11.17$, $p < .05$, while no such effect ($M = 2.2$, $SD = 9.6$) was obtained in the yoked-control condition, $F(1, 31) = 1.69$, $p = .20$ (see right side of Figure 1). This difference also is statistically supported by a significant three-way interaction between word valence, color-association (win vs. no win), and agency (person vs. computer) in an analysis of the error rates, $F(1, 62) = 4.28$, $p < .05$, $\eta_p^2 = .065$, 95% CI [0, .204].

RT priming scores obtained for colors associated with no wins were corrected for a positivity bias estimated from the yoked-control group ($M = 14.7$ ms) using the correction method described above. The analysis yielded a corrected priming score ($M = -18$ ms, $d = 0.43$, 95% CI [0.06, 0.79]) that was significant from zero, $t(31) = -2.41$, $p < .05$. According to this analysis, a processing advantage of positive words may have masked a priming of negative word judgments, suggesting a negative valence of colors associated with no wins.[1]

Comparison of colors associated with no loss and no win. The analyses above show that colors associated with no losses in the avoidance condition acquired a positive valence, while colors associated with no wins in the reward condition acquired a negative valence. This asymmetry was confirmed by statistical analyses of the trials with these colors only, which revealed a significant interaction between word valence (positive vs. negative), color-association (no loss vs. no win), and condition (avoidance vs. reward), $F(1, 62) = 6.40$, $p < .05$, $\eta_p^2 = .094$, 95% CI [.004, .243]. This interaction shows that an association with an objectively identical outcome (i.e., no change of a point score) exhibited different affective properties depending on whether the outcome was presented in a rewarding context or in an avoidance context.

Explicit Rating Measure

Figure 2 shows the mean ratings of the color patches on unipolar and bipolar rating scales in each experiment condition. Analyses of the judgments on the unipolar scales produced mixed results.

When the judgment scale was positive (neutral-very positive), there was a tendency to evaluate the color associated with no loss more positively ($M = 5.0$, $SE = 0.34$) than the alternative color that signaled a loss of points ($M = 4.2$, $SE = 0.34$), $F(1, 62) = 3.42$, $p = .069$, $\eta_p^2 = .052$, 95% CI [0, .186]. This tendency was not influenced by a response requirement during the catch-the-box task, $F(1, 62) = 0.01$, $p = .97$. When the judgment scale was negative (neutral-very negative), no rating differences were observed (with all $ps > .20$).

Participants in the reward condition evaluated colors that were associated with a point win ($M = 5.2$, $SE = 0.31$) more favorably on a unipolar positive scale than the colors that signaled no win ($M = 4.1$, $SE = 0.34$), $F(1, 62) = 5.94$, $p < .05$, $\eta_p^2 = .087$, 95% CI [.002, .235]. This effect was not influenced by agency (person vs. computer), $F(1, 62) = 1.09$, $p = .30$. Again, no effects were obtained with judgments on a unipolar negative scale (all $ps > .10$).

Ratings on a bipolar scale were as expected from affective contrast models. Colors that signaled successful avoidance of a loss were evaluated more positively ($M = 5.8$, $SE = 0.31$) than colors that signaled a loss ($M = 4.2$, $SE = 0.32$), $F(1, 62) = 14.26$, $p < .001$, $\eta_p^2 = .187$, 95% CI [.043, .347], irrespective of agency, $F(1, 62) = 0.47$, $p = .50$. In the reward-related conditions, colors associated with a win ($M = 6.0$, $SE = 0.27$) were rated more positively than colors associated with no win ($M = 4.5$, $SE = 0.32$), $F(1, 62) = 10.42$, $p < .05$, $\eta_p^2 = .144$, 95% CI [.021, .302].

[1] Analyses of corrected priming scores were repeated with corrections by a positivity bias estimated from both participant groups (i.e., avoidance plus yoked-control and reward plus yoked-control, respectively). In these analyses, the corrected priming score of colors associated with no loss was still significant ($M = 19$ ms, $d = 0.40$, 95% CI [0.04, 0.76]), $t(31) = -2.41$, $p < .05$. The corrected priming score of colors associated with no wins, however, did not reach significance ($M = -11$ ms, $d = 0.27$), $t(31) = -1.50$, $p = .14$.

