The Effect of Emotional Salience on Emotion-Induced Blindness

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Abstract

Emotion-induced blindness refers to a phenomenon where the presentation of a task-irrelevant emotional stimulus captures an individual's attention, resulting in the inability to "see" a rapidly presented target stimulus. The study employed the RSVP paradigm to investigate the effects of physical salience and emotional salience of emotional distractors on emotion-induced blindness under dissimilar background conditions and similar background conditions. Under dissimilar background conditions, the critical distractor differed significantly from filler stimuli; under similar background conditions, there was no significant difference between the critical distractor and filler stimuli. Experiment 1 compared the differences in emotion-induced blindness between the two background conditions. The results showed that the emotion-induced blindness effect emerged under dissimilar background conditions; under similar background conditions, the emotion-induced blindness effect disappeared. Experiment 2 compared the differences in emotion-induced blindness between the two background conditions after adding a red rectangular border to the critical distractor images. The results revealed that individuals' noticing of the emotional salience of distractors had a significant impact on emotion-induced blindness; under similar background conditions, the emotion-induced blindness effect emerged once negative distractors were cued. The findings indicate that the generation of emotion-induced blindness is not only related to the amount of attentional resources captured by distractor stimuli, but also related to the amount of attentional resources initially invested by the individual.

Full Text

The Effects of Emotional Salience on Emotion-Induced Blindness

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Abstract

Emotion-induced blindness (EiB) refers to a phenomenon where a task-irrelevant emotional stimulus captures attention, rendering individuals "blind" to a rapidly presented target stimulus. Using the rapid serial visual presentation (RSVP) paradigm, the present study examined how the physical and emotional salience of emotional distractors influence EiB under dissimilar and similar background conditions. In the dissimilar background condition, critical distractors differed significantly from filler stimuli, whereas in the similar background condition, no significant differences existed between critical distractors and filler stimuli.

Experiment 1 compared EiB effects between these two background conditions. Results revealed a robust EiB effect in the dissimilar background condition, which disappeared entirely in the similar background condition. Experiment 2 introduced a red rectangular frame around critical distractor images to investigate whether this manipulation would restore the EiB effect. Findings demonstrated that drawing attention to the emotional salience of distractors significantly impacted EiB; once negative distractors were cued in the similar background condition, the EiB effect re-emerged. These results indicate that the emergence of EiB depends not only on how much attentional resources a distractor captures but also on how many attentional resources are initially allocated to the task.

Keywords: emotion-induced blindness, physical salience, emotional salience, cueing

In most visual scenes, the visual system cannot simultaneously process all available information, necessitating selective prioritization of certain stimuli for processing. Emotional stimuli typically receive attentional priority over non-emotional stimuli (Anderson et al., 2011; Öhman et al., 2001). Research has demonstrated that even when emotional stimuli are task-irrelevant, participants struggle to inhibit attention to them, resulting in emotion-induced blindness (Most et al., 2005). Emotion-induced blindness (EiB) describes the phenomenon where a task-irrelevant emotional stimulus captures attention, causing individuals to become "blind" to a rapidly presented target stimulus. This perceptual failure manifests as impaired processing of the current task despite the emotional stimulus's irrelevance.

The EiB phenomenon has garnered considerable attention from researchers in recent years (Kennedy et al., 2014; Most et al., 2005; Proud et al., 2020). Studies of EiB typically employ the rapid serial visual presentation (RSVP) paradigm, in which a series of images are rapidly presented at the center of the screen (Treisman & Souther, 1985). Except for the critical distractor image, filler pictures usually consist of landscape or building photographs. Participants are tasked with identifying the orientation of a target picture. In EiB research, the temporal interval between the critical distractor and target pictures is quantified as "Lag," where Lag1 indicates that the target appears 100 ms after the critical distractor. Previous studies have confirmed that at Lag2 (i.e., when the target appears as the second item following the distractor, or 200 ms after the distractor), presenting a task-irrelevant negative distractor significantly reduces target identification accuracy (by approximately 10–40%), indicating an EiB effect. Although neutral distractors also produce some attentional impairment, the resulting EiB effect is substantially smaller (accuracy reduction of approximately 8–10%) compared to emotional distractors (Kennedy et al., 2014; Most et al., 2005). The EiB effect is essentially eliminated at Lag8 (i.e., when the target appears as the eighth item following the distractor, or 800 ms after the distractor). Furthermore, comparisons between Lag2 and Lag4 have consistently revealed robust EiB effects at Lag2 (Kennedy & Most, 2015).

