

Emotional Specificity of Early Startle Modification During Picture Viewing

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Emotional modification of the startle reflex is a robust phenomenon. The time-course of this emotional modification is less clear: Although startle blink magnitude is reliably enhanced after several seconds of viewing emotionally negative pictures, reports of blink magnitude modification at short (< 500 ms) picture-to-probe onset intervals have been less consistent.

Bradley, Cuthbert and Lang (1993) found that blink magnitude during negative picture stimuli was inhibited relative to responses during neutral pictures at a probe time of 300-ms. An extension of this work, using 500-ms picture presentations as compared to the more typical 6-s presentations, found no difference in blink magnitude between responses during negative and neutral stimuli at the 300-ms probe time (Codispoti, Bradley, & Lang, 2001).

Two experiments looking at the effects of attention on emotional modification of startle (Vanman, Boehmelt, Dawson, & Schell, 1996, Experiment 2; Vanman, Dawson, & Brennan, 1998) reported enhanced blink magnitude for negative stimuli at an early probe time (250 ms), but only compared responses during negative and positive material. The relationship between responses during these emotionally valent categories and responses during a neutral category is unclear in these studies (e.g., negative picture responses may be heightened compared to neutral, or both negative and positive stimuli responses may be inhibited relative to neutral stimuli responses).

Globisch, Hamm, Esteves and Öhman (1999) found enhanced startle blink responses in high-snake fear participants for snake stimuli, relative to neutral and positive stimuli, at a 300-ms probe time. A preliminary study in our laboratory (Stanley & Knight, unpublished data) showed enhanced startle blink response magnitude at a 300-ms probe time in an unselected sample of participants, for two types of threat stimuli (animal and non-animal) relative to neutral stimuli. The experiments described here aim to clarify the status of emotional modification of startle at probe times shorter than 500 ms.

Study 1

Globisch et al. (1999) used a set of highly-feared animal stimuli in their study, whereas other experiments looking at early startle modification (e.g., Bradley et al., 1993) have included a variety of negative stimuli, such as threatening animals, pointed firearms, and mutilated bodies. Study 1 used an unselected sample of participants and compared responses from positive, neutral, and two specific negative content picture

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categories – primarily mutilation content images (e.g., human corpses, bodily injuries) and primarily threat related images (e.g., threatening animals, aimed guns).

Study 1 Method Summary

- $n = 80$ (48 female) participants. All independent variables were within-subjects.
- Four emotional picture categories – Positive, Neutral, Mutilation (negative), and Threat (negative).
- Startle probes presented at one of two times: Early (at 300 ms) and Late (between 2 to 5 seconds).
- Blink magnitude was recorded from below the left eye with EMG electrodes.

Study 1 Results

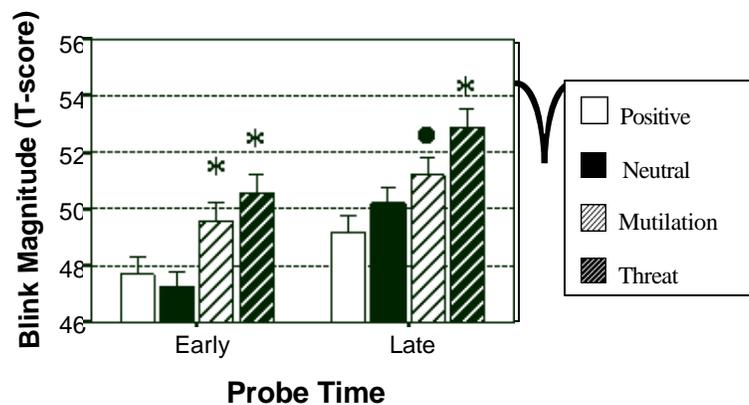


Figure 1. Mean standardised blink magnitude across all four emotional categories. Error bars indicate one standard error. Data are presented separately for the early (300 ms) probe time and the late (2–5 s) probe time. Significant differences are at $p < .05$. * = significantly different from neutral responses, • = significantly different from positive category responses only.

At the early probe time, both mutilation and threat content pictures potentiated startle blink magnitude relative to neutral pictures, $F_s(1, 76) = 9.48$ & 24.24 , $p_s = .003$ and $< .001$, respectively. Both types of pictures successfully enhanced startle at an early probe time.

Study 2

Within a particular emotional system, stimuli can be differentiated from one another by the intensity with which they activate that emotional system in the brain. Study 2 subdivided the four emotional categories of Study 1 into groups on the basis of how emotionally arousing (i.e., intense) they had been rated by participants. Employing picture categories that were divided into three levels by arousal ratings (high, medium, and low), Cuthbert, Bradley and Lang (1996) reported that only high-arousal negative pictures potentiated startle blink magnitude, when startle probes were presented several seconds after picture onset. The study reported below used pictures with arousal ratings roughly equivalent to those of the high and

medium arousal level picture sets of Cuthbert et al. (1996), to test how the intensity characteristics of negative threat and mutilation contents influence responding to startle probes at an early stage of picture viewing.

Study 2 Method Summary

- $n = 42$ (21 females) participants. Independent variables were within-subjects.
- Picture categories same as Study 1. Each category subdivided into “high” and “low” arousal pictures.
- Startle probes again presented at early (300 ms) and late (2-5 s) stages in the picture-viewing period.