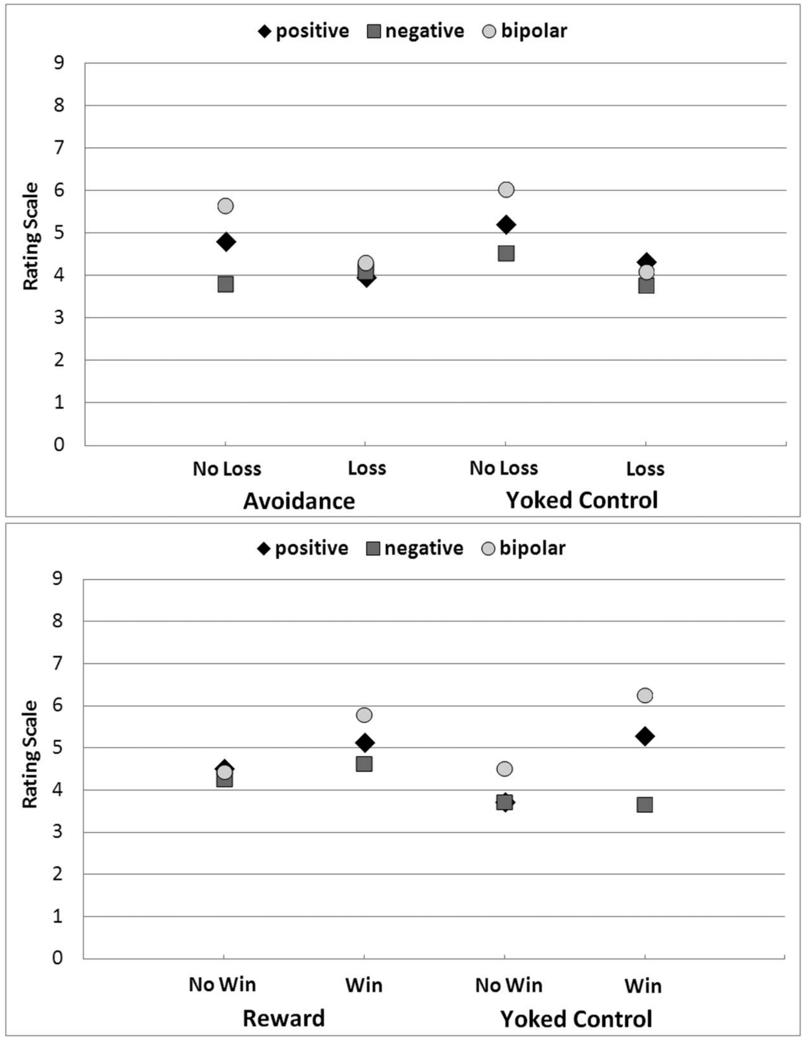

Figure 2. Mean affective ratings of color patches on unipolar and bipolar rating scales in the different conditions. Note that a high score on the positive and bipolar scale indicates a more favorable evaluation of the color patch, while a high score on the negative rating scale indicates a more unfavorable evaluation.

Again, the execution of an active response had no effect on the judgmental effect, $F(1, 62) = 0.18$, $p = .67$.

An analysis of the bipolar ratings of the colors associated with no loss and no wins only confirmed that colors associated with no loss ($M = 5.7$, $SE = 0.43$) were evaluated more positively than colors associated with no win ($M = 4.5$, $SE = 0.43$) in the active-response conditions (i.e., avoidance vs. reward), $t(62) = 1.96$, $p < .05$ (one-tailed), $d = 0.49$, 95% CI [0, 0.99], and in the passive-observation conditions ($M = 6.0$, $SE = 0.46$, and $M = 4.5$, $SE = 0.46$), $t(62) = 2.29$, $p < .05$, $d = 0.57$, 95% CI [0.07, 1.07].

Discussion

The results confirm an affective valence of avoided punishments and missed rewards. Not very surprising, gaining "nothing" (i.e., no points) was judged more favorably in the explicit ratings when an undesired outcome (i.e., loss of points) was avoided and more unfavorably when a desired outcome (i.e., a point win) was missed. This pattern was expected given previous research on affective contrast effects showing that pleasant stimuli are judged less favorably when embedded with clearly pleasant stimuli while unpleasant stimuli are judged more favorably when embedded with clearly unpleasant stimuli (e.g., Larsen & Norris, 2009; Parducci, 1984). The affective contrast effect observed in the explicit ratings was not affected by the requirement of an active response, because the colors were evaluated similarly following an active response and after passive observation of the outcomes. Furthermore, it is possible that the participants obeyed a conversational norm to avoid redundancy and to communicate differences between the outcomes in their evaluative judgments (Schwarz, 1996).