Regarding the mechanisms underlying EiB, the stimulus-driven capture hypothesis (Theeuwes, 2010) posits that spatial attention is automatically allocated to the location of the most salient object on the screen, and objects with salient features automatically capture attention. Salient features are generally categorized into two types: physical salience and emotional salience. Physical salience refers to objective differences between a stimulus's inherent features and those of surrounding stimuli (e.g., an object being noticeably larger than its neighbors). Emotional salience encompasses negatively valenced stimuli (e.g., dangerous animals, angry faces, severely injured individuals) or positively valenced stimuli (e.g., nude bodies) that are highly arousing and evoke negative or positive emotional experiences (Storbeck et al., 2019).

Currently, no consistent standard exists for controlling the physical salience of experimental materials in RSVP-based EiB research. In many EiB studies, each RSVP stream contains one critical distractor image that may be negative, positive, or neutral. Target and filler pictures are typically landscape or architectural photographs that differ substantially from critical distractor images in physical attributes, potentially rendering the critical distractor unique or conspicuous within the RSVP stream. In such cases, images with distinctive features may automatically attract attention, raising the possibility that EiB phenomena may be attributable, at least partially, to physical rather than emotional salience.

To address this concern, previous research has attempted to control physical attributes of experimental materials in three ways. First, researchers have controlled the categorical distinctiveness of critical distractor images by creating two conditions: a homogeneous condition that minimizes category differences among filler images (e.g., all teapots or all pianos) to enhance the categorical uniqueness of critical distractors, and a heterogeneous condition that maximizes category differences among filler images (e.g., apples, pianos, teapots) to reduce physical heterogeneity relative to critical distractors. Critical distractors were negative, neutral, or simply a random filler image (as a baseline condition), appearing randomly between positions 3–8 in the RSVP stream. Participants were randomly assigned to one of the two conditions and tasked with identifying a target picture from the filler images marked with a blue border. Results showed that in the homogeneous condition, both negative and neutral distractors impaired target identification, with accuracy significantly lower than baseline. In the heterogeneous condition, negative distractors produced significantly lower accuracy than baseline, whereas neutral distractors did not differ significantly from baseline. These findings indicate that neutral distractors impair target processing only when they are completely different from other items in the filler set, whereas negative distractors impair processing even when categorical differences are minimized (Briana et al., 2015; Kennedy & Most, 2013).

Second, researchers have controlled the physical properties of critical distractor images by matching negative and neutral distractors as closely as possible in layout and color. For example, a negative distractor image depicting blood might be matched with a neutral distractor image of a person wearing a red shirt to maximize physical feature matching (Most et al., 2013). Most et al. (2013) observed that even when the two image types were physically similar, negative distractor images still produced a larger EiB effect than neutral distractor images. To more effectively control physical properties, some studies have included scrambled images in addition to negative and neutral images, with scrambled images being highly similar to critical distractors in brightness, color, and other physical features (Kennedy & Most, 2013).

Third, researchers have controlled the physical properties of critical distractor, filler, and target images by presenting all RSVP stimuli in black and white. Some researchers have designed experiments where only the critical distractor and target images appear in color while all filler images are black and white (Kennedy et al., 2018). These results demonstrate that EiB cannot be attributed to low-level features such as brightness or color (Most et al., 2005). Other researchers have employed the Natural Image Statistics Toolbox to quantitatively analyze brightness, color, and spatial resolution of the three stimulus types to control for physical attribute differences, finding that physical salience of critical distractors plays a key role in attentional capture while emotional valence has minimal effect (Hoffman et al., 2020). This recent finding challenges current interpretations of EiB phenomena, as it is widely believed that EiB results from emotional information in distractor images influencing attention and subsequently preventing target identification. In reality, research has not consistently demonstrated that emotional stimuli always capture attention and interfere with task-relevant processing (Pessoa et al., 2002; Vuilleumier et al., 2001). Thus, there is currently no strong evidence that EiB originates solely from emotional information carried by distractor images.