Study 2 Results

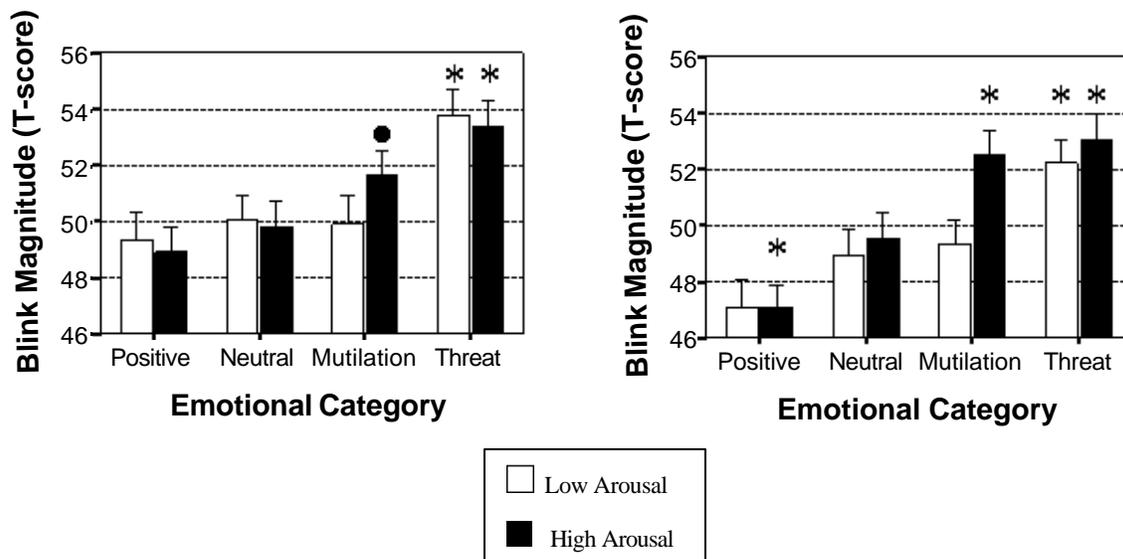


Figure 2. Mean standardised blink magnitude across all four emotional categories, for high and low arousal pictures. Error bars indicate one standard error. Data are presented in the upper panel for the early (300 ms) probe time and in the lower panel for the late (2-5 s) probe time. Significant differences are at $p < .05$. * = significantly different from neutral responses, ● = significantly different from positive responses.

Study 2 again showed potentiation of startle at the early, 300-ms probe time for negative picture stimuli. High and low arousal threat stimuli showed enhanced startle blink magnitude at the early probe time, $F_s(1, 40) = 9.27$ & 7.99 for high and low arousal respectively, $p_s < .01$. High-arousal mutilation pictures showed enhanced blink magnitude at the early probe time, compared to positive, $F(1, 40) = 5.13$, $p = .03$. Low arousal mutilation pictures failed to potentiate startle at the early probe time compared to both neutral and pleasant stimuli, $F_s(1, 40) < .23$, $p_s > .63$. Responses for these low arousal mutilation pictures were also not significantly different from those for neutral pictures at the late probe time, $F(1, 40) = .16$, $p = .69$.

Conclusions and Discussion

Together, these studies provide strong supportive evidence for negative emotional potentiation of the startle reflex at an early stage of picture viewing. This does not appear to be specific to a single type of negative emotional stimulus, and was also observed in an unselected sample of participants, thus extending and supporting the findings of Globisch et al. (1999). Some negative stimuli (i.e., the low-arousal mutilation pictures in Study 2) failed to potentiate startle at either probe time: This lack of potentiation would indicate that these stimuli completely fail to engage the startle modification circuitry, rather than differentially influencing the startle system at early and late probe times.

The results of these experiments suggest that emotional modification of startle by negative stimuli is in fact more consistent across the picture viewing period than previously hypothesised. Our laboratory is currently assessing startle reflex modification at an earlier stage of picture viewing (150 ms), as well as manipulating the complexity of images to see how this affects emotional modulation of startle.

References

- Bradley, M. M., Cuthbert, B. N., & Lang, P. J. (1993). *Psychophysiology*, 30, 541-545.
- Codispoti, M., Bradley, M. M., & Lang, P. J. (2001). *Psychophysiology*, 38, 474-478.
- Cuthbert, B. N., Bradley, M. M., & Lang, P. J. (1996). *Psychophysiology*, 33, 103-111.
- Globisch, J., Hamm, A. O., Esteves, F., & Öhman, A. (1999). *Psychophysiology*, 36, 66-75.
- Vanman, E. J., Boehmelt, A. H., Dawson, M. E., & Schell, A. M. (1996). *Psychophysiology*, 33, 691-697.
- Vanman, E. J., Dawson, M. E., & Brennan, P. A. (1998). *Personality and Social Psychology Bulletin*, 24, 994-1005.

Additional Information

- EMG electrodes used were Medicotest BRS-50K, with a 1.5 X 1.5 cm conductive area.
- The raw EMG signal was digitally filtered off-line to a bandwidth of 28 to 500 Hz. Following this, the signal was rectified and smoothed with a 10-ms time constant. The results of blink magnitude analysis were similar when a 100-ms time constant was used.
- For every participant, each condition's data was collated from responses to 3 images (e.g., in Study 2, for each participant each level of Emotional Category x Arousal Level x Probe Time consisted of data from 3 pictures.)
- SCR magnitude in response to the startle probe was also collected. Blink latency to peak and SCR latency to peak analyses showed no significant effects, and are to be re-analysed as latency to onset.