Given this interpretation problem with explicit ratings, it is even more interesting to look at the findings obtained with an implicit liking measure. Using an affective priming task, a positive or negative valence of color cues associated with wins, missed wins, losses and avoided losses was inferred indirectly from the speed of evaluative word categorizations. The indirect measurement technique rules out response biases such as a conversational norm. Results showed that colors associated with an avoided loss facilitated positive word judgments over negative word judgments, whereas colors associated with a missed win produced a reverse priming pattern. Thus, a color associated with an avoided loss acted like a positive prime and a color associated with a missed win acted like a negative prime. Notably, such an affective priming effect was obtained only in the active-response conditions, not in the passive-observation conditions. Thus, the requirement of an active response had an influence on the motivational evaluation of the observed outcomes. Further, the observation of an affective priming effect in the active-response conditions only also rules out a more mundane explanation of the contrast effect involving response-mapping processes (Scherer & Lambert, 2009).

Why were outcomes in the implicit measure evaluated differently after an active response and not after passive observation? One very simple explanation is that participants in the passive-observation conditions cared less about the outcomes delivered by a computer, reducing the emotional impact of the outcomes. This explanation, however, is not very plausible, because color patches in the passive-observation conditions were rated similarly to those in the active-response conditions. The clear liking difference in the explicit rating measures confirms that the passive-observation group had knowledge of the meaning of the color patches.

Another possibility is that outcomes of one's own actions were learned better and/or processed more efficiently than outcomes that are not contingent on one's own performance. Attention is directed to the produced outcomes during executive action control, and action outcomes are monitored for feedback-guided action learning (Botvinick, Braver, Barch, Carter, & Cohen, 2001; San Martín, 2012). Action monitoring thus may have facilitated feedback processing (and evaluation of the feedback) in the active-response conditions relative to the passive-observation conditions.

Finally, it is possible that self-produced outcomes are appraised differently from outcomes that are produced by external circumstances. Consistent with this explanation, many studies showed that a success (or failure) being attributed to an internal cause elicits more positive (or negative) feelings than a comparable success (or failure) that is attributed to an external cause (e.g., McFarland & Ross, 1982; Weiner, Frieze, Kukla, Reed, Rest, & Rosenbaum, 1987). Thus, successful avoidance of a monetary loss through one's action may have elicited more positive feelings (e.g., pride) than successful avoidance attributed to a computer algorithm. Moreover, research has shown that stress reactions are decreased in conditions in which people can modify the nature of a negative outcome in comparison with conditions in which no control is possible (Averill, 1973). Subjective perceptions of mastery and personal control thus may have changed the affective appraisal of missed wins and avoided losses in the active-response conditions. Further research is necessary to distinguish between these accounts.

Implications for Avoidance Theories

The present research clearly shows that an identical event (i.e., no change of points) exhibited different affective properties depending on whether the event was presented in a rewarding ("win") context or in a punishing ("loss") context: Cues of an avoided loss acted like positive primes in an affective priming task, whereas cues of a missed win acted like negative primes. This finding of a functional equivalence is in line with the rich animal and human literature showing that a conditioned stimulus that signals reliably the absence of an aversive event (i.e., a conditioned aversive inhibitor) has the same motivational properties as a conditioned stimulus that signals the delivery of a reward (i.e., a conditioned appetitive excitator) (Dickinson & Pearce, 1977; Papini & Dudley, 1997). The present study adds to this research by providing a more direct measure of the valence of these events.

Furthermore, the present findings support two-factor theory and opponent-process theory, which have emphasized affective processes in the generation of an avoidance response. It should be noted, however, that the present study cannot distinguish between both accounts without making additional assumptions about the representation of affect. For instance, it is possible that a reduced disliking of an avoided loss (as expected from two-factor theory) goes along with an increased liking of this event (as expected from opponent-process theory). With a unidimensional representation of affect (Russell & Carroll, 1999), a decrease in negative affect thus could not be dissociated from an increase in positive affect, making the affective predictions from both accounts indistinguishable. Alternatively, it is possible that an increase in liking is dissociable from a decreased disliking, as proposed by bidimensional accounts of positive and negative affect (Cacioppo & Berntson, 1994). The present findings are compatible with both structural accounts of affect, and the implications for avoidance theories hence depend on the assumptions one wants to make about the representation of affect.

Irrespective of the debate on a unidimensionality or bidimensionality of affect, the most parsimonious theoretical account is to propose that successful avoidance of a negative outcome is a positive experience that has reinforcing properties. Future research may examine whether the positive experience of an avoided loss differs quantitatively from the positive experience of an achieved reward (McGraw, Larsen, Kahneman, & Schkade, 2010). According to the present analysis, however, there appears to be no qualitative difference in the affective experience of having achieved a reward and having avoided a loss.

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