In summary, controversy persists regarding whether the "look-at-me" salience signal in EiB phenomena stems from the physical salience or emotional salience of emotional pictures. Based on this controversy, Experiment 1 of the present study employed the RSVP paradigm to examine the role of physical salience of emotional pictures in EiB. We used two background conditions: a dissimilar background condition and a similar background condition. In the dissimilar background condition, filler pictures consisted of urban landscape images that differed physically from negative and neutral distractor images. Most previous EiB studies have used this dissimilar background condition and consistently found significant EiB effects (Kennedy et al., 2014; Kennedy et al., 2020). In contrast, the similar background condition used close-up images of people and animals in non-emotional contexts that were similar to negative and neutral distractor images in brightness, color, and spatial resolution.

Experiment 1 hypothesized that the EiB phenomenon arises from differences in physical features (e.g., color, brightness, complexity) of emotional distractor pictures within the RSVP stream. Once the physical salience of critical distractor images is strictly controlled, EiB may disappear. We further hypothesized that the substantial reduction or elimination of the EiB phenomenon may be related to visual masking of the critical distractor image by preceding and following filler pictures in the RSVP stream, as visual masking is more severe when mask and target are visually similar (Hansen & Loschky, 2013). Such masking may degrade low-level visual information, making it difficult for critical distractor images to capture attention.

Building on this rationale, Experiment 2 added a red rectangular border around critical distractor images. Given that physical salience may be a prerequisite for EiB, if visual information from critical distractor images remains present in the similar background condition but requires attention to be acquired, then adding a red rectangular border to attract participants' attention should test this hypothesis.

Experiment 1

2.1 Purpose

Experiment 1 examined the role of physical salience in EiB by investigating participants' performance in identifying target picture orientation under two background conditions. If EiB was substantially reduced or eliminated in the similar background condition, this would indicate that attentional capture in EiB depends at least partially on physical salience rather than emotional salience.

2.2.1 Participants

Prior to data collection, we conducted a power analysis using G*Power (Faul et al., 2009). Based on a medium effect size of f = 0.25 (Cohen, 1992), an alpha level of 0.05, and the experimental design of Experiment 1, the analysis recommended a sample size of 24 participants to achieve statistical power of 0.957. To account for potential invalid participants, we recruited 30 university students (16 male) aged 18–22 years (M = 20.6, SD = 1.17). All participants were right-handed, had normal or corrected-to-normal vision, and reported no history of psychiatric or neurological disorders. They participated voluntarily and provided written informed consent, receiving compensation upon completion. One participant was excluded due to accuracy below 60% (likely due to inattention), leaving a final sample of 29 valid participants.

2.2.2 Apparatus and Materials

Participants viewed stimuli on a 19-inch monitor (resolution: 1280$×1024, *refreshrate* :
60*Hz*)*controlledbysoftwarewritteninE*−*Prime*2.0.*Stimuliwerecolorimages*(480×360*pixels*)*subtendingappro*
of visual angle, presented at the center of the screen. Participants were seated 70–80 cm from the screen. Experimental stimuli included critical distractors, target stimuli, and filler stimuli selected from the Baker (2021) image database. This database uses the Natural Image Statistics Toolbox to quantitatively analyze brightness, color, and resolution of stimuli, effectively controlling for physical attribute differences among the three image types.

The stimulus set comprised 90 negative and 90 neutral distractor images. Negative distractor images depicted violence, medical injuries, and dangerous animals, while neutral distractor images showed people and animals in neutral contexts. Neutral and negative distractors were maximally matched on layout, color, quantity, and gender (Lang et al., 2008). Ten university students (5 male, 5 female; M age = 19.28, SD = 1.62) rated all images on valence (1 = very unpleasant, 9 = very pleasant) and arousal (1 = very calm, 9 = very excited) using 9-point scales. Independent t-tests confirmed significant differences between negative (valence: M = 7.69, SD = 0.71; arousal: M = 6.07, SD = 0.39) and neutral (valence: M = 4.57, SD = 0.75; arousal: M = 4.13, SD = 0.59) stimuli on both dimensions.

Filler stimuli consisted of 372 images. Half were wide-angle landscape color pictures that differed substantially from critical distractor images in layout, category, and color. Following Kennedy et al. (2014), who used similar stimuli in previous EiB research, we termed this set the *dissimilar background condition*. The remaining 186 images were close-up pictures of people and animals in non-emotional contexts that were visually similar to negative and neutral distractor images. We termed this set the *similar background condition*.

Target stimuli comprised 200 wide-angle landscape pictures (100 rotated left, 100 rotated right).

To validate our manipulation of physical salience across background conditions, we used the Natural Image Statistics Toolbox (Bainbridge & Oliva, 2015), following Baker et al. (2021). This toolbox measures and controls a range of simple low-level visual confounds in psychological experimental stimuli. We analyzed spatial frequency, hue, and brightness for four image categories: filler stimuli from dissimilar backgrounds, filler stimuli from similar backgrounds, negative distractors, and neutral distractors. Results showed that dissimilar background filler stimuli had significantly higher high spatial frequency (HSF) content than the other three categories ($p = 0.01$). In terms of hue, dissimilar background filler stimuli tended toward green, while the other three categories leaned toward red. For brightness, dissimilar background filler stimuli were significantly darker than similar background filler images ($p = 0.021$) and neutral distractors ($p = 0.009$). Crucially, physical attribute differences between negative and neutral distractors were not significant. These results confirm that critical distractors differed significantly from filler stimuli in the dissimilar background condition but not in the similar background condition, validating our physical salience manipulation.

2.2.3 Design and Procedure

We employed a 2 (background condition: similar vs. dissimilar) × 2 (Lag: 2 vs. 8) × 3 (distractor type: negative, neutral, baseline) within-subjects design, with target identification accuracy as the dependent variable. Each background condition comprised 16 blocks, with each combination of Lag level and distractor type repeated twice per block. Each block contained 12 trials, yielding 384 total trials across both background streams. The order of background conditions was counterbalanced using an ABBA design.

The trial procedure is illustrated in Figure 1 [Figure 1: see original paper]. Each trial began with a black fixation cross (2.5 cm × 2.5 cm, 0.39° × 0.39° visual angle) presented for 500 ms at the center of the screen, followed by an RSVP stream of 15 images (100 ms per image). The critical distractor image appeared randomly at positions 4–6 in the stream. Baseline distractors were selected from the same image set used for background pictures. The target stimulus appeared either 2 positions (Lag2) or 8 positions (Lag8) after the distractor. We selected these two positions to demonstrate the robust EiB effect at Lag2 and its elimination at Lag8 across background conditions. At the end of each sequence, participants responded by pressing "F" or "J" to indicate whether the target was rotated left or right. The response prompt disappeared after a keypress or after 4 s without response, followed by the next trial.

Results

Experiment 1 results showed that in the dissimilar background condition, both negative and neutral distractors produced EiB effects, consistent with previous research (Guilbert et al., 2020; Hoffman et al., 2020) (see Figure 2a [Figure 2: see original paper]). Specifically, at Lag8 baseline, accuracy was 94%; at Lag2 with negative distractors, accuracy was 81% (13% blindness); and at Lag2 with neutral distractors, accuracy was 90% (4% blindness). In contrast, the similar background condition showed a marked reduction in the EiB effect (see Figure 2b [Figure 2: see original paper]). At Lag8 baseline, accuracy was 85%; at Lag2 with neutral distractors, accuracy was 84% (2% blindness); and at Lag2 with negative distractors, accuracy was 83% (3% blindness). Thus, the magnitude of the EiB effect decreased by 60% in the similar background condition.

Q-Q plot normality tests for target accuracy in each background condition showed that data points aligned well with the reference line. Additionally, Kolmogorov-Smirnov tests indicated that all variables met normality assumptions, permitting further ANOVA analysis. A 2 (background condition: similar vs. dissimilar) × 2 (Lag: 2 vs. 8) × 3 (distractor type: negative, neutral, baseline) repeated-measures ANOVA on target identification accuracy revealed that all results met sphericity assumptions ($p > 0.05$). The main effect of background condition was significant, $F(1, 28) = 33.07$, $p < 0.001$, $^2p = 0.54$, with significantly lower accuracy in the similar background condition than in the dissimilar background condition (83% vs. 91%). The main effect of Lag was significant, $F(1, 28) = 36.38$, $p < 0.001$, $^2p = 0.55$, with significantly lower accuracy at Lag2 than at Lag8 (85% vs. 90%). The main effect of distractor type was significant, $F(2, 56) = 19.04$, $p < 0.001$, $^2p = 0.41$. Bonferroni-corrected post-hoc comparisons revealed that accuracy with negative and neutral distractors was significantly lower than baseline ($p = 0.020$ and $p = 0.014$, respectively). Pairwise comparisons between negative vs. neutral and neutral vs. baseline were also significant ($p = 0.030$ and $p = 0.011$, respectively).

The interaction between background condition and Lag was not significant, $F(2, 56) = 3.56$, $p = 0.069$, $^2p = 0.11$. However, the interaction between background condition and distractor type was significant, $F(2, 56) = 3.81$, $p = 0.031$, $^2p = 0.12$. Simple effects analysis revealed that in the dissimilar background condition, accuracy with negative distractors was significantly lower than with neutral and baseline distractors ($p < 0.001$), whereas in the similar background condition, no significant differences existed among the three distractor types ($p = 0.140$). This indicates that controlling physical salience of background conditions substantially reduced or eliminated the EiB phenomenon. Additionally, accuracy in the similar background condition was significantly lower than in the dissimilar background condition for negative, neutral, and baseline distractors ($p = 0.001$). The interaction between Lag and distractor type was significant, $F(2, 56) = 15.50$, $p < 0.001$, $^2p = 0.36$. Simple effects analysis showed that accuracy at Lag2 was significantly lower than at Lag8 for all distractor types ($p < 0.001$), and at Lag2, accuracy with negative distractors was significantly lower than with neutral and baseline distractors ($p < 0.001$). The three-way interaction among background condition, Lag, and distractor type was not significant, $F(2, 56) = 1.98$, $p = 0.150$.

Experiment 2

Experiment 2 investigated whether the failure of critical distractor images to capture attention in the similar background condition of Experiment 1 resulted from visual masking by preceding and following filler images in the RSVP stream or from emotional information failing to receive attention. By adding a red rectangular border around critical distractor images, we aimed to guide attention to them. If the EiB effect emerged under these conditions, it would indicate that the absence of blindness in Experiment 1's similar background condition was not due to low-level visual masking but rather to failure to attend to emotional distractors.

The sample size planning method and results were identical to Experiment 1. Thirty university students (16 male) aged 20–22 years (M = 20.5, SD = 1.18) participated. All were right-handed, had normal or corrected-to-normal vision, and reported no psychiatric or neurological history. Three participants were excluded due to accuracy below 60% (likely due to inattention), leaving 27 valid participants. All provided written informed consent and received compensation.

Materials were similar to Experiment 1, with the sole difference being the addition of a red rectangular border around critical distractor images. The border measured 7.05 cm in width and 4.94 cm in height (8.81° × 6.09° visual angle) and served to cue participants' attention to the emotional pictures. The design was again a 2 (background condition: similar vs. dissimilar) × 2 (Lag: 2 vs. 8) × 3 (distractor type: negative, neutral, baseline) within-subjects design, with target identification accuracy as the dependent variable. The procedure is illustrated in Figure 3 [Figure 3: see original paper].

Experiment 2 results showed that after cueing critical distractors, EiB effects emerged for both negative and neutral conditions in the dissimilar background condition (see Figure 4a [Figure 4: see original paper]), mirroring Experiment 1's findings. However, the magnitude of blindness was much greater in Experiment 2 (25%) than in Experiment 1 (17%), likely because the cue made distractors more likely to capture attention. In the similar background condition, the EiB effect for negative distractors increased substantially (see Figure 4b [Figure 4: see original paper]). At Lag8 baseline, accuracy was 81%; at Lag2 with neutral distractors, accuracy was 79% (1% blindness); and at Lag2 with negative distractors, accuracy was 71% (10% blindness). Overall, the blindness produced by negative pictures in the similar background condition was much greater than the corresponding blindness in Experiment 1 (10% vs. 3%), indicating that cueing attention to negative pictures in the similar background condition restored their ability to interfere with subsequent target identification.

Q-Q plot normality tests for target accuracy in each background condition showed good alignment with the reference line, and Kolmogorov-Smirnov tests confirmed normality for all variables, permitting ANOVA analysis. A 2 (background condition: similar vs. dissimilar) × 2 (Lag: 2 vs. 8) × 3 (distractor type: negative, neutral, baseline) repeated-measures ANOVA revealed that all results met sphericity assumptions ($p > 0.05$), requiring no Greenhouse-Geisser correction. The main effect of background condition was significant, $F(1, 26) = 49.92$, $p < 0.001$, $^2p = 0.66$, with significantly lower accuracy in the similar background condition than in the dissimilar background condition (81% vs. 88%). The main effect of Lag was significant, $F(1, 26) = 33.33$, $p < 0.001$, $^2p = 0.56$, with significantly lower accuracy at Lag2 than at Lag8 (81% vs. 85%). The main effect of distractor type was significant, $F(2, 52) = 14.52$, $p < 0.001$, ^{2}p = 0.36. Bonferroni-corrected post-hoc comparisons showed that accuracy with negative and neutral distractors was significantly lower than baseline ($p = 0.023$ and $p = 0.035$, respectively).

The interaction between background condition and distractor type was significant, $F(2, 52) = 4.64$, $p = 0.014$, ^{2}p = 0.15. Simple effects analysis showed that in the dissimilar background condition, accuracy with negative distractors was significantly lower than with neutral and baseline distractors ($p < 0.001$), consistent with Experiment 1. Critically, in the similar background condition, accuracy with negative distractors was also significantly lower than with neutral and baseline distractors ($p < 0.001$), contrary to Experiment 1's results. This indicates that cueing critical distractors in Experiment 2 produced EiB phenomena in the similar background condition. The interaction between background condition and Lag was significant, $F(1, 26) = 12.17$, $p = 0.003$, ^{2}p = 0.32. Simple effects analysis revealed that accuracy at Lag2 was significantly lower than at Lag8 in both background conditions ($p < 0.001$). The interaction between Lag and distractor type was significant, $F(2, 52) = 16.59$, $p < 0.001$, ^{2}p = 0.39. Simple effects analysis showed that accuracy at Lag2 was significantly lower than at Lag8 for all distractor types ($p < 0.001$), and at Lag2, accuracy with negative distractors was significantly lower than with neutral and baseline distractors ($p < 0.001$). The three-way interaction among Lag, distractor type, and background similarity was not significant, $F(2, 52) = 2.37$, $p = 0.100$.

General Discussion

The present study further confirms that EiB is a robust attentional bias effect. Our findings demonstrate that physical salience is at least an important determinant of the EiB phenomenon (Baker et al., 2021), which is inconsistent with some previous research. Many scholars have argued that EiB results from emotional salience of critical distractors rather than masking or interference from low-level visual features of physical salience. Three explanations may account for our findings.

First, both negative and neutral distractors appeared within sequences of different background pictures, capturing attention based on physical salience. Once physical salience was strictly controlled or eliminated, no salience signal remained to trigger attentional capture (Baker et al., 2021). According to Awh et al.'s (2012) priority map hypothesis, attentional selection sometimes depends solely on stimulus characteristics (Itti & Koch, 2001). Indeed, low-level features consistently produce strong and stable attentional biases, which is why physical salience constitutes a major category of attentional control processes.

Second, visual masking of negative pictures by preceding and following background pictures may be more effective in the similar background condition, as visual masking is more efficient when mask and target are visually similar (Hansen & Loschky, 2013).

Third, differences in attentional capture by critical distractors influence the emergence of EiB effects; the more attentional resources a critical distractor captures, the more likely EiB occurs. The amount of attentional resources captured depends on attribute differences between the critical stimulus and its context. In Experiment 1's dissimilar background condition, both negative and neutral distractors likely differed substantially from surrounding background images in emotional and physical attributes, producing EiB effects (Hoffman et al., 2020). In the similar background condition, these differences became minimal, requiring greater attentional investment from participants and disrupting the low-level visual information necessary for identifying emotional distractor images and extracting their valence.

Experiment 2's results showed that EiB occurred in both dissimilar and similar background conditions. Two explanations account for this finding. First, attention is critical for EiB phenomena, which explains why we observed no EiB in Experiment 1's similar background condition. This absence likely occurred because eliminating physical salience removed signals that could capture emotional salience. The cueing in Experiment 2 enhanced participants' ability to capture emotional information, facilitating attention to the visual information required for emotional salience. Second, EiB emergence relates to the amount of initially invested attentional resources. When initial attentional investment is low, attribute differences of critical distractors (physical or emotional) are not manifested. Only when initial attentional investment is substantial can attribute differences influence visual attentional processes and produce EiB effects.

Thus, emotional salience information from negative distractors in similar background streams remains present. When initial attentional investment is high, emotional salience may influence subsequent processes, affecting target identification, meaning extraction, and working memory consolidation (Nieuwenstein et al., 2009). In Experiment 2, cueing attention to distractor locations caused failures in processing target stimuli, indicating that visual information required for emotional valence remained present in Experiment 1 but was much less effective at driving attentional capture without physical salience. Previous research suggests that negative pictures produce larger EiB effects than neutral pictures because they receive greater initial attentional investment. This claim is supported by Kennedy et al.'s (2014) ERP study of EiB, which found that emotional pictures elicited larger P3b components than neutral pictures. The P3b component generally reflects behavioral effects resulting from distractor stimuli altering attentional orienting, judgment, and response decision-making for target stimuli (Lyu et al., 2010). Therefore, when negative images elicit P3b, they produce larger EiB effects, indicating that target suppression in EiB relates to negative images occupying more attentional resources. These results support the view that attending to emotional distractor images is a critical component of EiB.

These findings challenge current explanations of EiB mechanisms (McHugo et al., 2013). It is commonly believed that negative distractors produce larger EiB effects than neutral distractors, reflecting attentional capture by emotional salience. However, our results question this interpretation, suggesting that emotional salience plays minimal role in initial attentional capture. In summary, EiB is an attention-perception effect (Kennedy & Most, 2013) whereby emotionally salient distractors impair target perception only when they are attended and when targets appear temporally close. Future research should consider manipulating the presentation duration of each image in the RSVP stream; if image duration were shortened, the EiB effect observed in Experiment 2 might disappear again.

Under the conditions of the present study, we conclude: First, the emergence of EiB relates to the amount of attentional resources captured by distractor stimuli; the more attentional resources distractors capture, the more likely EiB occurs. Second, EiB emergence also relates to the amount of initially invested attentional resources. When initial attentional investment is low, attribute differences of distractor stimuli (physical or emotional) are not manifested, and the EiB effect disappears. Once initial attentional investment is high, attribute differences of distractor stimuli can influence visual attentional processes, making EiB more likely to occur.

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Note: Figure translations are in progress. See original paper for figures.